ANTHROPOLOGIA INTEGRA

ČASOPIS PRO OBECNOU ANTROPOLOGII A PŘÍBUZNÉ OBORY

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Foreword

Dear readers,

for the first time in the history of the journal Anthropologia Integra a special issue is being published. It is dedicated in its entirety to an international meet for early career scientists – ANTHROPological Student Conference. The issue contains an introduction to the organizing institution – Department of Anthropology at the Faculty of Science of Masaryk University, further there are four studies selected for publication by the conference organizers representing the best of received abstracts, and also a list of abstracts presented at the meet. It is my belief that not only the conference participants, but also the regular readers will find this issue to be of merit.

It is my great honor to welcome those of you participating at the conference physically here in Telč, on the grounds of Masaryk University. One of the fundamental aspects of scientific work is meeting and sharing our results. I am all the more pleased that we are meeting here after several years of isolation. Although modern technology has allowed us to meet in virtual space, I am certain you will agree with me that the traditional form of the conference is irreplaceable.

This meeting is taking place at a time when humanity is facing many changes. These changes concern globalization, migration, changing social values, demographic change, climate, or security issues. These are the challenges that should be addressed jointly by the research community in collaboration with other partners, such as educational and non-governmental organizations and the international community. The issues can be divided into the areas of health, demographic change, and well-being challenges in order to improve people's lifelong health and standard of living. An additional challenge is presented by the need to research and create an innovative and safe inclusive society in the context of change and growing global interdependence. And last but not least, we strive to conduct research the area of protection of people's freedom and security with the aim of developing solutions that create a natural balance between security, freedom and democracy. As scientists, we contribute our expertise to address these major challenges through research in many areas, such as ergonomics and the work environment, innovation and testing of protective equipment, gender research and equal opportunities, research on contemporary and historical cultures, and development of forensic identification methods.

I hope that this meeting will become the basis for closer contacts and joint projects between young researchers across countries and with different focuses in their research. The idea on which the Department of Anthropology at Masaryk University was founded in the 1920s is to examine humanity in its entirety, from a biological and sociocultural point of view. I would like for us to be able to repeat at this point the ideas from which the founder of the department, professor Suk, started, and find common themes that we can develop together in the future.

Sincerely,
Dominik Černý
Conference Chairman

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Introducing the Department of Anthropology

The Anthropological Student Conference is organized by the Department of Anthropology at the Faculty of Science, Masaryk University located in Brno, Czech Republic. The Department offers education and training in undergraduate, graduate, and doctoral anthropology programs and conducts research activities that fall within the disciplines of Physical/Biological Anthropology, Forensic Anthropology, Social/Cultural Anthropology, and Bioarcheology. Over the past decade, the Department has attracted steady interest from applicants, and more than one hundred students are enrolled in the two programs (undergraduate, graduate) each year. Seven students are currently enrolled in the doctoral study program.

The Department is a small-sized unit and the least numerous department at the faculty in terms of total headcount. Despite its size, the Department has a long tradition at the university. Inaugurated in the academic year 1923/1924, shortly after the foundation of Masaryk University in 1919, it represents one of the founding units of the Faculty of Science. The Department was founded by Vojtěch Suk, a renowned anthropologist with degrees in medicine and arts, who graciously accepted the task of establishing a new teaching and research unit. The first academic year began with four courses: Human Somatology, Selected Chapters in Primate Comparative Anatomy, Origins of Man and Humankind, and Development of Schoolchildren. However, as is well known, Professor Suk's activities went beyond teaching and research duties at his home university. A passionate explorer, he undertook numerous expeditions throughout Europe, North America, and North Africa. The photographs and objects collected during his travels have become invaluable components of the department's archives. He was also in close professional and personal contact with Dr. Aleš Hrdlička, an acclaimed physical anthropologist and equally enthusiastic traveler. These diverse activities have been imprinted in the foundations of the Department as an institution that studies humans in the full range of their activities.

During the World War II and the Nazi protectorate, the activities of the department came to a halt, and towards the end, the building was hit in a bombing raid that destroyed most of the inventory. After the war, Suk and his colleagues returned to rebuild the department from scratch. In the post-war era, Suk's former colleague Jindřich Valšík succeeded him as head of the department. Under his leadership, the department flourished and carried out several unique anthropological research projects, including the scientific study of Greek children resettled in what was then Czechoslovakia after the Greek Civil War, Lusatian Sorbs, and other specific ethnic groups. However, the subsequent period after the communist coup d'état of 1948 brought this development to a halt and in turn led to the almost complete destruction of the department.

The department was re-established in its present form in 1993 after a long period of weakening and staff shortages during the Communist era (1949-1989) and as a result of the lifelong efforts of the late Jan Beneš. Prof. Beneš, an established biological anthropologist and academic with extensive social activities, invited a diverse range of colleagues to join him as collaborators (including Jaroslav Malina, Vladimír Novotný, Josef Unger among others), who were further instrumental in introducing cultural, social, and behavioral aspects of anthropology. This concept adopted Suk's tradition of interdisciplinarity and synergy between natural sciences and humanities.

After the death of Jan Beneš in 1999, the following 2000s were characterized by an increase in research activities, the development of international cooperation, and extensive social-cultural activities, first with Jaroslav Malina and then with Jiří Svoboda as appointed department heads. Funded by an EU grant (FITEAMP), these activities led to important accomplishments, including expeditions to the Awash region, to the banks of the Blue Nile, and to the Galili site in Afar.

Today, the department's staff consists mainly of faculty members, joined by a small number of junior researchers who are still at the very beginning of their careers. Since 2019, the Department has been led by Petra Urbanová, who was appointed the first female Head of the Department in its history. Under her management, the Department has focused on transforming itself into a progressive, multicultural unit with an international staff. Of the 15 teaching and research core staff members, four are not of Czech origin, and three of them are English speakers only.

The Department of Anthropology embodies both teaching and research strategies in approximately equal measure. The concept of research activities follows a vision of anthropology as the study of the relationships between human biological roots and cultural adaptations. The department follows current, progressive trends in anthropology while remaining true to the tradition that has shaped it since its founding days. In keeping with the concept of anthropology as the science of humans and for humans, the Department balances research activities in basic and applied research. Ultimately, the department covers the responsibilities arising from the status of the Faculty of Science as a certified forensic institute (field of Criminalistics – Anthropology) and is a sought-after expert unit in the field of forensic image identification.

Fig. 1. Vojtěch Suk, the founder of the Department, examines a young child on his expedition to Labrador (top left), a group of Labrador residents (bottom left), the Labrador coastline (right).

In the recent years, the department's research strategy has crystallized into four major research topics, which follow traditional anthropological interests and seek to answer the questions of "who we are, where we come from, and where we are headed". The department blends these interests with a variety of advanced technological and analytical innovations such as 3D technologies, image analysis, PC-aided big data processing, and virtual modelling.

1) Mankind and the Environment in the Past

In the research topic "Mankind and the Environment in the Past" the Department focuses on studies of human skeletal remains and burial practices, evolutionary aspects of human variations, and interactions between past human populations and their living conditions. These studies shed light on the life and death of our ancestors, their appearance, form, and demographic profile, which includes sex, height, age at death, and population affinity, as well as the structure of their society and contact with other populations.

Our attention is on developing sound, research-based methods for skeletal anthropology and bioarcheology. Here, we recognize that modern trends include advanced 3D digital methods of on-site and laboratory documentation, molecular-genetic, proteomic, and isotopic assessment of skeletal remains. In addition, the interactions between skeletal and dental remains as proxies for human biology and a variety of extrinsic and intrinsic factors are considered essential in understanding our past. These include living environment, hygiene or dietary habits (through the study of intestinal parasites), migration patterns, dietary composition (stable isotopes), or exposure to steroid hormones (prenatal and postnatal skeletal and dental morphogenesis and tissue modifications). Our new ambition is to include stable isotope assessment in conjunction with an open-science isotope database – IsoArcH.

Studies of microevolutionary trends are grounded in the departmental fieldwork and the work of close collaborators. In terms of geo-temporal embedding, current research focuses primarily on the study of the physical appearance, lifestyle, and traditions of the South Moravian Hutterites, an Anabaptist (Protestant) ethno-religious group that sought and found refuge from Catholic oppression in the South Moravian region in the 1500s. The Department benefits largely from data (skeletal and environmental) collected at the Přibice burial site, which has been excavated and processed by the Department over the past four years.

Fig. 2. IsoArcH - open-science isotope database, excavations at the Přibice burial site, aerial on-site documentation using drones, 3D model mapping the excavated area (top left to bottom right).

2) Mankind and the Environment in the Modern Era

The studies of contemporary human variations are ones of the traditional topics of biological and physical anthropology. Our environment is constantly undergoing significant changes that affect human biology. Research at the Department focuses on microevolutionary trends and relationships between the modern environment and human body form and composition, and on the origins of health and disease (DOHaD) in Central European populations. Special attention is paid to the relationship between body fat and changes in its distribution and diseases that are now considered major social phenomena (obesity, metabolic and cardiovascular diseases). In addition, the effects of stress on the body at different stages of development are studied. This includes the influence of extrinsic and intrinsic factors on sexual maturation, human sexuality, and the timing of reproduction.

Along with the population studies, research activities are aimed at development and growth of individuals (individual life history data) to conduct growth assessment and develop growth prediction methods (including mathematical modelling). The Department houses large datasets on somatic growth and development, bone maturation, and environmental agents from several longitudinal and cross-sectional studies conducted in Central Europe in the 1900s and 2000s, e.g., the Brno Growth Study (BGS). Other datasets (reference or comparative) come from numerous collaborative projects (international and national).

This line of research falls equally on the side of the basic and the applied research. As one of the most important outcomes, the team has developed a SW application for an assessment of children's' height, weight and body mass index (BMI) growth based on individual growth models, available for family physicians and other practitioners.

A novel emerging, albeit perspective, subtopic which resonates with the deep-rooted topics of Mankind and the Environment at the Department is Environmental Anthropology. The topic examines the human-environment interactions through the lens and methodology of social and cultural anthropology and ethnography. The topic includes studies of interactions that link humans in their biosocial environment to various issues such as human-environment interactions, cultural views of the environment and forms of environmental experience in different societies, the political environment, and the complexity of these interactions in light of the ecological crisis. Currently, the topic is intertwined with the research activities focused on indigenous groups in the Amazon (e.g., Mebengokré tribe), which aim to discuss current teleological

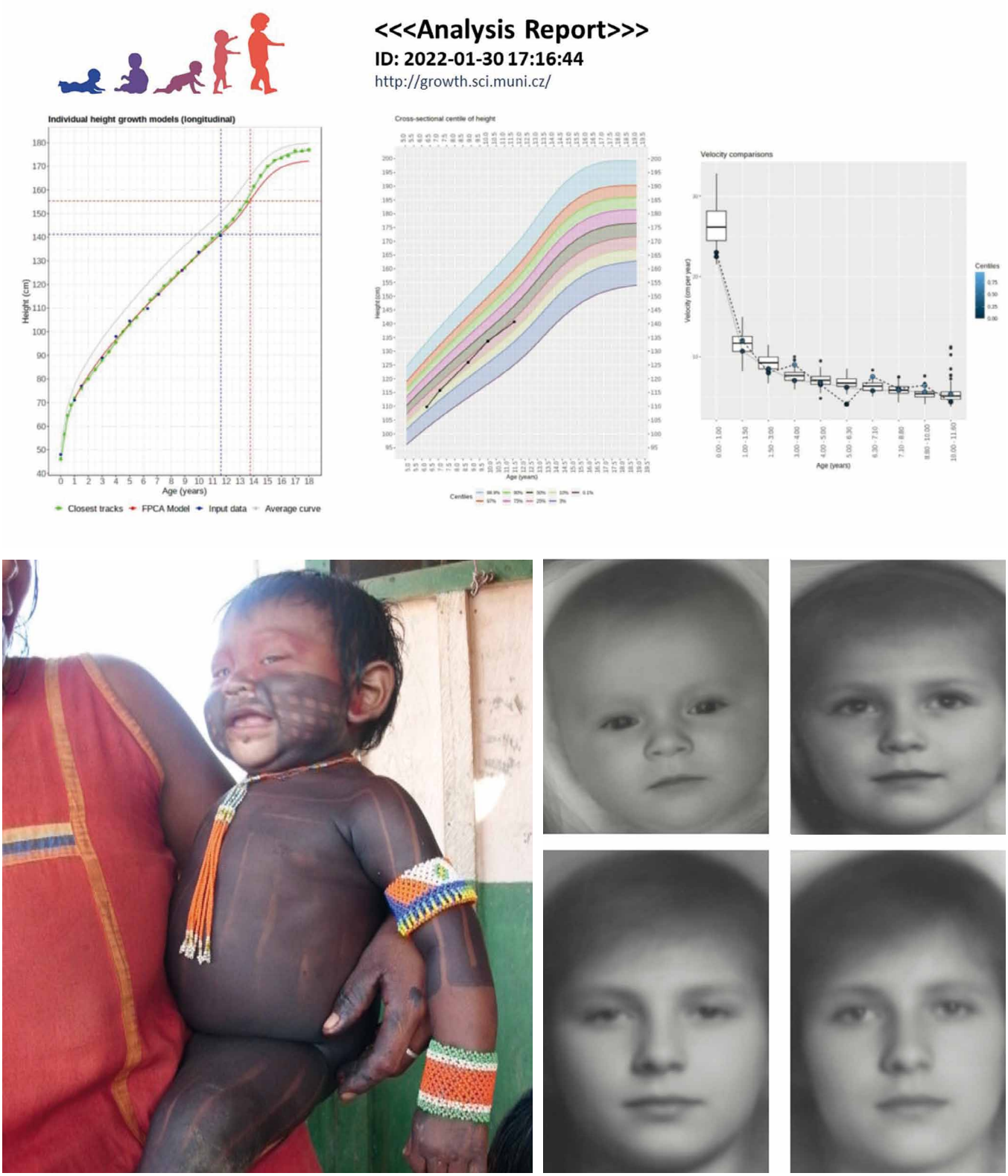

Fig. 3. Growth predictive methods (top), a Mebengokré child (bottom left), averaged participants of the Brno Growth Study.

approaches to ecosystems in biology and ecology and to establish a dialogue with indigenous experiences of ecosystem self-organization. Central to this is a discussion of the possibilities of an intercultural science that promotes more integrative approaches to both knowledge production and dissemination and environmental protection.

Fig. 4. Multi-camera photogrammetry system (top left), a human skull examined using a CT unit (top right), virtual reality workspace for assembling fragmented skeletal remains (bottom).

3) Virtual Anthropology

The Department has had a long-standing interest in diverse scientific topics which intertwine with the use of advanced, mostly imaging and PC-aided, technologies (MRI, CT, virtual reality, 3D scanning, photogrammetry, etc.). Emphasis is placed on the benefits derived from the non-invasiveness and non-destructiveness of these approaches. Overall, the traditional research topics related to human variations in the living and skeletal remains are explored. These include complex studies of human remains (skeletal, mummified) of historically important figures and other valuable finds (e.g., Jobst of Moravia, Franz von der Trenck).

The state-of-the-art, non-invasive digital techniques being developed at the Department benefit primarily from being image-based and therefore respecting the integrity of bodies and artifacts, cultural traditions, and religious beliefs, as well as contributing to cultural inclusion by being accessible online. To this end, the Department has provided in-demand services in the production of digital replicas of museum items and digital exhibition displays (e.g., virtual facial reconstructions).

In addition, human skeletal, dental and body morphogenesis is being extensively researched using 3D digital technologies. A particular focus is on facial morphogenesis, where studies of facial variation (including normal and abnormal facial morphogenesis, sexual dimorphism, and variation due to facial expressions) are conducted in conjunction with the FIDEN-

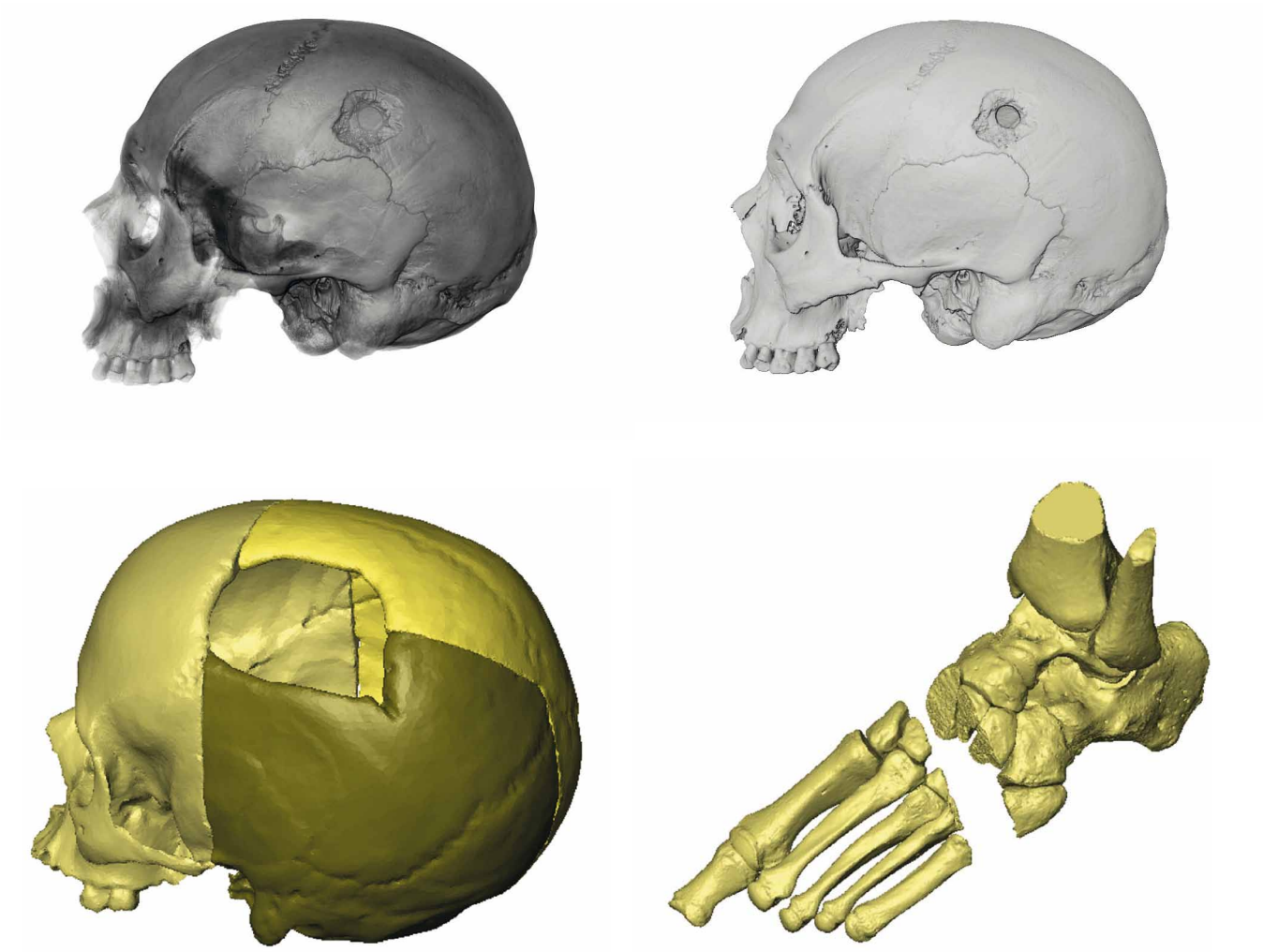

Fig. 5. PC-assisted examination of forensic trauma cases: gunshot wound (top) and saw-cut injuries (bottom).

TIS database. FIDENTIS 3D FACE DATABASE (F3D-FD) is one of the world's largest databases of 3D faces. It serves as a reference dataset for normal-range facial variations in Central Europe and has helped to improve our knowledge of facial and auricular features and their interplay with ancestral, environmental, socioeconomic, and demographic predispositions, ultimately helping us to answer the age-old question of "why we look the way we do." The topic has been researched in collaboration with a number of stomatological clinics, in particular the Department of Stomatology, Charles University in Prague and Motol University Hospital, as well as with partners from abroad (University of São Paulo, Federal University of São Paulo).

Lastly, during the COVID -19 pandemic, the Department participated in the global challenge to stop the spread of COVID -19 by answering the call to step in creatively and develop tools and resources to help those fighting the coronavirus. Using our large dataset of 3D virtual faces, our team helped in designing 3D printable masks and half-masks, and developed size categories of half-masks for subadults and adults. These personal protective equipment efforts have continued into post-pandemic era. Supported by the Security Research Grant from the Ministry of the Interior the team is currently developing a web-based application for full-body population data – A.D.A.P.T. – Anthropological DAtabase of Body ProporTions, which will aid professionals in the development, optimization, and production of personal protective equipment (e.g., respirators, protective shields or protective overalls for front-line workers) specifically designed for the Czech population.

4) Forensics-oriented Research

Research in forensics, security, and safety has traditionally been a top priority of the Department. Activities have consistently focused on applied research and experimental development applicable to criminal and legal investigations in the areas of personal identification - both living and deceased, skeletal traumatology, and crime scene investigation.

Fig. 6. The Department's educational efforts aimed at the youngest generations in the form of learning activities, science shows, and student projects.

Research is conducted primarily by the Laboratory of Morphology and Forensic Anthropology (LaMorFA). LaMorFA is recognized as a leading forensic anthropology laboratory in the country and, among other things, serves as a sought-after training center for forensic specialists (including law-enforcement officers). The Laboratory leverages this close relationship with forensic casework to develop forensic methods and techniques using advanced analytical and statistical approaches and to introduce technological innovations into routine forensic work. The lab is a state-of-the-art research facility equipped with cutting-edge technologies such as a full-body photogrammetry station (developed by the team as a functional prototype) and multiple optical scanners - facial, half-body, and handheld - human-computer interaction devices and 3D printers. It is also equipped with software licenses for surface and volume 3D image processing.

The research topic covers the increasingly important issues of personal identification through imaging technologies (CCTV, surveillance cameras, mug shots, photography in the wild). This branch of research relies on a large biometric database of 3D facial scans (FIDENTIS DATABASE - F3D-FD) which supports the development in the field of face recognition by providing access to large-scale quantitative data and on in-house software tools for processing 3D meshes – FIDENTIS Analyst, developed in collaboration with the Faculty of Informatics (Department of Visual Computing and Department of Computer Systems and Communications). In addition, issues related to forensic skeletal trauma have been extensively researched, with a focus on gunshot wounds, blunt force injuries and skeletal fracturing (e.g., laryngohyoid fractures due to force to the neck). A very innovative contribution has been microCT-based studies addressing microtraumas of sandwich-like cranial bones due to high-velocity impacts (e.g., gunshot injuries).

These four research topics have generated a variety of results with societal relevance that, among other things, help promote the Department and our scientific endeavors in general. In addition, the staff have been very active in promoting and disseminating the science by producing results of social benefit in areas such as cultural heritage preservation, regional development, health protection, etc. We have created a wide network of close public sector partners - from museums to cultural heritage institutes to regional non-profits, the church,

and religious organizations with whom staff have organized museum expositions, presentations, Q&A sessions, etc. Important are also our educational efforts aimed at the youngest generations in form of learning activities, science shows, student projects etc.

The society-oriented efforts extend abroad. For instance, the temporary exhibition entitled "Baron Trenck: The New Face of the Legend," which was held at Špilberk Castle in 2019 in cooperation with the Brno City Museum, has since been shown in several museums throughout Europe. Recently, we continued this tradition by initiating a collaboration with the Ethnographic Collection of the Centro Studi Americanistici in Perugia, Italy, where thousands of Native American artifacts are housed.

Last but not least, the Department publishes its own peer-reviewed journal – Anthropologia Integra, which offers students and young scholars the opportunity to publish their scientific texts. In the form of this special issue, the journal also offers this opportunity to the authors of selected papers presented at the conference.

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Does parental similarity degree affect the development of their offspring?

Linda Koníková[1*] – Miroslav Králík[1] – Ondřej Klíma[2] – Martin Čuta[1]

[1] Department of Anthropology, Faculty of Science, Masaryk University, 611 37 Brno, Czech Republic
[2] IT4Innovations Centre of Excellence, Brno University of Technology, 612 00 Brno, Czech Republic

** Corresponding author, Linda Koníková: konikova@mail.muni.cz*

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MÁ PODOBNOST MEZI RODIČI VLIV NA VÝVOJ JEJICH POTOMKŮ?

ABSTRAKT Podobnost v obličeji a jiných tělesných charakteristikách se považuje za jeden z aspektů při volbě reprodukčního partnera u člověka. Navzdory skutečnosti, že míra rodičovské podobnosti může ovlivnit potomky již v raných fázích jejich prenatálního vývoje, jen velmi málo empirických studií se zatím zaměřilo na důsledky tohoto nenáhodného procesu. Tato studie měla tři cíle: (1) otestovat hypotézu tělesného asortativního párování u lidí, (2) najít vztah mezi fyzickou podobností rodičů a růstovými křivkami jejich potomků a (3) najít konkrétní trendy v růstu potomků související s asortací jejich rodičů. Podobnost rodičů ve fyzických znacích tak byla analyzována ve vztahu k deskriptorům růstových křivek jejich potomků (n = 184 trojic matka-otec-dítě z databáze Brněnské růstové studie). Ve srovnání s náhodně vytvořenými páry si skuteční partneři nebyli podobnější v žádném ze sledovaných znaků. Fyzické znaky však mezi partnery korelovaly (většinou kladně). Nalezené byly i vztahy mezi fyzickou podobností rodičů a deskriptory růstových křivek jejich potomků. Rodičovská podobnost v různých znacích však ovlivňovala růst potomků různým způsobem.

KLÍČOVÁ SLOVA asortativní párování; nenáhodné párování; výběr partnera; preference; podobnost; lidský obličej; růstová křivka; potomci

ABSTRACT Similarity in facial and other physical characteristics has been recognized as one aspect of reproductive mate choice in humans. Despite the fact that parental similarity degree may affect offspring already in the early stages of their prenatal development, just a very few empirical studies have focused on the consequences of this non-random process so far. This study included three goals: (1) to test the hypothesis of body assortative mating in humans, (2) to find a relationship between physical similarity of parents and the growth curves of their offspring and (3) to find specific trends in the growth of offspring connected to parental assortative mating. Therefore, the similarities of parents in physical features were analysed in relation to the descriptors of the growth curves of their offspring (n = 184 mother-father-child triads from the Brno Growth Study database). In comparison to randomly generated pairs, real partners were not more similar to each other in any of the observed trait. However, some physical features correlated (mostly positively) between partners. Relationships between physical similarity of parents and the descriptors of the growth curves of their offspring were found. However, parental similarity in various features affected the growth of their offspring differently.

KEY WORDS assortative mating; non-random mating; mate choice; preferences; similarity; human face; growth curve; offspring

INTRODUCTION

Non-random mating based on physical or cultural (Speakman et al. 2007, 316) similarity of partners is known as positive assortative mating or homogamy (Pearson 1903, 481). Among the first, Pearson (1903, 482) noticed positive correlation in physical traits between partners. Since then, many authors showed correlations in body height, weight, attractivity, health and other physical traits of partners (George et al. 2015, 128–129; Hur 2003, 468–469; Speakman et al. 2007, 317–319; Spuhler 1968, 128; Zietsch et al. 2011, 7). Genetic similarity of partners was also studied (Guo et al. 2014, 2–7;

Rushton 1988, 329–330). In general, correlations in body traits are weak although there are more positive correlations than negative (Rushton et al. 1984, 184).

During the active mate choice, important role is played by human face and previous studies actually showed significantly higher facial similarity between partners compared to random pair formation (Alvarez and Jaffe 2004, 185–188; Thiessen et al. 1997, 160–162; Wong et al. 2018, 5). However, in other studies, the preferences of men (who preferred similar partners) and women (who preferred the most attractive partners) differed (Kocsor et al. 2011, 1266–1267) or there was a difference between matched preference (similar partners) and actual choice (other than similar partners). It appears that several factors play a role in the actual mate choice, often based on evolutionary models like the theory of parental investment (Todd et al. 2007, 15015). The opposite result is the preference for average faces, which are generally considered attractive (Penton-Voak et al. 1999, 110) and sexual resistance to similar faces because of a sign of kinship (DeBruine 2005, 920–921).

Despite that many studies have shown that the human partner choice is not random, just a few of them have focused on consequences resulting from this specific partner choice for offspring. Studies that are illustrating these consequences and possible effect on offspring are often associated with other than physical traits. Many studies showed a strong correlation for demographic characteristics (age), socioeconomical status (education, income) and attitudes (religion or social, family, and political orientation; Buston and Emlen 2003, 8807–8808; George et al. 2015, 128–129; Hur 2003, 468–469; Watson et al. 2004, 1044–1047; Zietsch et al. 2011, 7). Partners often prefer a similar personality which can be also reflected in the face morphology (Little et al. 2006, 975–981). Similarity of partners in personality and attitudes have a positive effect on satisfaction in relationship and also offspring satisfaction (Wu et al. 2019, 8–15). On the other hand, dissimilarity in psychological characteristics leads to conflicts between partners and thus has a negative impact on their offspring. With negative impacts on the relationship and offspring well-being correlations in psychopathologies or addictions are also connected (smoking, alcoholism; Low et al. 2007, 949; Luo 2017, 9). Negative impact of physical parental similarity was also found. Similarity of parents in obesity increases the risk of obesity prevalence in offspring (Jacobson et al. 2006, 104). Moreover, an epidemical consequence in the population may be assumed (Speakman et al. 2007, 321). Nevertheless, there is a question about active preference for obesity and lower fertility of partners.

One of the few studies focusing on social but also physical similarities (age, education, income, body height and smiling frequency) which may enhance offspring prosperity (body height and school attendance) focuses on native Amazonian society in Bolivia. The correlation coefficients between partners were higher than expected by chance. However, no statistically significant relationship between assortative mating and offspring prosperity was found (Godoy et al. 2008, 205–208). On the contrary, Edwards and Roff (2016, 50–53) found an association between parental similarity in education, age, religion and physical characteristics and cognitive tests of offspring based on marital matching models. In this case, similarity also maintained the stability of the marriage.

Adaptive explanations of assortative mating

Based on adaptation theories, it can be assumed that if assortative mating is observed in humans, it may be beneficial for an individual (Godoy et al. 2008, 203; Kościński 2007, 49–50; Roberts and Little 2008, 311–313). According to Thiessen and Gregg (1980) assortative mating increases inclusive fitness (defined by Hamilton 1964) of partners by increasing the proportion of parental (similar) alleles in future generations (Thiessen et al. 1997, 162). By Rushton et al. (1984, 186) and Rushton (1988, 329–330), optimal genetic similarity of parents may have positive consequences by increasing the degree of genetic relationship between parent and offspring, so it may improve stability of marriage, fertility and increase the degree of altruism in the family. Furthermore, Figueredo and Wolf (2009, 326–327) linked assortative mating with Life History Strategy. According to their model, positive assortative mating is associated with a slow life history. It compensates for the disadvantages of sexuality, and through homogeneous offspring it preserves genomes adapted for the stable and predictable environment. On the contrary, negative assortative mating represents a fast life history and through genetic diversity of the offspring it has evolved as an adaptation to an unstable and unpredictable environment (Wolf and Figueredo 2011, 172–173).

Proximate mechanisms of assortative mating

Assumed mechanisms of parental similarity impact on offspring growth include the thrifty phenotype hypothesis (Hales and Barker 1992) and early prenatal programming (Lucas 1991). During the critical period of development, offspring is stimulated by the environment with lasting consequences for its future development, for example body size adaptations (Lucas 1991; Wells 2003). Therefore, the similarity of parents in physical characteristics could through more similar combination of alleles ensure the better conditions for smooth development of offspring. However, the optimal genetic similarity is important. Optimal outbreeding (by Bateson 1983) is balanced by assortative mating similarity maximalization and lethal homozygous selection (Alvarez and Jaffe 2004, 178; Epstein and Guttman 1984, 245; Thiessen and Gregg 1980). Nevertheless, a non-linear trend of assortative mating benefits is expected because the risk of many genetic defects increases with increasing degree of parental similarity (Penton-Voak et al. 1999, 105). On the other hand, the offspring of genetically diverse parents would be forced to combine a several different alleles, which could result in a certain developmental load. However, their prosperity may depend on the environment. As mentioned, negative assortative mating may maximalise

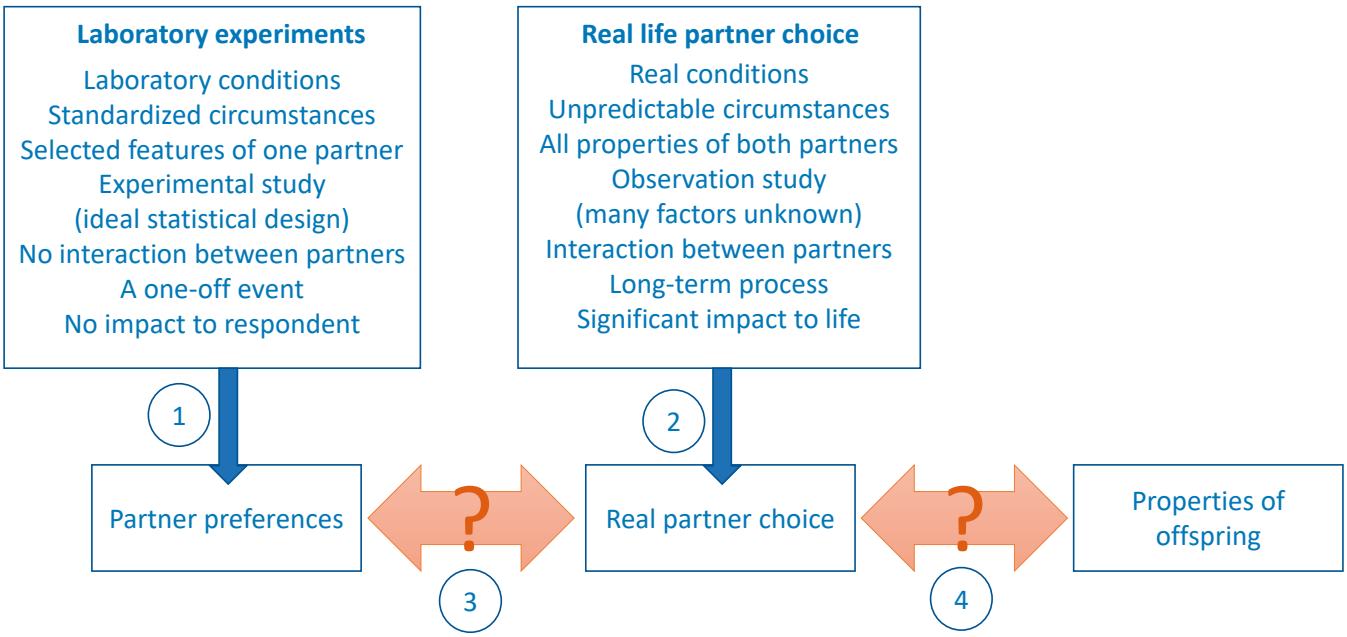

Figure 1: Scheme of the scientific approach to mate choice in humans. Most often, mate preferences are observed in laboratory (cognitive) experiments (1), where stimuli and research groups of volunteers are specified under defined conditions and respondents express their mate preferences. Another type of research is the study of real partner choice (2), the characteristics of partners from real couples based on observations, questionnaires, matrix data, etc. Less research has explored the relationship between pure preferences and their realization in life (3), and the least found in the literature is a focus on how partners' choice of certain traits affects the properties of their offspring (4), i.e., how partner choice affects the next generation. This research focuses on the study of this relationship (4).

the heterozygosity, so this offspring can be better adapted to an unpredictable environment, such as the struggle against pathogens (Godoy et al. 2008, 202; Ochoa and Jaffé 1999, 6; Penton-Voak et al. 1999, 105).

To sum up, it is assumed that the parental similarity degree is one of the factors that can affect offspring already in the early stages of their prenatal development. However, there is an open question if preference of a similar partner comes with potential benefits for the offspring (direct or indirect). Research on partner preferences (Figure 1) often does not follow the consequences of that choice which may represent the actual explanation of observed human mate choice. This study is among the first to focus on the relationship between certain traits of parents and the characteristics of their offspring in detail.

GOALS OF THE STUDY

The goal of the study was to follow up the studies which have showed significantly higher similarity between partners compared to random pair formation (Alvarez and Jaffe 2004, 185–188; Thiessen et al. 1997, 160–162; Wong et al. 2018, 5) and therefore to find a possible explanation of this phenomena. Mainly the facial similarity of partners was studied because the fact that the human face plays an important role during all stages of active partner choice (Miller 1998, 20) and as a genetic contribution of the parents it is also reflected in the faces of the offspring. Furthermore, based on adaptation theories, assortative mating benefits can be observed in offspring, if it (in addition to higher fitness), would have a positive effect on offspring prosperity (Godoy et al. 2008, 201–203). We hypothesise that parental similarity could ensure quality conditions for the growth and development of their offspring. Therefore, the more similar the parents are in facial traits, the smoother ontogenesis of their offspring can be assumed. The study included three goals: (1) to test the hypothesis of body assortative mating in humans, (2) to find a relationship between physical similarity of parents and the growth curves of their offspring and (3) to find specific trends in the growth of offspring connected to parental assortative mating. Therefore, the similarities of parents in physical features were analysed in relation to the descriptors of the growth curves of their offspring.

MATERIAL AND METHODS

Brno Growth Study

The sample was represented by individuals from the Brno Growth Study (BGS) database. The original longitudinal study, initiated in 1961, focused on growth and development of children from Brno, Czech Republic (Bouchalová 1987, 20–21).

Sample of children

Examinations of children (n = 555, 278 boys) within the Brno Growth Study took place at the Department of Social

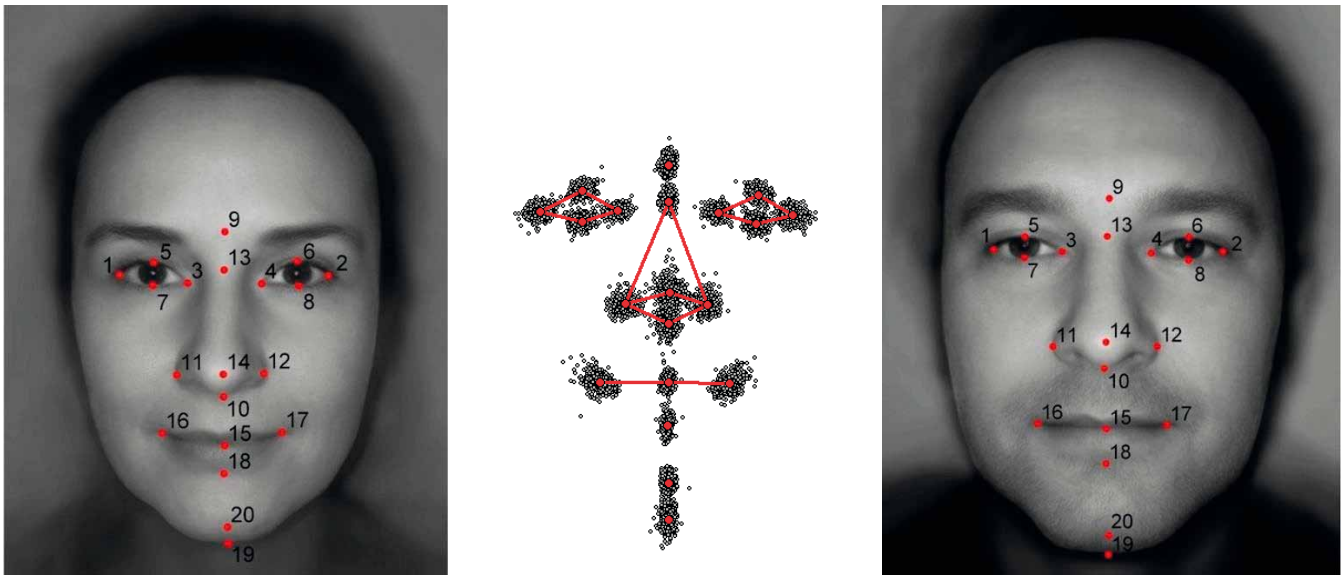

Figure 2: Visualisation of digitalized landmarks (outer average faces) and GPA superposition of landmarks of all individuals (in the centre). The average shape with the lines between the points is marked in red.

Medicine, Faculty of Medicine, University of Jan Evangelista Purkyně and the Pediatric Research Institute in Brno supervised by M. Bouchalová. A total of 334 participants remained until the end of the study and for 18 years they underwent a regular medical, psychological and social examination including body measurement (Bouchalová 1987, 20–25).

The postnatal growth curves of body height of the studied children were analysed by means of Functional Data Analysis (Ramsay et al. 2020) using newly developed R-package *growthfd* (Králík et al. 2021; Klíma et al. 2021) available at website: <https:/ondrej-klima.github.io/growthfd/>. The procedure is based on fitting B-splines into the data, registering all curves in the point of Age at Peak Velocity in adolescence, and decomposing variations in the functions by means of Functional Principal Component Analysis (FPCA), separately for phase and amplitude. As a result, each curve is described by scores on 12 Functional Principal Components, 6 for phase and 6 for amplitude. Curve shape changes for interpretation are available in the R-package *growthfd* and in the supplementary materials of the published method (Králík et al. 2021).

Parental sample

The records of parents from the Brno Growth Study collected from 1970 until 1977 consisted of whole-body photography and basic personal data (date of birth, examination date, sibling number and order) and body measurements (body height, weight, and face measurements). A total of 635 photographs from parental files were scanned with 600 DPI resolution. The images were sorted in order to exclude individuals with a missing partner record (n = 53), individuals without a photograph (at least one of the partners lacked a photograph, n = 98) and individuals for whom it was impossible to record landmarks in the face area due to insufficient image quality, head rotation and the presence of glasses. The resulting number of images that were further used was 420.

Geometric morphometrics of parental faces

Scanned and edited face images (n = 420 parents, 210 men and 210 women) were added to TPS file in the random order using *tpsUtil 1.78* (Rohlf 2019). Based on the anthropometric points defined for the FIDENTIS 3D face database (Urbanová et al. 2018, 207–208, 210), twenty landmarks which could be used with respect to the image quality and face position were defined (Figure 2). The landmarks were digitalised in *tpsDig2 2.31* (Rohlf 2017). Cartesian coordinates in 3D array (20 x 2 x 420) were calibrated using morphological facial height (the distance between nasion and gnathion). Real measurements of morphological facial height available from parental records were divided by the distance between nasion and gnathion landmarks and obtained fraction represented the scale value by which the raw coordinates were multiplied (n = 416 individuals with possible calibration, 208 men and 208 women).

Calibrated coordinates were analysed by Generalized Procrustes Analysis (GPA) method using R-package *geomorph* (Adams et al. 2020, Figure 2). At first, Procrustes shape coordinates were used for the calculation of full Procrustes distances (PD) between configurations of all individuals one by one using routines in the R-package *shapes* (Dryden 2019). From the matrix of full Procrustes distances, it was possible to select values for real pairs (n = 208 real life parents) and randomly generated pairs (n = 43056). In this variant of analysis, the similarity of parents was defined based on the PD between them. The lower Procrustes distances were between partners (the closer their overall configurations were to each other in the shape space), the more similar they were considered. Secondly, differences in centroid sizes (CS) were computed for

all individuals (real and random pairs) calculated as female value subtracted from male value ($D = X_M - X_F$). In this variant of analysis, partners were considered more similar in the overall face size, the closer to zero the differences in CS were between them.

Procrustes shape coordinates were subsequently analysed by Principal Component Analysis (PCA, R-package *geomorph*, Adams et al. 2020) resulting in 36 Principal Components. Principal Components were visualised to show the difference between the reference and target shape (minimum and maximum of the score represented by given component, R-package *geomorph*, Adams et al. 2020). Based on the visualizations, twelve components which represented the real difference in shape between individuals were selected. Selected components included changes in the shape of the head and facial parts as well as changes originated during the photo shoot with a possible interpretation of the similarity in personality between partners (for example head position or facial expression). The distances on the selected components were calculated between partners (males and females) within real (n = 208) and random pairs (n = 43056). The lower the distance on the selected component was between them, the more similar the partners were in the shape expressed by the component.

Additional information about parents

Life-history features and anthropometry of parents from the parental records were also analysed. The similarity of parents was defined as a difference between them in studied characteristics calculated as female value subtracted from male value ($D = X_M - X_F$) for all individuals (real and random pairs).

Life-history features of parents

Parents were born from 1911/04/17 to 1946/01/18 with 1st to 9th birth order and with 1 to 11 siblings. The ages of parents were defined as ages at the time of birth of offspring, calculated from the dates of birth of parents and offspring. The mean age difference (in years) between the real pairs was 3.97 (min = −6.75, max = 20.44). The mean of difference in number of siblings was −0.211 (min = −8, max = 9) and for birth order it was −0.174 (min = −8, max = 5). Differences between partners in number of siblings and birth order were divided into categories −2 and less, −1, 0, 1, 2 and more.

Anthropometry of parents

Differences between parents were calculated based on their anthropometric measurements. The mean of difference in height (in centimetres) was 11.5 (min = −5.5, max = 27.5). The mean of difference in weight (in kilograms) was 14.0 (min = −40.8, max = 59.4). The head measurements (differences between real partners, all in centimetres) were as follows: head circumference (mean = 2.3, min = −2.5, max = 8.0), head width (mean = 0.76, min = −1.1, max = 4.6), head length (mean = 0.98, min = −2.0, max = 3.8), head height (mean = 0.73, min = −1.6, max = 3.6), minimum frontal breadth (mean = 0.47, min = −1.7, max = 2.9), bizygomatic breadth (mean = 1.15, min = −1.3, max = 4.1), bigonial breadth (mean = 0.72, min = −1.2, max = 3.2), physiognomic facial length (mean = 1.15, min = −2.1, max = 4.5), morphological facial length (mean = 0.88, min = −1.7, max = 3.50), nose to chin distance (mean = 0.57, min = −2.0, max = 2.6), nose width (mean = 0.35, min = −1.0, max = 1.8), nose height (mean = 0.39, min = −0.8, max = 1.7), mouth width (mean = 0.3, min = −1.1, max = 1.4), mouth height (mean = −0.23, min = −3.6, max = 1.4).

Data analyses

Relationships between parental variables (distances and differences between partners) and the descriptors of the growth curves of their offspring were analysed. The number of cases where data were available for both children and parents were 184 (96 mother-father-daughter and 88 mother-father-son triads). Data analysis was performed in R (R Core Team 2020). The differences between groups (partners within real and random pairs or between the parents of boys and girls) were compared using Student's t-test or nonparametric Mann-Whitney U test. The correlations between partners were computed using Pearson's correlation coefficient.

All differences between partners (in face centroid size, age, and anthropometric measurements) were edited due to the nature of similarity in the following manner. Mean differences of studied variables between the real partners (parents) represented the optimal values of differences (similarity) between partners ($O = \text{mean}(D_{1\text{-}n})$). These optimal values were subtracted from each value of difference between partners, so they replaced zero (difference between partners = 0 which means that their difference is identical to the mean value of all differences in the sample) as beginning of coordinates. All obtained differences between partners were then absolutized ($D_1 = |D - O|$). Partners were considered more similar in a certain variable, the closer to zero the absolute differences between them were in that variable.

Relationships between parental variables and descriptors of the growth curves of the offspring were computed in correlation matrices (R-package *Hmisc*, Harrell 2021) using Spearman's correlation coefficient. Correlation matrices were also computed for individual variables of mothers and fathers to control a possible influence of one of the parents. It was thus determined whether the relationship with descriptors of the growth curves of the offspring depend on the characteristics of mother, father, or the absolute difference between them. Relationships were interpreted when the absolute differences between the parents were more significant than the value of each parent. Significant relationships were visualized using scatterplots and regression lines. Categorical data (number of siblings and birth order) were tested by Kruskal-Wallis test and significant relationships were further compared using Dunn's all-pairs test (R-package *PMCMRplus*, Pohlert 2022) and visualized using boxplots.

RESULTS

Difference between the real and random pairs

There was no statistically significant difference found between the Procrustes distances between partners within real (mean = 0.102, min = 0.059, max = 0.196) and random pairs (mean = 0.103, min = 0.039, max = 0.269) nor between the face centroid size absolute differences between partners within real (mean = 14.054, min = −35.622, max = 54.315) and random pairs (mean = 14.054, min = −70.413, max = 81.636). No statistically significant differences between the groups of real and random pairs were found in the distances between partners on any of the selected components nor in the absolute difference between partners in other characteristics (e.g., age, height, weight or head measurements).

Difference between the parents of boys and girls

Parents of girls had significantly lower Procrustes distances between them compared to parents of boys, so they were more similar in the overall landmark configuration (t = −1.997, p-value = 0.047). Based on the shape expressed by individual components, parents of girls were also more similar in the shape of the head (t = −2.017, p-value = 0.045), and in the chin height (t = −2.391, p-value = 0.018). Parents of boys were more similar in the shape of eyes (t = 2.110, p-value = 0.036). Based on anthropometric measurements parents of girls were more similar in the minimum frontal breadth (t = −2.558, p-value = 0.011). Mothers of boys had significantly higher head width compared to mothers of girls (W = 4110.5, p-value = 0.014) and fathers of boys had significantly higher minimum frontal breadth compared to fathers of girls (W = 4321.5, p-value = 0.051).

Correlations between partners

There was a statistically significant strong positive correlation found in the age of parents (0.734, between parents of girls it was 0.708 and between parents of boys 0.766). Medium strong positive correlation was found in height (0.436, between parents of girls it was 0.514, but between parents of boys the correlation was weak: 0.342). No significant correlations were found in body weight. Weak positive correlation was found in bizygomatic width (0.267, between parents of girls it was insignificant and between parents of boys it was 0.351). Very weak positive correlation was found in chin height (0.138, between parents of girls it was weak: 0.288 and between parents of boys it was insignificant), in nose width (0.142), in bigonial width (0.134) and in the number of siblings (0.142). Between parents of girls was further found a weak positive correlation in the shape of eyes (0.218), in the head position on the photography (0.216) and a very weak positive correlation in the head circumference (0.188). Between the parents of boys was further found a weak negative correlation in the mouth height (−0.223) and in the head position on the photography (−0.203).

Correlations between parents and growth of their offspring

This section contains interpretations of significant correlations between parental variables and descriptors of the growth curves of the offspring, represented by Functional Principal Components (FPC), separately for phase and amplitude, which are introduced at the beginnings of subsequent paragraphs. Tables of Spearman's correlation coefficients and p-values are available in Supplementary Materials (Tables S1–S2 for distances/absolute differences between partners and Tables S3–S6 for individual variables of mothers and fathers). Facial shape changes on Principal Components, of which the distance between parents significantly correlated with descriptors of the growth curves of offspring are visualised in Table S7. Growth curve variations of offspring and respective relationships in parents are available in Figures 3–7 and in Supplementary Materials (Figures S1–S6).

Phase FPC1 represents total age shift in the growth curve meaning the variation between subjects with overall early and late maturation. In other words, it is about the differences between children in how they progress in their biological development at the same age. Phase FPC1 represents 79.7% of variance in boys and 77.6% of variance in girls. In boys, phase FPC1 is related to the head width of fathers ($\rho = 0.23$, p-value = 0.030), and to the distance on PC8 (which represents chin height/distance between sublabiale and pogonion, $\rho = -0.21$, p-value = 0.046) and absolute difference in nose to chin distance ($\rho = -0.27$, p-value = 0.012) between parents. As the distance on PC8 between parents decreases (they are more similar in chin height based on distance between sublabiale and pogonion), the score on phase FPC1 of sons increases (the growth curve shifts from blue to red), therefore according to the height growth curve, sons have a greater tendency to mature earlier compared to other boys. The same relation is true for the absolute difference in nose to chin distance between parents and the score on phase FPC1 of sons. In girls, phase FPC1 is related to the age of fathers ($\rho = 0.23$, p-value = 0.023), to the minimum frontal breadth of mothers ($\rho = 0.27$, p-value = 0.008), and to the face centroid size absolute difference between parents ($\rho = 0.21$, p-value = 0.036). As the absolute difference in face centroid size between parents decreases (they are more similar in overall face size), the score on phase FPC1 of daughters decreases (the growth curve shifts from red to blue), therefore according to the height growth curve, daughters have a greater tendency to mature later compared to other girls.

Amplitude FPC1 represents overall variation in amplitude which reflects absolute height throughout the whole postnatal growth. Amplitude FPC1 represents 78.5% of variance in boys

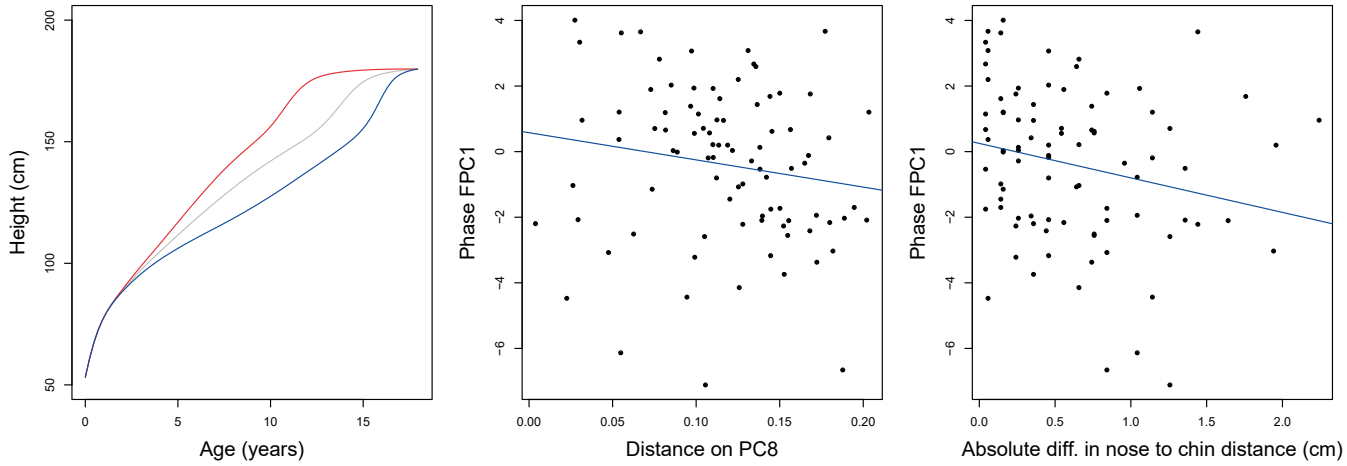

Figure 3: Phase FPC1 growth curve variations in boys and respective relationships in parents. Mean growth curve is marked grey, red curve represents positive values (+ 3SD), and blue curve represents negative values (– 3SD) within the curve change represented by individual Functional Principal Component (FPC).

and 75.5% of variance in girls. In boys, amplitude FPC1 is related to the height of fathers (ρ = 0.46, p-value = 0.000) and mothers (ρ = 0.54, p-value = 0.000), to the weight (ρ = 0.34, p-value = 0.001), head width (ρ = 0.21, p-value = 0.049), head height (ρ = 0.25, p-value = 0.019), nose to chin distance (ρ = 0.21, p-value = 0.047) and score on PC12 (ρ = 0.29, p-value = 0.007, eye shape) of mothers, and to the age (ρ = 0.21, p-value = 0.046), bigonial breadth (ρ = 0.24, p-value = 0.022) and score on PC13 (ρ = 0.24 p-value = 0.025, nose alar position) of fathers, which is why amplitude FPC1 is also related to the distance on PC13 between parents (ρ = 0.26, p-value = 0.015). In boys, amplitude FPC1 is further related to the distance on PC5 (ρ = −0.21, p-value = 0.047, glabella position and nose width), and to the absolute difference in mouth height (ρ = 0.21 p-value = 0.050) between parents. As the distance on PC5 between parents decreases (they are more similar in glabella position and nose width), the score on amplitude FPC1 of sons increases (the growth curve shifts from blue to red), therefore they were overall taller compared to other boys in the same growth phase. At the same time, as the absolute difference in mouth height between parents decreases (they are more similar in mouth height), the score on amplitude FPC1 of sons decreases (the growth curve shifts from red to blue), therefore they were overall shorter compared to other boys in the same growth phase. In girls, amplitude FPC1 is related to the height of fathers (ρ = 0.45, p-value = 0.000) and mothers (ρ = 0.42, p-value = 0.000), to the mouth height (ρ = 0.21, p-value = 0.042) of mothers, and to the score on PC4 (ρ = −0.20, p-value = 0.049, facial expression), score on PC14 (ρ = 0.31, p-value = 0.003, chin shape/distance between pogonion and gnathion), head height (ρ = 0.22, p-value = 0.029), nose height (ρ = 0.20, p-value = 0.047) and weight (ρ = 0.26, p-value = 0.010) of fathers, which is why amplitude FPC1 is also related to the absolute difference in weight (ρ = 0.20, p-value = 0.050) between parents. In girls, amplitude FPC1 is further related to the distance on PC12 (ρ = 0.25, p-value = 0.013, eye shape), absolute difference in centroid size (ρ = −0.32, p-value = 0.002), minimum frontal breadth (ρ = 0.33, p-value = 0.001) and bizygomatic breadth (ρ = 0.23, p-value = 0.021) between parents. As the distance on PC12 between parents decreases (they are more similar in the shape of eyes), the score on amplitude FPC1 of daughters decreases (the growth curve shifts from red to blue), therefore they were overall shorter compared to other girls in the same growth phase. As the absolute difference in minimum frontal breadth and bizygomatic breadth between parents decreases (they are more similar in these variables), the score on amplitude FPC1 of daughters also decreases, therefore they were overall shorter compared to other girls in the same growth phase. On the contrary, as the absolute difference in face centroid size between parents decreases (they are more similar in overall face size), the score on amplitude FPC1 of daughters increases (the growth curve shifts from blue to red), therefore they were overall taller compared to other girls in the same growth phase.

Phase FPC2 reflects one change in the growth dynamics so the postnatal growth curve is divided into two parts with different growth rates (individuals with higher growth rate in the first period, have lower growth rate in the second postnatal period and vice versa). Phase FPC2 represents 16.0% of variance in boys and 19.3% of variance in girls. In boys, phase FPC2 is related to the age of fathers (ρ = −0.21, p-value = 0.049), and to the score on PC4 (ρ = −0.21, p-value = 0.049, facial expression), score on PC12 (ρ = −0.26, p-value = 0.015, eye shape), score on PC13 (ρ = 0.27, p-value = 0.010, nose alar position), height (ρ = −0.25, p-value = 0.020), weight (ρ = −0.22, p-value = 0.044) and head height (ρ = −0.24, p-value = 0.027) of mothers. In boys, phase FPC2 is further related to the distance on PC5 (ρ = 0.21, p-value = 0.046, glabella position and nose width) and to the absolute difference in bigonial breadth (ρ = −0.30, p-value = 0.005) between parents. As the distance on PC5 between parents decreases (they are more similar in glabella position and nose width), the score on phase FPC2 of sons decreases (the growth curve shifts from red to blue), therefore they have a greater tendency to have a lower growth

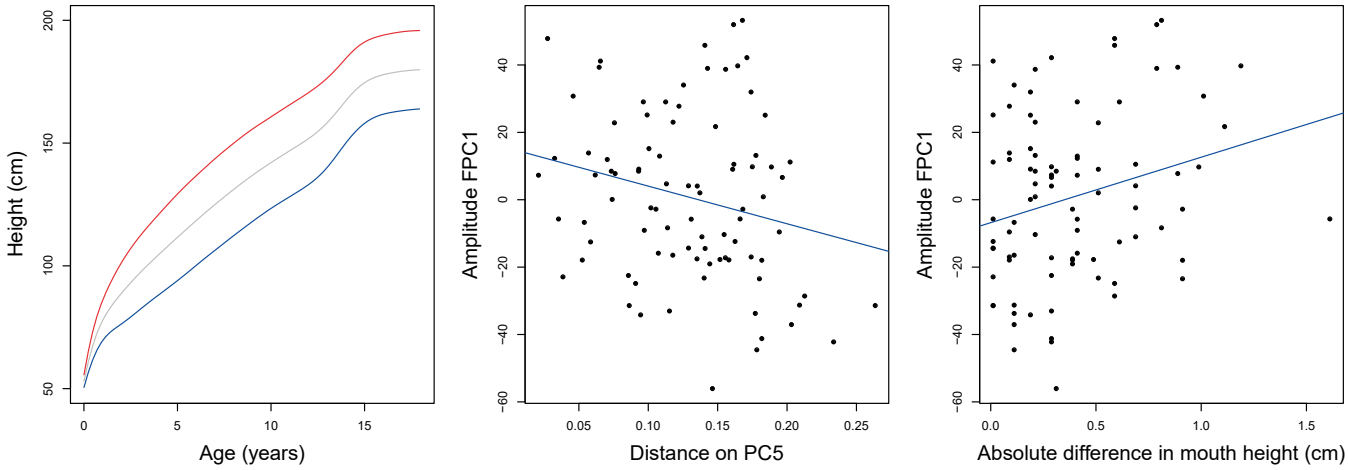

Figure 4: Amplitude FPC1 growth curve variations in boys and respective relationships in parents. Mean growth curve is marked grey, red curve represents positive values (+ 3SD), and blue curve represents negative values (– 3SD) within the curve change represented by individual Functional Principal Component (FPC).

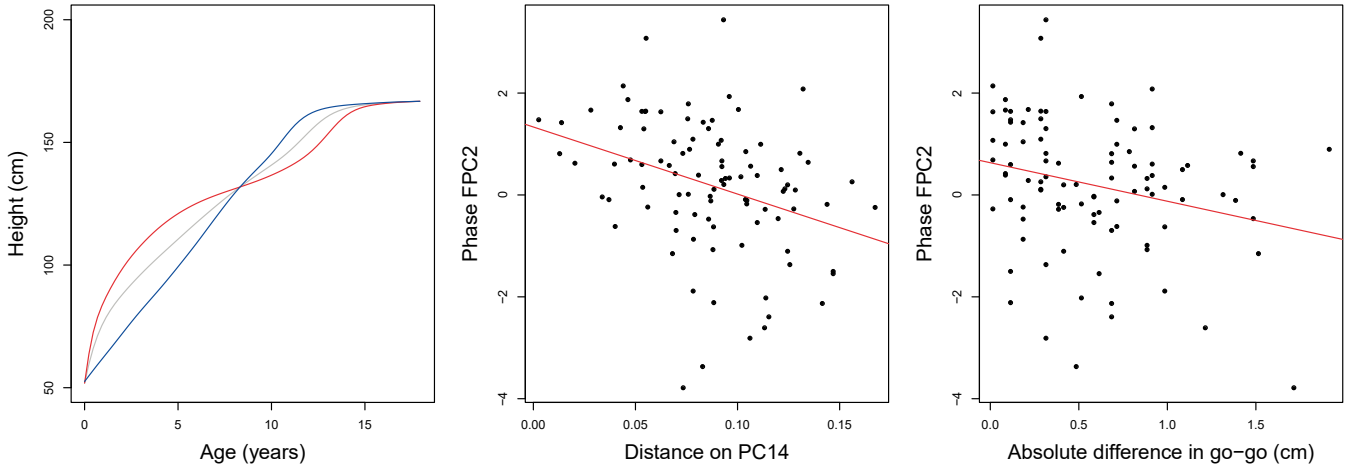

Figure 5: Phase FPC2 growth curve variations in girls and respective relationships in parents. Mean growth curve is marked grey, red curve represents positive values (+ 3SD), and blue curve represents negative values (– 3SD) within the curve change represented by individual Functional Principal Component (FPC).

rate in the first postnatal period (approx. until 9 years) and to mature earlier compared to other boys. At the same time, as the absolute difference in bigonial breadth between parents decreases (they are more similar in bigonial breadth), the score on phase FPC1 of sons increases (the growth curve shifts from blue to red), therefore they have a greater tendency to have a higher growth rate in the first postnatal period (approx. until 9 years) and to mature later compared to other boys. In girls, phase FPC2 is related to the head width of mothers (ρ = 0.24, p-value = 0.019), and to the distance on PC14 (ρ = −0.38, p-value = 0.000, chin shape/distance between pogonion and gnathion) and to the absolute difference in bigonial breadth (ρ = −0.27, p-value = 0.007) between parents. As the distance on PC14 between parents decreases (they are more similar in the chin shape based on distance between pogonion and gnathion), the score on phase FPC2 of daughters increases (the growth curve shifts from blue to red), therefore they have a greater tendency to have a higher growth rate in the first postnatal period (approx. until 8 years) and to mature later compared to other girls. The same relation is true for the absolute difference in bigonial breadth between parents and the score on phase FPC2 of daughters. Based on Kruskal-Wallis test, phase FPC2 in girls is related to the difference in number of siblings between parents (χ^2= 10.63, p-value = 0.031). Pairwise comparisons using Dunn's all-pairs test showed difference between category −1 and −2 (p-value = 0.069). When the difference in number of siblings between parents is −1, which means that mothers have one more sibling than fathers, the score on phase FPC2 of girls is higher, therefore they have a greater tendency to have a higher growth rate in the first postnatal period (approx. until 8 years) and to mature later compared to girls whose mothers have two or more siblings more than fathers (the difference in number of siblings between parents is −2 and less).

Amplitude FPC2 reflects one change in the growth dynamics so the postnatal growth curve is divided into two parts with

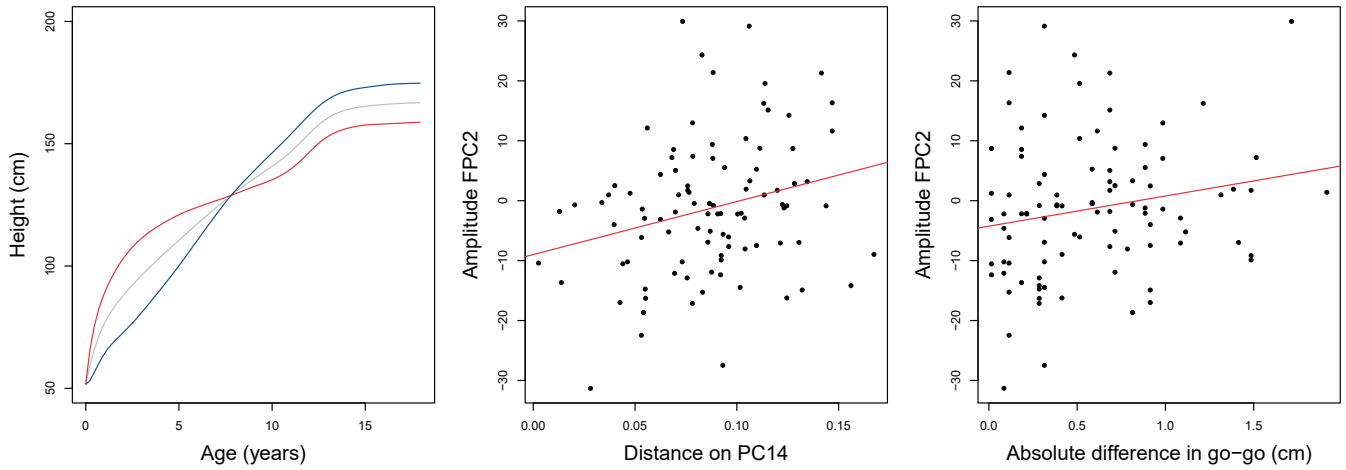

Figure 6: Amplitude FPC2 growth curve variations in girls and respective relationships in parents. Mean growth curve is marked grey, red curve represents positive values (+ 3SD), and blue curve represents negative values (– 3SD) within the curve change represented by individual Functional Principal Component (FPC).

different relative heights (individuals taller in the first period, are shorter compared to the sample in the second postnatal period and vice versa). Amplitude FPC2 represents 13.9% of variance in boys and 19.9% of variance in girls. In boys, amplitude FPC2 is related to the absolute difference in head height (ρ = −0.22, p-value = 0.038) and in bigonial breadth (ρ = 0.23, p-value = 0.032) between parents. As the absolute difference in head height between parents decreases (they are more similar in head height), the score on amplitude FPC2 of sons increases (the growth curve shifts from blue to red), therefore they were overall taller in the first postnatal period (approx. until 7.5 years) and shorter in the second postnatal period compared to other boys in the same growth phase. At the same time, as the absolute difference in bigonial breadth between parents decreases (they are more similar in bigonial breadth), the score on amplitude FPC2 of sons decreases (the growth curve shifts from red to blue), therefore they were overall shorter in the first postnatal period and taller in the second postnatal period compared to other boys in the same growth phase. In girls, amplitude FPC2 is related to the score on PC4 (ρ = 0.22, p-value = 0.033, facial expression) and score on PC5 (ρ = 0.27, p-value = 0.008, glabella position and nose width) of fathers, to the height of fathers (ρ = −0.25, p-value = 0.013) and mothers (ρ = −0.42, p-value = 0.000), and to the centroid size (ρ = −0.25, p-value = 0.013), head width (ρ = −0.22, p-value = 0.030), nose to chin distance (ρ = −0.26, p-value = 0.009) and nose width (ρ = −0.26, p-value = 0.011) of mothers. In girls, amplitude FPC2 is further related to the distance on PC14 (ρ = 0.25, p-value = 0.016, chin shape/distance between pogonion and gnathion) and to the absolute difference in bigonial breadth (ρ = 0.21, p-value = 0.044) between parents. As the distance on PC14 between parents decreases (they are more similar in chin shape based on distance between pogonion and gnathion), the score on amplitude FPC2 of daughters decreases (the growth curve shifts from red to blue), therefore they were overall shorter in the first postnatal period (approx. until 7.5 years) and taller in the second postnatal period compared to other girls in the same growth phase. The same relation is true for the absolute difference in bigonial breadth between parents and the score on amplitude FPC2 of daughters. Based on Kruskal-Wallis test, amplitude FPC2 in girls is related to the difference in number of siblings between parents (χ^2= 9.62, p-value = 0.047). Pairwise comparisons using Dunn's all-pairs test showed difference between category −1 and 1 (p-value = 0.061). When the difference in number of siblings between parents is 1, which means that fathers have one more sibling than mothers, the score on amplitude FPC2 of girls is higher, therefore they were overall taller in the first postnatal period (approx. until 7.5 years) and shorter in the second postnatal period compared to girls whose mothers have one more sibling than fathers (the difference in number of siblings between parents is −1).

Phase FPC3 reflects two changes in the growth dynamics so the postnatal growth curve is divided into three parts with different growth rates (individuals with higher growth rate in the first period, have lower growth rate in the second postnatal period, and they mature earlier compared to the sample and vice versa). Phase FPC3 represents 3.8% of variance in boys and 2.8% of variance in girls. In boys, phase FPC3 is related to the score on PC5 (ρ = −0.30, p-value = 0.005, glabella position and nose width) and score on PC10 (ρ = −0.22, p-value = 0.037, nose width) of mothers, to the minimum frontal breadth (ρ = −0.22, p-value = 0.043) of fathers, and to the distance on PC3 between parents (ρ = −0.24, p-value = 0.026, head rotation). As the distance on PC3 between parents decreases (they are more similar in head rotation during photo shooting), the score on phase FPC3 of sons increases (the growth curve shifts from blue to red), therefore they have a greater tendency to have a higher growth rate in the first postnatal period (approx. until 5 years), to have a lower growth rate in the second postnatal period (approx. until 12 years) and to mature earlier compared to other boys (the change in

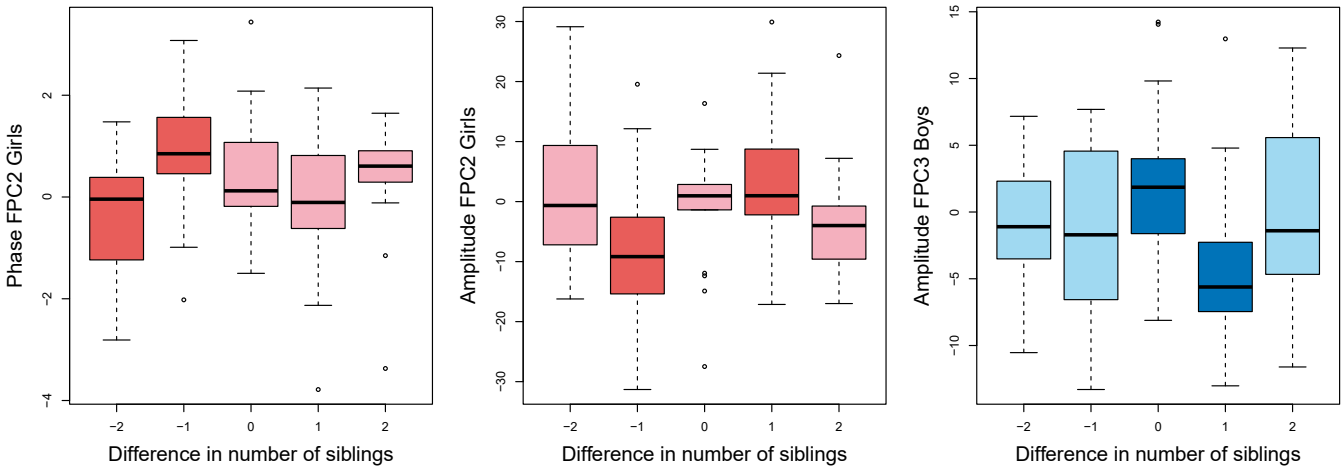

Figure 7: Boxplots of relationship between difference in number of siblings between parents categorized as −2 and less, −1, 0, 1, and 2 and more, and respective descriptors of the growth curves of their offspring. Categories which differ significantly are highlighted in a darker colour.

their growth rate occurs twice). In girls, phase FPC3 is related to the number of siblings (ρ = −0.22, p-value = 0.033) and height (ρ = 0.23, p-value = 0.027) of fathers, to the birth order (ρ = −0.22, p-value = 0.029) and age (ρ = −0.20, p-value = 0.049) of mothers, and to the distance on PC3 between parents (ρ = −0.29, p-value = 0.005, head rotation). As the distance on PC3 between parents decreases (they are more similar in head rotation during photo shooting), the score on phase FPC3 of daughters increases (the growth curve shifts from blue to red), therefore they have a greater tendency to have a higher growth rate in the first postnatal period (approx. until 5 years), to have a lower growth rate in the second postnatal period (approx. until 12 years) and to mature earlier compared to other girls (the change in their growth rate occurs twice).

Amplitude FPC3 reflects two changes in the growth dynamics so the postnatal growth curve is divided into three parts with different relative heights (individuals taller in the first period, are shorter in the second postnatal period, and they are again taller compared to the sample in the third postnatal period and vice versa). Amplitude FPC3 represents 6.6% of variance in boys and 3.5% of variance in girls. In boys, amplitude FPC3 is related to the score on PC12 (ρ = −0.25, p-value = 0.020, eye shape), score on PC14 (ρ = 0.24, p-value = 0.027, chin shape/distance between pogonion and gnathion), head width (ρ = 0.32, p-value = 0.003), head height (ρ = 0.22, p-value = 0.038), minimum frontal breadth (ρ = 0.24, p-value = 0.026) and mouth width (ρ = 0.26, p-value = 0.013) of fathers and to the height of fathers (ρ = 0.37, p-value = 0.000) and mothers (ρ = 0.25, p-value = 0.020). There were no statistically significant correlations found between parental variables (distances or absolute differences between them) and amplitude FPC3 in boys. Based on Kruskal-Wallis test, amplitude FPC3 in boys is related to the difference in number of siblings between parents (χ^2= 11.02, p-value = 0.026). Pairwise comparisons using Dunn's all-pairs test showed difference between category 1 and 0 (p-value = 0.0113). When the difference in number of siblings between parents is 0, which means their numbers of siblings are same, the score on amplitude FPC3 of boys is higher, therefore they were overall taller in the first postnatal period (approx. until 5 years), shorter in the second postnatal period (approx. until 14 years) and taller in the third postnatal period (the change in the relative height occurs twice) compared to boys whose fathers have one more sibling than mothers (the difference in number of siblings between parents is 1). In girls, amplitude FPC3 is related to the score on PC4 (ρ = −0.24, p-value = 0.020, facial expression) of fathers and to the score on PC13 (ρ = −0.23, p-value = 0.028, nose alar position), head circumference (ρ = 0.22, p-value = 0.031), head length (ρ = 0.25, p-value = 0.015), minimum frontal breadth (ρ = 0.25, p-value = 0.013), bigonial breadth (ρ = 0.32, p-value = 0.002) and mouth width (ρ = 0.22, p-value = 0.032) of mothers. There were no statistically significant correlations found between parental variables (distances or absolute differences between them) and amplitude FPC3 in girls.

DISCUSSION

This study focused on parental similarity because of its importance during partner choice, mainly on facial similarity. With the hypothesis that offspring's characteristics may represent the consequences of assortative mating, parental similarity was analysed in relation to the descriptors of the growth curves of their offspring. We assumed that parental similarity could ensure quality conditions for the growth and development of their offspring. Therefore, the more similar the parents are in facial traits, the smoother ontogenesis of their offspring can be expected. It means, in the context of quality conditions (stable environment) that the growth rate of offspring will be lower, and they will be overall taller compared to others.

The first goal aims to test the hypothesis of body assortative mating in humans. Compared to studies which have shown significantly higher similarity between partners than between

random pair formations (Alvarez and Jaffe 2004, 185–188; Thiessen et al. 1997, 160–162; Wong et al. 2018, 5), in our sample the real partners were not more similar to each other in any of the observed traits than randomly generated pairs. However, this result may be affected by the variance of the sample (Wolanski and Siniarska 1984, 250–251). The similarity of partners might be lower than in biologically more diversified samples probably due to origin of the sample prevalently from one small quarter of the town Brno, i.e., partners tend to be relatively less similar compared to samples (e.g., based on wide geographic region) where the variance of observed traits is higher. Nevertheless, strong positive correlation in age was found between the partners, which agrees with the results according to Spuhler (1968, 128) and George et al. (2015, 129). Medium strong positive correlations were found for parental height, compared to a low correlation (0.25) according to George et al. (2015, 129) and low correlation (0.20) according to Zietsch et al. (2011, 16). Weak correlations of other body characteristics and dominance of the positive correlations agreed with previous studies (George et al. 2015, 129; Rushton et al. 1984, 184; Spuhler 1968, 128).

Relationships between physical similarity of parents and the descriptors of the growth curves of their offspring (second goal) were found. In this sample, sons of parents more similar in chin height (based on distance between sublabiale and pogonion) and in nose to chin distance have, according to the height growth curve, a greater tendency to mature earlier. Sons of parents more similar in glabella position and nose width have a greater tendency to have a lower growth rate in the first postnatal period (approx. until 9 years) and to mature earlier compared to other boys and furthermore, they were overall taller compared to other boys in the same growth phase. On the contrary, sons of parents more similar in mouth height were overall shorter compared to other boys in the same growth phase. Sons and daughters of parents more similar in bigonial breadth have a greater tendency to have a higher growth rate in the first postnatal period (approx. until 7–9 years) and to mature later compared to others, and at the same time they were overall shorter in the first postnatal period and taller in the second postnatal period compared to other boys or girls in the same growth phase. The same relations are true for daughters of parents more similar in the shape of chin (based on distance between pogonion and gnathion). On the contrary, sons of parents more similar in head height were overall taller in the first postnatal period, and shorter in the second postnatal period compared to other boys in the same growth phase. Daughters of parents more similar in overall face size (centroid size) have, according to the height growth curve, a greater tendency to mature later and they were overall taller compared to other girls in the same growth phase. On the contrary, daughters of parents more similar in the shape of the eyes, minimum frontal breadth and in bizygomatic breadth were overall shorter compared to other girls in the same growth phase. Sons and daughters of parents more similar in head rotation (during photo shooting) have a greater tendency to have a higher growth rate in the first postnatal period (approx. until 5 years), to have a lower growth rate in the second postnatal period (approx. until 12 years) and to mature earlier compared to other boys and girls (the change in their growth rate occurs twice).

However, it is difficult to discuss our results due to lack of comparative studies. We have not yet found a study of similar focus and content in the literature. Nevertheless, based on previous summary of results and Table 1, some relationships appear to be coherent therefore we assume that the effects we found correspond to real biological phenomena (Note: by parental variable we always mean the absolute difference between partners in the respective variable, respectively distance between them on certain Principal component which represents the mentioned shape).

1. Variables similar in biological meaning significantly correlate with the same descriptor of the growth curve. For example, chin height and nose to chin distance of parents correlate negatively with FPC1 phase in boys, and minimum frontal breadth and bizygomatic breadth of parents correlate positively with FPC1 amplitude in girls.
2. Variables opposite in biological meaning are related to the same descriptor of the growth curve with opposite effects. For example, head height of parents correlates negatively with amplitude FPC2 in boys and conversely bigonial breadth of parents correlates positively with amplitude FPC2 in boys.
3. One parental variable correlates with both phase and amplitude of Functional Principal Component with corresponding effect. For example, parental face centroid size correlates positively with FPC1 phase and negatively with FPC1 amplitude in girls which means that daughters of parents more similar in overall face size have greater tendency to mature later and to be overall taller compared to other girls in the same growth phase. Similarly, this connection is true for correlations between the shape of chin of parents and FPC2 phase and amplitude in girls, and for correlations between bigonial breadth of parents and FPC2 phase and amplitude in boys and also in girls.
4. Same effects on certain Functional Principal Component are present in boys and girls, i.e., in two independent analyses (two separate samples). For example, head rotation of parents correlates negatively with FPC3 phase in boys and girls, and bigonial breadth of parents correlates negatively with FPC2 phase and positively with FPC2 amplitude in boys and girls.

Similar results have been found for the same sample using different methodology in Koníková (2021), where physical similarity of partners (in the same traits) was analysed in relation to the growth parameters of their offspring represented by individual growth milestones during puberty and adolescence (Králík et al. 2021, 5). Based on those results, sons of the parents more similar in glabella position and nose width were taller at the point of peak velocity in puberty compared to other boys, and daughters of the parents more similar in the same

Spearman correlation		Sex	Centroid size absolute difference	Distances between partners					Absolute differences between partners					
				PC3	PC5	PC8	PC12	PC14	Head height	Ft - ft	Zy - zy	Go - go	Nose to chin	Mouth height
FPC1	phase	M				-0,210* 0.046							-0,270* 0.012	
		F	0,210* 0.036											
	amplitude	M			-0,210* 0.047									0,210* 0.050
		F	-0,320** 0.002				0,250* 0.013			0,330** 0.001	0,230* 0.021			
FPC2	phase	M			0,210* 0.046							-0,300** 0.005		
		F						-0,380** 0.000				-0,270** 0.007		
	amplitude	M							-0,220* 0.038			0,230* 0.032		
		F						0,250* 0.016				0,210* 0.044		
FPC3	phase	M		-0,240* 0.026										
		F		-0,290** 0.005										

Table 1: Table of Spearman's correlation coefficients and p-values between parental variables (face centroid size absolute difference, Principal Component distances and absolute differences in anthropometric measurements between partners) which correlate significantly with the descriptors of the growth curves of their offspring (Functional Principal Components 1–3 phase and amplitude).
**. Correlation is significant at the 0.01 level.
*. Correlation is significant at the 0.05 level.

feature were overall shorter at all of the monitored points during growth. For comparison, sons of the parents more similar in glabella position and nose width, were overall taller during the whole growth, but no significant relationship was found in girls in current study. Consistent results were found for the relationship between parental similarity in some features and body height of girls. In Koníková (2021), daughters of parents more similar in minimum frontal breadth were shorter at the point of take-off before spurt in puberty and daughters of parents more similar in the shape of eyes and in bizygomatic breadth were shorter at all of the monitored points during growth compared to other girls. In the current study, daughters of parents more similar in the same mentioned features were overall shorter throughout the whole postnatal growth compared to other girls in the same growth phase. Similarly, the result that daughters of parents more similar in chin shape (based on distance between pogonion and gnathion) had lower velocity at point of take-off before body height spurt agrees with our result that daughters of parents more similar in the same feature have a greater tendency to have a higher growth rate in the first postnatal period (approx. until 8 years) and to have a lower growth rate in the second postnatal period, so they matured later compared to other girls. On the other hand, this study found no significant relationship between parental similarity in height and descriptors of the growth curve of their offspring compared to Koníková (2021). However, individual parental height (separate body height of mothers and fathers) correlated positively (actually strongest from all correlations) with absolute heights throughout the whole postnatal growth of sons and daughters.

The third goal aims to find specific trends in the growth of offspring connected to parental assortative mating. To simplify the interpretation, the results are divided into three groups according to relation to FPC1–3. In relation to FPC1, we can distinguish two categories. The first category includes parental variables which correlate positively with FPC1 phase (facial centroid size of parents of girls) and negatively with FPC1 amplitude (facial centroid size of parents of girls and glabella position and nose width of parents of boys). These relationships agree with hypothesis of Figueredo and Wolf (2009, 326–327) that positive assortative mating is associated with a slow life history what means that offspring of similar parents

tend to be overall taller during the whole growth and to mature later (have lower growth rate compared to others) which is also consistent with our hypothesis that the more similar the parents are in facial traits, the smoother ontogenesis of their offspring can be expected. On the contrary, the second category includes parental variables which correlate negatively with FPC1 phase (chin height and nose to chin distance of parents of boys) and positively with FPC1 amplitude (mouth height of parents of boys, and shape of the eyes, minimum frontal breadth and bizygomatic breadth of parents of girls). Offspring of parents more similar in these traits conversely tend to be overall shorter during the whole growth and to mature earlier (have higher growth rate compared to others).
In relation to FPC2, the first category includes parental variables which correlate positively with FPC2 phase (glabella position and nose width of parents of boys) and negatively with FPC2 amplitude (head height of parents of boys). Sons of parents more similar in these traits tend to have lower growth rate and to be overall taller in the first postnatal period, and to have higher grow rate and to be overall shorter in the second postnatal period compared to other boys. On the contrary, the second category includes parental variables which correlate negatively with FPC2 phase and positively with FPC2 amplitude (bigonial breadth of parents of boys and girls, and shape of chin of parents of girls). Offspring of parents more similar in these traits conversely tend to have higher growth rate and to be overall shorter in the first postnatal period, and to have lower grow rate and to be overall taller in the second postnatal period compared to others.
In relation to FPC3, we found negative correlation with head rotation of parents of boys and girls. This relationship can be caused by more frequent fluctuations of both parental and offspring variables since FPC3 phase represents two quite subtle changes in the growth rate of offspring, and distance on PC3 between parents represents their head rotation during photo shooting (possible personality aspect).
To sum up, we can list parental variables in which the higher degree of similarity is in final related to:

- delayed maturity of girls: centroid size, chin shape and bigonial breadth,
- overall higher final height of girls: centroid size, chin shape and bigonial breadth,
- early maturity of girls: none,
- overall lower final height of girls: eye shape, minimum frontal breadth and bizygomatic breadth,

- delayed maturity of boys: bigonial breadth,
- overall higher final height of boys: bigonial breadth and glabella position and nose width,
- early maturity of boys: glabella position and nose width, chin height and nose to chin distance,
- overall lower final height of boys: mouth heigh and head heigh.

Overall, it can be stated that parental similarity in various features affected the growth of offspring differently in this sample, therefore we have not found a common trend in the growth of offspring in relation to a parental assortative mating. In other words, the effect of parental assortative mating will be probably different for assortative mating in different traits.
One of the limitations of parental similarity study is the question of active choice, i.e., whether the observed similar features are actually preferred among partners. However, this study focused mainly on facial similarity because the human face is clearly visible and considered important during all stages of partner choice. Furthermore, the effect of convergence (increasing similarity with time, Watson et al. 2004, 1033) is eliminated by relatively low facial plasticity and in addition, the parents were photographed after a relatively short period of cohabitation, after birth of their offspring. However, the influence of social homogamy is possible (similarity due to common geographic and social area, the town Brno in this case). The important factor influencing adaptive explanation of parental similarity is the environment. Firstly, benefits of adaptation may be connected with the environment of evolutionary adaptedness, in which these adaptations have evolved (Buss 2016, 37). And secondly, benefits of parental similarity for offspring depend on actual environment (i.e., if it is stable and predictable or unstable and unpredictable; Ochoa and Jaffé 1999, 6; Penton-Voak et al. 1999, 105; Wolf and Figueredo 2011, 172–173) and on the extent to which it affects the human at all.

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The hybrid globalizations of traditional Chinese medicine. An ethnographic analysis of practitioners in Milan

Daniele Mario Buonomo

Ph.D. candidate in Cultural and Social Anthropology, University of Milano-Bicocca, Italy

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HYBRIDNÍ GLOBALIZACE TRADIČNÍ ČÍNSKÉ MEDICÍNY. ETNOGRAFICKÁ ANALÝZA PRAKTIKUJÍCÍCH V MILÁNĚ

ABSTRAKT Podle Světové zdravotnické organizace se dnes tradiční čínskou medicínou (TCM) zabývá více než 300 000 lékařů v přibližně 100 000 klinikách čínské medicíny ve více než stovce zemí světa. Kromě jejího vzkvétajícího uplatnění přitahuje TCM stále větší pozornost antropologů. Zatímco mnohé mezinárodní studie ukázaly, jak v Číně západní biomedicínský model silně ovlivňuje akademickou výuku i praxi TCM, konkrétní studie v rámci Evropy, zejména v Itálii, dnes stále chybí. Cílem článku je na základě analýzy toho, jak se TCM praktikuje ve městě Miláně, podrobně prozkoumat vztah mezi TCM a biomedicínou a obecně mezi modernitou a tradicí. Prostřednictvím etnografické studie prováděné v Miláně mezi listopadem 2020 a květnem 2021 byly zkoumány rozmanité způsoby překladu znalostí a interpretace postupů místními lékaři TCM. Prostřednictvím rozhovorů a pozorování lékařských praktik deseti různých lékařů vedl výzkum k identifikaci tří odlišných kategorií ve vztahu k lékařům TCM v Miláně: "puristé", "integrátoři" a "hybridizátoři". V rámci tohoto příspěvku se zaměřuji na jejich podobnosti a rozdíly a ukazuji, jak TCM nabývá podoby hybridní a lokální praxe.

KLÍČOVÁ SLOVA tradiční čínská medicína; globalizace; hybrid; lékařský pluralismus; etnografie; Milán

ABSTRACT According to the World Health Organization, nowadays, more than 300,000 practitioners in about 100,000 Chinese medicine clinics in over one hundred countries worldwide practice traditional Chinese medicine (TCM). Beyond its flourishing application, TCM attracts the growing attention of anthropologists. If International scholars have shown how, in China, the Western biomedical model highly influences both the academic teaching and the practice of TCM, specific studies within Europe, especially in Italy, are still lacking today. Based on an analysis of how TCM is practiced in the city of Milan, my aim is to scrutinize the relation between TCM and biomedicine and, broadly, between modernity and tradition. Through an ethnography conducted in Milan between November 2020 and May 2021, I explore the diverse ways of translating the knowledges and interpreting the practices by local TCM doctors. By means of interviews and observations of medical practices of ten different practitioners, my research led me to identify three dissimilar categories in relation to TCM practitioners in Milan: the "Purists", the "Integrators" and the "Hybridizers". Within this contribution, I focus on their similarities and differences, showing how TCM assumes the shape of a hybrid and localized practice.

KEY WORDS traditional Chinese medicine; globalization; hybrid; medical pluralism; ethnography; Milan.

INTRODUCTION

In the last two decades, the use traditional Chinese medicine (TCM) has grown significantly both in Eastern and Western countries. The World Health Organization (WHO), in fact, has shown a growing interest in TCM since 1979, when it began to focus the attention on acupuncture and moxibustion (Wu – Fischer 1997). In 1998, for the first time, it drew up a list of ailments that traditional Chinese medicine was able to treat successfully, supported by scientific evidence. Recently, in 2014, it issued the *WHO Traditional Medicine Strategy: 2014-2023*, a document on the strategies to adopt for the integration and regulation of the traditional and complementary medicines[1].

1 In Italy, acupuncture, together with homeopathy and phytotherapy, belong to what is called complementary or non-conventional medicine.

Today acupuncture is widespread all over the world. From the reports provided by 129 countries, it emerges that 80% of them make use of it (WHO 2013). Volker Scheid (2002) argues that TCM, in the era of globalization, appears as a global medicine and he explains its implications with the following words:

> Such globalization encompasses various processes. Within China, it refers to attempts to infiltrate territory that was once the sole domain of bio-medical power and technology. It refers to the standardization of teachings, practice, and bureaucratic control necessary for such a process to succeed. Globalization also, of course, refers to the dispersion of Chinese medicine throughout the world, where it is now practiced in an increasing number of different settings (Scheid 2002, 269).

Taking the steps from this consideration, my theory, which I will deepen with this research, is that those processes are not only specific to China, but they are also global.

In the era of globalization, several scholars (Jullien 2005; Scheid 2002) question the traditional dichotomy between Western and Chinese philosophy and so between a "correlative thinking mode of Eastern tradition and causal thinking mode of Western tradition" (Lan 2012, 273). This is also what I aim to do with this study by analyzing how medical knowledge is translated (Latour – Woolgar 1986) and transformed in Milan. Different studies (Farquhar 1994; Hsu 1999; Taylor 2005) have shown how the Western biomedical model influenced both the academic teaching and the practice of TCM.

Arthur Kleinman has been the promoter of an analytical perspective that aims to investigate medical systems as cultural systems. His model, as "an attempt to understand health, illness, and healing in society as a cultural system, and to compare such systems cross-culturally" (Kleinman 1978, 85), although criticized by theories developed in the field of medical anthropology in recent times, has proved to be a useful theoretical approach for my research.

My hypothesis is that TCM, in Milan, oscillates between a more "standardized" model – the result of continuous assimilation of elements of biomedicine which tends to scientific standards (Unschuld – Andrews 2018) – and a more "traditional" one, characterized by the presence of older practices. Using Taylor (2005) words, between the modern "Chinese medicine" (*zhongyi* 中医), also known as TCM, and the "ancient medicine" (*gudai yixue* 古代医学). This aspect gives rise to a great heterogeneity in the modalities of interpretation of medical practice.

More specifically, the goal of my research is to study how doctors and practitioners in Milan appropriate traditional Chinese medicine. I will focus on investigating the ways of translating and hybridizing TCM by Milanese practitioners, examining the underlying reasons.

The questions that guided my research are: in a global world how does traditional Chinese medicine oscillate between an idea of modernity and tradition? How is it locally translated? In what ways is it appropriated and hybridized?

METHODOLOGY

To grasp the specificities in the diverse ways of translating knowledges and interpreting medical practices, I focused not really on the "comparison of similarities, but rather on the comparison of differences and peculiarity" (Malighetti – Molinari 2016, 141, *translation by the author*). I analyzed how the different educational paths, the formal and informal knowledge, and the choices of the doctors influenced their way of practicing TCM. For this purpose, I conducted a multi-sited ethnography (Marcus 1995) focused on the practice of traditional Chinese medicine by local doctors and practitioners in Milan. To produce a "thick description" (Geertz 1973) of practices at the crossroads between global circulation and processes of local appropriation and transformation, I took semi-structured interviews and "life stories" interviews (Bertaux 1981).

My ethnographic research was conducted in Milan in the period between November 2020 and May 2021. It involved ten practitioners, of which, apart from a TCM operator and a Vietnamese doctor, were all doctors of Italian nationality. They were five men and five women ranging between 36 and 70 years of age. Three of them, doctors Ferri[2], Colombo and Lombardi, practice their biomedical specialization simultaneously with traditional Chinese medicine: cardiology, dietetics and nutrition, neurology and occupational medicine, respectively. They practice their biomedical specialization either in the same offices, or in different clinics. The doctors Greco, Gentile and Caruso combine the practice of traditional Chinese medicine with different disciplines, of Western origin, belonging to complementary medicine: I am referring specifically to homeopathy and homotoxicology. The rest of them only practice TCM. In general, they all make use of acupuncture and, depending on their choices, one or more TCM technique to a lesser extent.

The ethnography was structured in three phases: the first consisted of an analysis of twenty-five different websites, necessary to map the presence of doctors and operators in the city of Milan and, at the same time, identify their distinctive features. Subsequently, I carried out interviews followed by observations of practices with the ones who accepted my presence.

The analysis started from the websites. The first goal was to examine how practitioners perceive traditional Chinese medicine and consequently how they present it to the public. Specifically, my aim was to report the different ways of representing and advertising TCM on websites, highlighting the similarities and the differences.

The observation in the field was a critical point of my research. Although only two out of ten practitioners I interviewed strictly denied me the possibility of attending their treatments, the opportunities for observing practices at the

2 To ensure the privacy of the people I worked with, I decided to use names of fantasy. All the names that follow are therefore invented by me and do not correspond in any way to the real names of my interlocutors. Any references to existing people are purely coincidental.

beginning of my research were scarce, both because of the global pandemic and for reasons that, to summarize, were justified because of the respect for privacy. Only doctor Bianchi always allowed me to observe his patients. They, after a brief introduction from Dr. Bianchi about who I was and why I was there, willingly accepted my presence.

To overcome the lack of data obtained through field observation, I underwent treatments as a patient with three different practitioners, whom I asked to explain step-by-step what they were doing and for what reasons. The specific choice of these three practitioners was due to the reason that, since they use three different approaches, as we will see below, they can be labeled into distinct categories. Respectively, Rossi as a TCM operator is not allowed to practice acupuncture and so she practiced this technique with friends and relatives. Having met her through a common acquaintance, I had the opportunity to undergo her treatments, which consisted of *tuina* massages, cupping, and acupuncture. Dr. Lombardi is one of the very few in Milan to use the *I Ching*[3] as a tool in the diagnosis and medical practice, therefore he has proved to be an interesting subject to observe; in addition to diagnosing using the *I Ching*, he practiced acupuncture for me. Dr. Greco, thanks to the heterogeneity of techniques she uses, proved to be a singular physician to observe.

Through an "observation of participation" (Tedlock 1991) as an anthropologist-patient, I tried to be at "the same time an involved actor and a detached observer" (Geertz 2000, 39).

PURISTS, INTEGRATORS AND HYBRIDIZERS: SIMILARITIES AND DIFFERENCES OF TCM

Through interviews and observations of practices, I identified three recurring aspects among the people I worked with. Specifically, the reasons behind the choice to practice traditional Chinese medicine; a hybrid diagnostic mode, which consists of several methods used side by side or overlapping each other, and the definition of what are the limits and areas of action of acupuncture.

Diverse reasons led my interlocutors to choose to practice TCM, but fundamentally, they were all driven by the belief they have found a practice that "works". According to them TCM, thanks to its holistic view of the patient, can solve "a series of problems that classical Western medicine is unable to deal with[4]" (Dr. Colombo 16/03/2021). In particular, it emerged how "the fate" is the main aspect that acts as a background to this choice. In general, everyone decided to deepen this discipline to make it a profession, since they found biomedicine lacking in some aspects. Dr. Gentile, for example, said that the latter was not enough for her and that after the first energy lesson, in which she was "shocked", she thought: "I have found my way" (17/02/2021).

Another feature on which everyone agrees is to combine multiple diagnostic methods to make "a global analysis" (Dr. Lombardi 12/02/2021). From their stories and the observation of practices, it emerged that the diagnostic method of traditional Chinese medicine, which includes questions about case history, inspection, auscultation-olfaction, and palpation (Kaptchuk 1983), is combined with Western diagnosis. However, not everyone makes full use of the four Chinese exams. For some, the examination of the wrists, the most important according to the ancient Chinese texts, as explained in *The Yellow Emperor's classic of internal medicine*, is less used because is considered the most difficult one. As regards medical history, it turned out that it is composed of a set of questions of both Western and Eastern anamnesis. For example, the history of family and personal illnesses are explored in the same way – with the possible request to provide Western exams – with a range of information ranging from personal tastes, sleep quality and stool consistency. Although there are differences in the way of using diagnostic methods, based on the diverse modalities of practice and the biomedical specialization, all converged on the fact that the diagnosis must also be biomedical and therefore it is useful, sometimes necessary, to prescribe or base on Western exams.

Regarding the third aspect, my interlocutors believe that traditional Chinese medicine can be useful for treating several diseases and disorders. The list varies from doctor to doctor, but overall aligns with the list provided by the WHO. At my request about which pathologies can be treated by acupuncture and TCM, I was usually given a list of diseases whose cure is ascertained by scientific studies. Doctors, however, focused on the pathologies they treat the most, which are usually in line with their biomedical specialization. More in general, they emphasized that TCM effectiveness, specifically acupuncture, is greater when there are no anatomical modifications. The big limitation of acupuncture appeared to be the treatment of cancer. Dr. Van summed up the general thought when he asserted about cancer: "I think it's the only pathology where surgery is needed. I use acupuncture in oncology for those who undergo chemotherapy and are in pain. Not exactly on the tumor itself but for problems related to it" (11/02/2021).

After underlining the similarities, I focus briefly on the differences that emerged in the interpretation and practice of TCM in Milan. The most important ones, which I will deepen, are related to the diagnosis, the choice of practicing certain techniques rather than others, the preference of the needles to be used and how to insert them, the explanation given about the effectiveness and the possible side effects of acupuncture and finally the correlation with the ancient text *I Ching*. What emerged is substantial heterogeneity of approaches.

Although, as we have seen previously, they all shared the im-

3 Known also as *I King*, *The Book of Changes* (*Yijing* 易经) is a Chinese classical text fundamental to Chinese thought and philosophy (Cheng 1997; Jullien 1993). Yang Li (1998) argues that the theories underlying *The Yellow Emperor's classic of internal medicine* – one, if not the most important of the TCM texts – are all derived from the *I Ching*.

4 All the interviews were in Italian. The translations from Italian language are my own.

portance of associating multiple diagnostic methods, the ways to do it are different. Dr. Gentile, for example, uses the Western and Eastern anamnesis and the kinesiology test – a method of diagnosing belonging to the homeosynergetic – consequently not using the wrist and tongue examination. Dr. Caruso claimed she hybridized the two diagnostic systems, declaring that the anamnesis method she uses has been defined by her: "I created my own file by putting a bit of what I think brings me closest to the completeness of the diagnosis" (15/03/2021). Besides diagnosis, another difference is in the selection of techniques. In fact, although most doctors are trained in several techniques, the most used is acupuncture. Dr. Van and Dr. Gentile only practice acupuncture. Dr. Pellegrini, TCM practitioner and trainer in Italy and around the world, and Rossi, *tuina* massage operator, told me that they practice all TCM techniques. Dr. Ferri practices acupuncture, dietetics – both Western and Eastern – and the use of medicinal herbs. It emerged during my research that acupuncture is the most used technique because is considered a medical act. The choice of the other techniques instead, oscillates between the different specializations of the doctor and the different interpretations of TCM.

As for acupuncture, one of the biggest differences found during the meeting with my interlocutors concerns the choice and method of needle insertion. In general, an aptitude to use the needles with which one has learned to do acupuncture emerged. The choice of the needle is therefore linked both to the habit of the acupuncturist and, to a lesser extent, to the type of point to puncture. As for the technique, they use a deeper or more superficial insertion, perpendicular or oblique; some stimulate the needle once is inserted into the acupoint and others, once inserted, no longer touch it. Rossi, on the other hand, never leaves the needle during the insertion because she always wants to "stay on the acupoint" (28/01/2021). As Doctor Ferri once, smiling, told me: "Every acupuncturist in the end has his own method and his favorite needle" (12/03/2021). The choice of the needle and the insertion technique used, albeit based on a habit and the doctors' comfort, are also justified because of the explanation of the effectiveness of acupuncture. I have found three approaches: a biomedical explanation, a Chinese TCM explanation, and a combination of the previous ones. These approaches range from a more classical explanation – linked to the idea of energy balance, using the concept of *qi* 气 and *yin yang* 阴阳 [5] – to a scientific one. Within the latter, however, there are considerable differences: there are explanations given in line with reflexology, neuro-humoral approach or based on the energetics of living systems (ESV), up to the latest studies in the scientific field and therefore to an explanation of efficacy for connective tissue stimulation. It is interesting to note that the choice of the type of needle and the method of insertion are functional to the explanation given about its effectiveness: different approaches define different methods.

There are also conflicting opinions regarding the side effects of TCM, in particular acupuncture. These vary from those who claim that acupuncture has no side effects to those who believe that there are and can even be serious. In general, they argued that, if doctors practice acupuncture the risk profile is extremely low. Specifically, Dr. Van, Dr. Caruso, Dr. Bianchi, and Dr. Lombardi believe there are no side effects. In this regard, Dr. Bianchi affirmed: "There are no side effects if those who perform acupuncture know what they are doing (...) If you do it badly, it may not help or worsen a symptom" (25/02/2021). The opposite is the opinion of Dr. Gentile, who used a Chinese metaphor to deepen her point of view: "For the ancient Chinese doing acupuncture is like holding a tiger's whisker or tail in one's hand. It is not something that is either good or does not do anything to you"(23/02/2021). As side effects, she said that it could make a person feel bad, with an increase in pain or by enhancing the symptom, or with an effect on the emotional side, as happened to one of her patients. Rossi also argued that there could be important side effects with the practice of traditional Chinese medicine, as well as with all medical practices.

From the meetings with the practitioners, it emerged the importance of studying ancient classical texts to fully comprehend traditional Chinese medicine. The importance given to these texts, however, varies greatly from subject to subject. In fact, there are those who studied these texts because they were part of the classes of traditional Chinese medicine they attended to and those who examined them later. In general, all my interlocutors studied on the handouts or texts provided by the schools they enrolled in. The texts were mainly in Italian and sometimes in English. Among all the classical texts, which have been more or less studied, I focused on the *I Ching*. Concerning it, some say they studied it, such as Dr. Pellegrini, and others did not, such as Dr. Van or Rossi. The remainings, for example Dr. Colombo, said that they appreciated it on a theoretical level but: "However it requires a specific analysis that I followed only on a cultural level" (16/03/2021). There is also who studied it but stated: "For my scientific soul, think of throwing coins to having an answer seems like a bit of an answer book, I can't take it that much. I do not use it in practice, I do not throw coins to choose points" (Dr. Ferri 12/03/2021). On the other hand, some use it during medical practice, as happens to Dr. Greco and Dr. Lombardi. The first explained to me that sometimes she uses it, but it remains only on the conversational level and, after having focused on a theme, the acupuncture session begins; other times, however, when a particular theme emerges, it "can be brought back into the needles" (Dr. Greco 02/02/2021). The second doctor, who confessed to me that he has been studying this text since 1993, stated: "I always say that using the I Ching for divination purposes only is like asking a nuclear engineer to do the addition of elementary school children: you do not exploit all his capacity" (Dr. Lombardi 12/02/2021).

5 The *qi* is the vital energy that flows through the body. It is composed of two complementary forces, *yin* and *yang*. For a general presentation of the key concepts of TCM, see Cheng 1997, Lan 2012, Veith 1966.

Based on the differences and similarities between the ways of interpreting and practicing TCM that emerged during this ethnographic study, I defined three heterogeneous categories to classify the practitioners of traditional Chinese medicine in Milan: the "Purists", the "Integrators" and the "Hybridizers".

With the term "Purists", I identify the practitioners who studied TCM mainly with experts coming from or trained in, the East: in my case study, in particular, Vietnam and Taiwan. They practice, following the teachings of their masters, a more "traditional" form of TCM, as they affirm, where the traditional term means a practice "that has not changed over time" (Dr. Van 11/02/2021) or that has been defined as "the true Chinese medicine, as it was practiced before its modernization" (Rossi 01/22/2021). Another characteristic of the purists is that they do not prescribe or recommend Western drugs. In this regard, Dr. Van states: "I know acupuncturists who prescribe painkillers, anti-inflammatories, sleeping pills: it is no longer acupuncture" (Dr. Van 11/02/2021). The purists, composed of Rossi and Dr. Van, represent the minority among the others.

The "Integrators" are doctors who studied traditional Chinese medicine in Europe and China. They trained with various masters from Italy, France, and China. Even if many have been to China, none of them studied the Chinese language. They integrate TCM with biomedicine, both in diagnosis and in practice. There are various levels between them: there is a range that varies from those who say, for the choice of the acupoints: "I rely on international scientific literature" (Dr. Ferri 12/03/2021), to those who declare: "When I cannot come to the head of a diagnosis, or it seems to me correct but the therapy does not work, also to know if perhaps we need to completely change the therapy, stop doing acupuncture and send the patient to others, then I use the I Ching" (Dr. Lombardi 12/02/2021). They prescribe Western medicines and refer patients to the emergency room or other medical facilities as needed. Most of the practitioners involved in this study (i.e., Dr. Bianchi, Colombo, Ferri, Lombardi, and Pellegrini) belong to the category of the integrators. The reason behind it, it can maybe be found in the general push to integrate biomedicine and TCM. This approach, promoted by Mao Zedong and the Communist party in the late 1950s (Croizier 1968; Liu *et al*. 2018; Taylor 2005) continued until recently, in China as well as in the Western countries, as it emerges from the *WHO Traditional Medicine Strategy: 2014-2023*.

The doctors, who have studied TCM in Italy with Italian heads and on Italian texts, compose the last category, the "Hybridizers". Their medical training is very heterogeneous and ranges from TCM, biomedicine, psychology, to a whole series of techniques that fall within alternative and complementary medicine: homotoxicology, homeopathy, reiki, applied kinesiology, and mesotherapy. They have a personal method of practice, based on the hybridization of different disciplines. It emerged during the observations and from the interviews, for example in the case in which I was told: "I integrate homeosinergetic medicine with acupuncture (...) finally, I evaluate the acupoints to use with the kinesiology test" (Dr. Gentile 17/02/2021). They prescribe and use mainly natural or homeopathic drugs. Dr. Caruso, Greco and Gentile belong to this group.

The labels of the categories were chosen accordingly to my interlocutors' self-representation. Within these categories, there are two different approaches: one more "conservative" and one more "innovative". By the first term, I mean an approach aimed at using the classic techniques of TCM, namely acupuncture, *moxibustion*, cupping, *tuina* massage, exercise therapy (including *qigong* and *taijiquan*), diet therapy and pharmacopeia, or better Chinese herbal medicine. With the term innovator, I identify those who use, within the TCM, a series of "new" techniques, or the classic techniques by applying them in diverse ways. An example of innovation is provided by Dr. Van, who uses acupuncture on racehorses, or by Dr. Colombo, who uses tuning forks on the acupoints. Dr. Greco, on the other hand, practices, among the various techniques, acutaping, that is a reinterpretation of taping – a patch used for injuries or muscle pain – on the TCM meridians, while Dr. Bianchi practices aculifting, or rather, the use of "very thin Japanese needles all placed in the acupoints of the face to stimulate collagen" (11/02/2021). From this ethnographic study it emerges how today in Milan, TCM, and specifically acupuncture, oscillates between modernity and tradition, and consequently the extent to which this involves syncretic, hybrid and localized practices.

CONCLUSION

With my case study in the city of Milan, I provided an example of the continuous transformations that TCM experiences in relation to biomedicine and the local context. Although half of the doctors I met trained in the same TCM Centre, the So-Wen school, the different choices they made and the different specializations they undertook influenced their way of practice. The importance of the agency in defining TCM practices, as underlined by Farquhar (1994), helps us to understand the emergence of different approaches: "conservative", "innovative", "scientific", or "traditionalist". The pluralism of TCM, and specifically of acupuncture, is not a new aspect in the Western countries, as emerged from the study of Linda Barnes (2003) about the acupuncturist in Massachusetts. The fact of considering acupuncture a medical act, however, filters the possibility of its interpretation and defines its limits.

Broadly, the relationship between biomedicine and traditional Chinese medicine reflects the relationship between modernity and tradition and between local and global. Giovanni Pizza to show the complex cultural heterogeneity and differentiation of biomedicine suggests using the term "cultural practices of biomedicine". He argues that "the acquisition of knowledge in medical training aims to transform the body of learners, producing a new *habitus*" (Pizza 2017, 172, *translation by the author*).

The *habitus*, defined by Pierre Bourdieu as "systems of durable, transposable dispositions, structured structures pre-

disposed to function as structuring structures" (Bourdieu 1977, 72), is useful to underline how the individual behavior is modeled, and at the same time models, social reality. Since the way of being in the world is necessarily conditioned by external structures, although physicians may present diversifications and therefore, they can be classified within the category of purists, integrators or hybridizers, the *habitus* is an essential component in defining the way of practicing TCM. All of them to make a diagnosis always consider biomedical exams. They claim and write on their websites that they are, above all, "bio-doctors".

For future research, it is important to consider the relationship between biomedical discourse and local production. Pizza suggests using the concept of biomedical field and thus replacing it with the closed concept of biomedical system. To define the biomedical field, Pizza recalls Bourdieu's definition of the field: "a social space within which specific institutions (for example the religious, scientific, health fields) operate" (Pizza 2017, 145, *translation by the author*). I suggest applying the concept of field to traditional Chinese medicine, to study the interaction between biomedical and TCM fields and, hence, the relation between global and local within a globalized and globalizing world. Within the biomedical field, Kleinman (1995) identifies three general features: the process of bureaucratization, professionalization, and medicalization. From my study emerged how the first two aspects increasingly influence, becoming its characteristics, also the way of practicing traditional Chinese medicine in Milan. The practice of acupuncture, for example, has been institutionalized in Italy, with a sentence from the Court of Cassation in 1982. Its spread throughout the world has not made it exempt from bureaucratization processes also in the West. If we dwell on the data collected by the World Health Organization about the world expenditure for traditional Chinese medicine products, we can see how TCM is increasingly linked to industrial capitalism.

> The output of Chinese materia medica was estimated to amount to US$83.1 billion in 2012, an increase of more than 20% from the previous year. In the Republic of Korea, annual expenditures on TM [traditional medicine] were US$4.4 billion in 2004, rising to US$7.4 billion in 2009. Out-of-pocket spending for natural products in the United States was US$14.8 billion in 2008. (WHO 2013, 27)

The professionalization process that TCM undergoes in Italy is visible from the fact that since the institutionalization of acupuncture, it is only possible to practice it after earning a medical degree. Even if the complementary and alternative medicine (CAM) regulation in Europe is diverse, acupuncture is regulated as a treatment in 24 European countries, where it is practiced with increasingly standardized procedures. In about half of them, only doctors can practice acupuncture (Wiesener *et al.* 2012). It is not difficult to imagine this aspect in a scenario in which the WHO (2013) defines traditional Chinese medicine as an "international industry".

New starting points emerged from this work. "Following" (Marcus 1995) the practice and the biographies of doctors in Milan allowed me to produce data, which, albeit limited, brought out new research questions. What does modernity mean? What does tradition mean? What are the hybrid cultural forms that are emerging in the globalized world? How to study them?

From a broader theoretical point of view, it is a question of questioning, or re-questioning, through the case of traditional Chinese medicine, the modernity-tradition dualism and its relationship with globalization and the circulation of practices, especially considering the fact that, citing Bruno Latour (1991), we have never been modern.

Scheid pointed out the importance of TCM localization processes in China. He argues that:

> It is crucial, therefore, to define Chinese medicine in contemporary China from the outset as something locally constructed and capable of assimilating many different elements (Chinese and non-Chinese, ancient and contemporary, medical and non-medical), yet also as a global reference that makes local agency possible (Scheid 2002, 20).

Being able to understand these dynamics in the local can prove to be significant for future studies about traditional Chinese medicine in a globalized context. I believe my study can contribute to the anthropological reflection concerning this issue in the Western countries and, broadly, in having brought out new research questions for future research. It can represent a starting point for an ethnographic study from local to global and vice versa, which can compare these same dynamics in the places of origin of TCM: Mainland China and Taiwan.

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Meta-analysis of radioulnar contrasts in dermatoglyphic ridge counts between individual fingers

Lenka Polcerová[1*] – Miroslav Králík[1] – Tereza Meinerová[1,3] – Mária Chovancová[2] – Martin Čuta[1]

[1]Faculty of Science, Department of Anthropology, Laboratory of Morphology and Forensic Anthropology, Masaryk University, Brno, Czech Republic
[2]Faculty of Natural Sciences, Department of Anthropology, Comenius University in Bratislava, Bratislava, Slovakia
[3]Laboratory of 3D Imaging and Analytical Methods, Faculty of Science, Charles University, Prague, Czech Republic

** Corresponding author*

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META-ANALÝZA RADIOULNÁRNÍCH KONTRASTŮ DERMATOGLYFICKÝCH KVANTITATIVNÍCH HODNOT MEZI JEDNOTLIVÝMI PRSTY RUKY

ABSTRAKT Radioulnární kontrasty (numericky: rozdíly) mezi kvantitativními hodnotami dermatoglyfických vzorů jednotlivých prstů lidské ruky (počet lišt – ridge count, RC) se ukázaly jako vhodné indikátory signalizace prenatálního vývoje. V této studii jsme porovnávali výsledky meta-analýzy mezipohlavních rozdílů v radioulnálních kontrastech mezi publikovanými *průměrnými hodnotami* RC (získány jako průměr z vyššího RC každého prstu) s mezipohlavními rozdíly, kdy radioulnární kontrasty byly vypočítány již na individuální úrovni.
Průzkumem databází NCBI-PMC, ScienceDirect a archivních zdrojů jsme našli celkem 273 dermatoglyfických studií (po odstranění duplikátů mezi databázemi). Avšak po aplikaci všech výběrových kritérií bylo pro meta-analýzu vhodných pouze 11 vzorků, a to i včetně našich vlastních čtyř vzorků. V porovnání s úsilím vynaloženým při hledání publikací se nám podařilo najít jen velmi málo studií, které by vůbec publikovaly statistické parametry RC na jednotlivých prstech, a které by tak byly vhodné pro studium kontrastů mezi prsty. Pokud již byly publikovány statistické parametry pro jednotlivé prsty, nepředstavovaly tyto údaje průměrné hodnoty RC z radiální i ulnární strany prstů (tj. 10 hodnot na každé ruce), ale pouze průměrné hodnoty RC z vyšší hodnoty za každý prst (tj. 5 hodnot na každé ruce) na individuální úrovni.
Pohlavní dimorfismus získaný meta-analytickými metodami (kontrasty mezi průměrnými hodnotami RC), koreluje téměř absolutně s hodnotou dimorfismu kontrastů vypočítaných na individuální úrovni (průměrné hodnoty individuálních kontrastů RC). Výběr jednoho (vyššího) RC z každého prstu však rozmazává dimorfismus a ztěžuje interpretaci mezipohlavních rozdílů. Výsledky pak nelze porovnávat s hodnotami získanými z kompletního souboru všech RC na prstech. V kombinaci s malým počtem studií s vhodnými daty publikovanými po jednotlivých prstech proto nemůžeme doporučit meta-analýzu publikovaných studií jako vhodný prostředek ke studiu meziprstních radioulnárních kontrastů. Za tímto účelem je třeba mít k dispozici primární data – RC na individuální úrovni.

KLÍČOVÁ SLOVA dermatoglyfika; otisky prstů; počet lišt; meta-analýza; sexuální dimorfismus

ABSTRACT Radioulnar contrasts (numerically: differences) between ridge counts of individual fingers of the human hand have been identified as promising features in respect to prenatal signalling. In this study, we compared the results of a meta-analysis of intersex differences in radioulnar contrasts between published mean values of dermatoglyphic ridge counts on the fingers of the hand (calculated from the higher RC of each finger) with intersex differences obtained from radioulnar contrasts already calculated at the individual level.
Searching the NCBI-PMC, ScienceDirect databases, and archival resources, we found a total of 273 dermatoglyphic studies (after merging duplicates in databases). However, only 11 of those studies were suitable for meta-analysis after application of all selection criteria, including our own four studies. Considering the effort spent in searching for articles, we were able to find very few studies that published statistical parameters of ridge counts by individual finger and that would thus be suitable for studying contrasts between fingers. When statistical parameters have been published for individual fingers, they did not represent the descriptions of all ridge counts from the radial and ulnar sides of the fingers (i.e., 10 values on each hand), but only the ridge count with the higher value is selected for each finger (i.e., 5 values on each hand) at the individual level.
The meta-analytically obtained sex dimorphism (contrasts between the mean values of the ridge counts) are virtually indistinguishable from the dimorphism from the contrasts calculated at the individual level (means of the contrasts). However, the step of selecting one (higher) ridge count from each finger blurs the dimorphism and makes interpretation of the sex differences difficult. The results cannot then be compared with those obtained from the complete set of all ridge counts on the fingers. Combined with the small number of studies with suitable data published on a finger-by-finger basis, we therefore cannot recommend meta-analysis of published studies as a suitable means of studying interfinger radioulnar contrasts. For this purpose, primary/raw ridge count data at the individual level must be available.

KEY WORDS dermatoglyphic; fingerprints; ridge count; meta-analysis; sexual dimorphism

INTRODUCTION

Dermatoglyphics can draw from experience and the results of more than a hundred years of studies. Meta-analytic aggregations and comparisons of a large number of studies allow both to distinguish erroneous results from the biologically plausible major trends and to generate higher-level views of a multi-population nature, to study e.g., geographic gradients (e.g., Králík et al. 2019), dependence on climatic factors (e.g., Bhasin 2007; Rosa 1985), that are not possible in single population studies and limited samples. However, the use of published data in meta-analysis depends on the numerical nature of the secondary data that are published.

Because fingerprints and palm prints provide several different values per subject (e.g., patterns of 10 fingers), from the beginning of scientific interest in dermatoglyphics, features have been developed to allow the larger number of values for each subject to be somehow simplified, usually summed, averaged, or otherwise converted into a simple index that would be suitable as a representation of the subject for statistical comparisons. (Statistical methods for multilevel comparisons, e.g., mixed models, were not developed at that time). The secondary data (statistical parameters) of these derived features are then published, while the parameters of the original raw data (let alone the original raw data themselves) are not.

For example, the size of the dermatoglyphic pattern (called *quantitative value of pattern* or *ridge count*, abbreviated as RC) is a well quantifiable feature that can be objectively and reproducibly determined by counting the epidermal ridges crossed by the line connecting the triradius and the core of the pattern (Cummins a Midlo 1961). On ten fingers of the hand, 20 ridge counts can be evaluated in this way (**Figure 1**). In the following analyses, however, these were usually added together and only the sum was statistically evaluated. Two forms of this sum were applied: first, the so-called Absolute Finger Ridge Count (AFRC), where all 20 values were summed, and second, the Total Finger Ridge Count (TFRC), where only the larger of the two values from each finger was counted in the total (Holt 1952; 1968). TFRC was used more frequently. Since human populations (and also various pathological conditions) differ in the size of dermatoglyphic patterns, these summary features (TFRC, AFRC) were quite useful in comparing populations.

In particular, for RC, one of the most important quantitative dermatoglyphic features, it has been shown in recent years that not only the sum of RC values (TFRC) is important, but also the differences between individual fingers carry significant information (Kahn et al. 2008; 2001). Some radioulnar contrasts (differences) between RCs on different fingers show systematic sex dimorphism (Polcerová et al. 2022), so we can think of them as markers of prenatal sexual differentiation, similar to the 2D:4D ratio of finger length (cf. Jantz 2021). In these studies, however, the investigation of radioulnar gradients was only possible due to the availability of finger-resolved primary data, i.e., all 20 ridge counts. A meta-analysis based on the published data would be highly beneficial as it could greatly expand the number of included samples and help to confirm the broad universality of sexual dimorphism of radioulnar contrasts in RCs on the fingers of the human hand. However, such meta-analysis would only be possible if published data on individual RCs of all fingers were available. Given the predominant use of TFRCs instead of native RCs, it is unclear whether sufficient studies will be available.

The purpose of this study is to perform a meta-analysis of dermatoglyphic studies dealing with RCs and to determine whether radioulnar contrasts of published parameters of individual ridge counts are comparable to results (Polcerová et al. 2022) based on primary data of RCs of individual fingers. First, we had to find out what the published RC data are and whether it is possible to find data separately for each RC of each finger. If such data existed in the literature, the next step was to collect such studies and use their data to evaluate the radioulnar contrasts of the RCs and compare them with the results found by analysis of the primary individual data (Polcerová et al. 2022).

SUBJECTS AND METHODS

Resources

We searched within two selected databases: *NCBI-PMC* and *Science Direct* for key words: "dermatoglyphics", "finger ridge count", "population study" (14. 6. 2019). As mentioned in Králík et al. (2019) sources dating before year 1990 are complicated to reach as those resources are not yet fully digitalized or are in non-English literature which affected resulting number of studies: 127 in *NCBI-PMC* and 143 in *Science Direct*. After applying selection criteria (bellow), we decided to add our own data from an ongoing project TACR (approved in advance by the Ethic Committee for Research of our institution: EKV-2018-028) and archival resources from our institution.

Ongoing project (TACR) represents *recent* Czech population and consists of adult volunteers. Fingerprints were obtained by standard dermatoglyphic methodology according to Cummins and Midlo (1943) and only those individuals where it was possible to analyse fingerprints from both palms and all fingers at the level of ridge count were included.

Archival resources were represented by three samples (collected in 1948, 1976, and 1989): sample of adult population of Lusatian Sorbs, sample of exchange Vietnamese students and *historical* sample of adult Czech population used in diploma thesis of Meinerová (2018); for further information about samples please ref. Polcerová et al. (2022).

Selection criteria for meta-analysis

We defined the following criteria for studies to be included in our final sample:

1. source has published mean ridge count for *each finger* on both hands with standard deviation;
2. data from source are categorized by sex (i.e., mean ridge

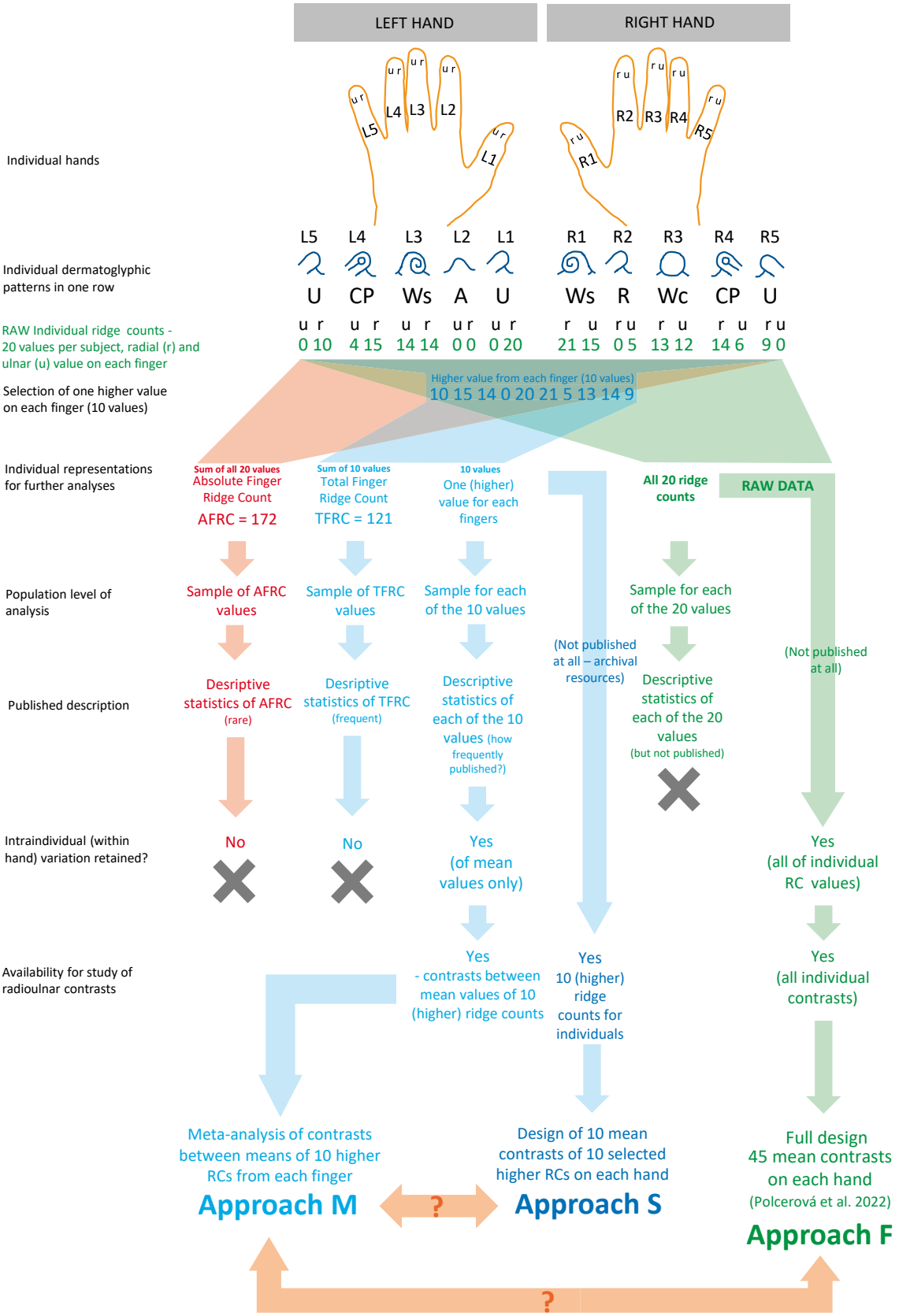

Figure 1: A research flowchart for the dermatoglyphic assessment of ridge counts on the fingers of the hand, its processing, analysis and publication, indicating the pathway and relationship of the three methodological approaches used in this study.

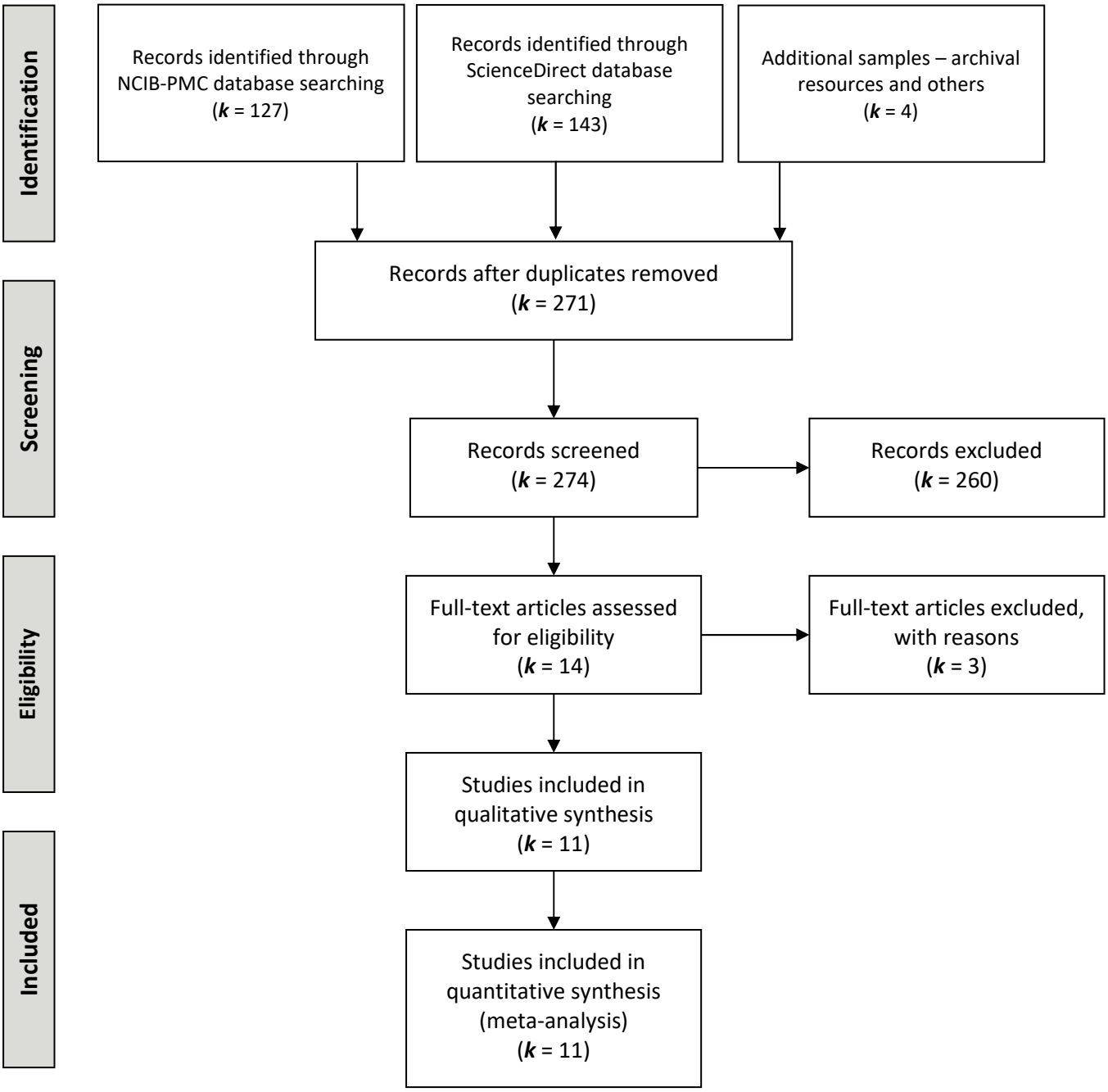

Figure 2: Selection of studies - PRISMA diagram (Moher et al. 2009). These 11 studies are represented by 12 samples as one of the studies provided two samples.

counts for individual fingers are not merged by sex but values for females and males are separately presented;

3. data represents healthy individuals (i.e., controls in medical studies);
4. methodology for fingerprinting is constant among studies. Based on search within resources we chose the nomenclature and methodology of ridge counting by Cummins and Midlo (1943) or in case of ridge counting also Holt (1968).

Studies that did not fulfil those criteria or had severe inconsistencies and computation errors within their data (standard deviation was higher that mean ridge count or number of individuals did not correspond with the published information) were excluded from our sample.

The whole selection process is described by flowchart (ref. Moher et al. 2009) in **Figure 2**. As can be seen from the flowchart, the largest reduction in the volume of studies occurred after screening of individual publications and their assessment for eligibility. At this step we discovered that the published studies did not contain primary individual data at all, i.e., individual subject RCs, which was to be expected to

Figure 3: Map of all 12 samples included in analysis with differentiated sexes.

No	Year	Author	Population	Sex	n (*males*)	n (*females*)
1	2017	Andreenko - Baltova	Bulgarians	f, m	414	480
2	1983	Cantor et al.	Americans	f, m	270	253
3	1973	Fuller	British	m	825	-
4	2015	Hong et al.	Han	m	129	-
5	2008	Karmakar et al.	Chuvashians	f, m	293	254
6	2018	Meinerova – CZ^{A}	Czechoslovaks	f, m	36	44
7	2018	Meinerova – LSRB^{A}	Lusatian Sorbs	f, m	51	45
8	2018	Meinerova – VNM^{A}	Vietnamese	f, m	57	19
9	2005	Milicic - Vidovic	Slovenians - lowland	f, m	100	119
10	2005	Milicic - Vidovic	Slovenians - mountains	f, m	63	58
11	1975	Saldana - Garcia	British	f	-	825
12	2020	TACR*	Czechs and Slovaks	f, m	51	69

Table 1: Overview of samples used for meta-analysis. Samples marked ^{A} come from archive records and samples marked with an asterisk (*) come from ongoing research project (mentioned above in the chapter *Resources*). For these four samples (marked ^{A} and *), we have primary raw data and are subject to comparison across the three approaches (M, S and F, ref. **Figure 1**).

some degree, especially given our strict criteria. However, at the same time, it was also clear that secondary data (number of cases, mean and standard deviation) were available infrequently just for TFRC or AFRC, but almost never for all 20 RCs. If secondary data were available for individual fingers, it was always for the parameters of one RC of particular finger, i.e., not both RCs (radial and ulnar). Based on these findings, we realized that the original methodological design of the study had to be adapted.

The final sample included only 12 usable population samples within 11 publication sources, where one source published two samples that fulfilled our criteria. Out of those 12 samples 9 contains information about both sexes (**Table 1**). Geographical visualization of these samples is available in **Figure 3**. The predominance of samples is found in Europe, while the area of Asia and North America is less represented. All samples are from the Northern Hemisphere. This uneven distribution is due to sparsely published separate average ridge counts for individual fingers for each sex.

Meta-analytical procedures

Based on results of Polcerová et al. (2019; 2022) and Králík et al. (2019) we decided to explore the consistency of radioulnar gradients among multiple populations and possible sexual dimorphism in those radioulnar gradients via meta-analytical methods summarized in Borenstein et al. (2009).

It is important to note that the most promising results shown in Polcerová et al. (2022) are based on RCr and RCu (radial and ulnar ridge counts for each pattern on each finger), while in the collected sources and, therefore, also in the presented meta-analysis these values are combined according to the traditional methodology of Cummins and Midlo (1943) and Holt (1968). For each finger, descriptive statistics are not published separately for radial RC (RCr) and ulnar RC (RCu), but only the larger of the two RCs for each finger is counted, which on some fingers (or in some people) may be radial and on others (other people) ulnar RC. This had to be adjusted to our comparison with the results we produced and

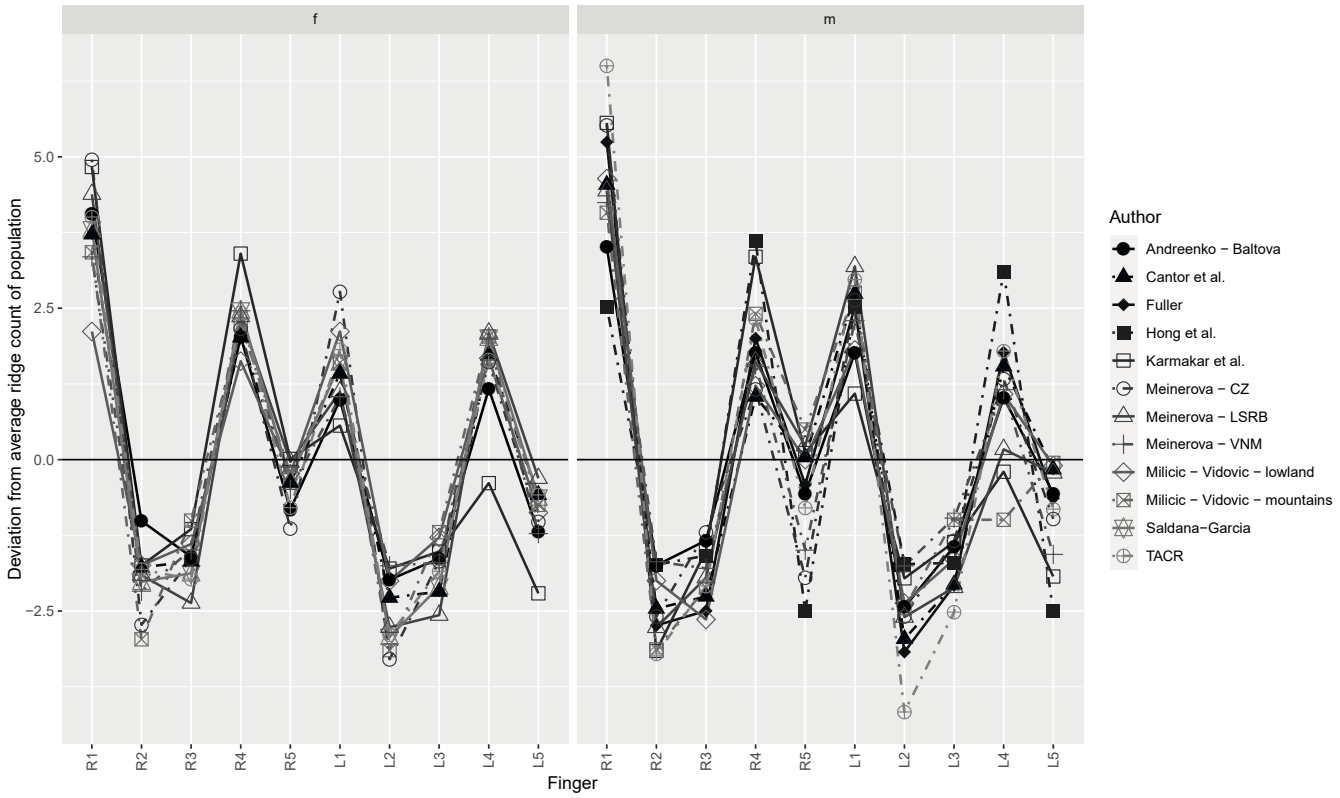

Figure 4: Mean ridge counts for individual fingers across all samples superimposed on overall average ridge counts of each sample with respect to sex (left field represents females – *f*, right field represents males – *m*). The *x*-axis shows the individual fingers, the *y*-axis shows the deviation from the average ridge count of the population.

published based on the primary data of all 20 RCs (Polcerová et al. 2022).

Thus, our results represent a comparison of three blocks (ref. **Figure 1**):

1. the first is the radioulnar contrasts obtained from the meta-analytic aggregation of the published mean values (larger RCs) from each finger (all 9 samples that contains information about both sexes);
2. the meta-analytic sample included a subset of 4 samples treated in the same way that were previously included in the publication by Polcerová et al. (2022); only the largest value from each of the two RCs was selected in each finger, statistical parameters were calculated for each of the ten fingers, and these entered the meta-analysis);
3. the latter 4 samples processed the mean radioulnar contrasts of all 20 RCs from the primary individual data (exactly those published in Polcerová et al. (2022)).

Objectives of the meta-analysis

In the meta-analysis we focused on two main questions:

- whether aggregated effects of radioulnar contrasts between mean values of finger RCs show sexual dimorphism and whether it is consistent among samples;
- how the manifested sexual dimorphism in radioulnar contrasts from meta-analysis differs from radioulnar contrasts computed on individual level from raw RCu and RCr.

Because studies collected for the meta-analysis (published secondary data of RCs, **Table 2**) contained one mean RC value for each individual finger (**Figure 4**), the analysis represents a calculation with 10 fingers and 10 their radioulnar contrasts within each hand. Therefore, 10 separate meta-analyses were computed (contrasts of all finger pairs: F1-F2, F1-F3 … F4-F5) for each hand and sex i.e., 40 meta-analyses. First, we computed these aggregated effects of each radioulnar contrast and, subsequently, we used these aggregated values for males and females in each hand separately and computed their sex differences.

Effect sizes of radioulnar contrasts

For statistical computing we chose the `R` software (R Core Team 2020) and the `RStudio` interface (RStudio Team 2016) with the `metafor` package (Viechtbauer 2021). Within `metafor` package we used `SMCR` measure to calculate standardized mean difference as (*d*) since we consider fingers as matched groups. As mentioned in Borenstein et al. (2009) to compute *d* from the standard deviation of the differences it needs to impute the standard deviation *withing* groups, which would then serve as the denominator:

No	Year	Author	Sex	n	R1		R2		R3		R4		R5		L1		L2		L3		L4		L5	
					m	sd	m	sd	m	sd	m	sd	m	sd	m	sd	m	sd	m	sd	m	sd	m	sd
1	2017	Andreenko - Baltova	f	480	15.34	9.42	10.26	6.23	9.67	5.22	13.30	4.55	10.45	4.05	12.26	4.95	9.29	5.85	9.64	5.13	12.44	4.87	10.08	4.56
1	2017	Andreenko - Baltova	m	414	16.65	6.93	11.39	6.68	11.80	5.11	14.90	4.77	12.57	5.39	14.90	6.59	10.70	7.63	11.70	6.01	14.16	5.17	12.58	5.05
2	1983	Cantor et al.	f	253	16.30	6.00	10.80	6.50	10.90	5.30	14.60	6.00	12.20	5.40	14.00	6.30	10.30	6.00	10.40	5.80	14.30	5.80	12.00	5.10
2	1983	Cantor et al.	m	270	18.00	5.00	11.00	7.00	11.20	5.30	14.50	5.70	13.50	4.70	16.20	5.70	10.50	6.50	11.40	5.80	15.00	5.60	13.30	5.00
3	1973	Fuller	m	825	19.76	6.25	11.78	7.41	12.02	6.48	16.52	6.51	14.10	5.38	17.04	6.37	11.34	7.05	12.44	6.77	16.29	6.52	13.88	5.09
4	2015	Hong et al.	m	129	16.64	6.10	12.38	5.23	12.53	4.54	17.72	5.48	11.62	4.12	16.63	6.02	12.39	4.82	12.41	4.15	17.22	4.52	11.61	3.89
5	2008	Karmakar et al.	f	254	16.92	6.18	10.34	6.53	10.94	5.38	15.49	7.23	12.10	5.37	12.65	5.30	10.29	6.28	10.57	5.40	11.70	5.88	9.88	4.78
5	2008	Karmakar et al.	m	293	18.67	6.55	9.95	6.22	11.61	5.93	16.46	7.92	13.22	6.40	14.20	5.87	11.15	6.50	11.75	6.95	12.91	5.95	11.18	5.31
6	2018	Meinerova - CZ[A]	f	44	18.43	5.15	10.75	7.14	11.84	5.01	15.64	5.76	12.34	4.96	16.25	5.85	10.18	6.63	11.80	5.59	15.09	5.70	12.45	5.44
6	2018	Meinerova - CZ[A]	m	36	21.25	6.51	13.14	7.06	14.53	5.51	16.89	6.12	13.78	5.68	18.36	6.77	13.14	6.12	14.39	6.00	17.06	5.81	14.75	5.28
7	2018	Meinerova - LSRB[A]	f	45	16.53	5.02	10.24	6.76	9.78	5.27	14.51	6.88	12.11	5.69	13.27	5.61	9.38	5.98	9.58	5.54	14.24	6.76	11.84	4.82
7	2018	Meinerova - LSRB[A]	m	51	15.39	7.16	8.18	7.28	9.00	5.72	12.57	6.82	11.18	5.49	14.14	6.84	8.35	6.67	8.84	6.99	11.12	7.01	10.73	6.03
8	2018	Meinerova - VNM[A]	f	19	15.68	6.07	10.16	5.36	10.84	4.09	14.79	4.65	11.84	4.68	13.37	6.23	10.58	6.08	10.63	5.50	14.32	4.00	11.11	4.00
8	2018	Meinerova - VNM[A]	m	57	18.86	5.35	12.93	6.04	12.82	5.59	16.18	4.22	13.12	4.69	16.91	5.88	12.86	5.69	13.65	4.87	15.77	5.14	13.05	4.22
9	2005	Milicic - Vidovic - lowland	f	119	14.25	5.86	10.39	5.94	10.74	5.30	13.76	5.14	11.90	4.35	14.25	5.86	10.13	5.71	10.85	5.64	13.81	5.61	11.26	4.70
9	2005	Milicic - Vidovic - lowland	m	100	17.78	5.37	11.14	6.09	10.50	5.40	14.36	5.35	13.14	5.25	14.95	5.46	10.77	6.07	11.49	5.51	14.22	5.32	13.04	4.78
10	2005	Milicic - Vidovic - mountair	f	58	16.10	5.18	9.71	6.92	11.67	4.36	14.91	4.91	12.45	4.54	14.28	5.79	9.53	6.07	11.48	5.50	14.71	5.09	11.93	4.43
10	2005	Milicic - Vidovic - mountair	m	63	17.75	6.42	10.54	7.27	11.56	6.51	16.08	5.56	14.17	4.83	16.43	6.60	11.22	7.40	12.68	6.52	12.68	6.52	13.62	4.34
11	1975	Saldana-Garcia	f	825	16.50	6.49	10.68	7.23	10.82	6.23	15.16	6.78	12.36	5.95	14.30	6.37	9.77	7.03	10.60	6.76	14.71	7.13	12.07	5.77
12	2020	TACR[*]	f	69	17.68	7.08	11.86	7.24	11.70	5.99	16.10	6.04	12.88	5.88	15.49	6.64	10.78	7.02	11.83	5.97	15.32	6.00	13.09	5.40
12	2020	TACR[*]	m	51	19.20	7.06	9.49	7.17	10.61	6.24	15.02	6.94	11.90	6.12	15.67	7.40	8.53	6.95	10.18	6.43	14.49	7.08	11.88	5.57

Table 2: Input data for meta-analysis (approach M). Published studies, archive samples ([A]) and ongoing research ([*]). In addition *m* represents mean values and *sd* represents standard deviation for each finger.

$$d = \frac{\bar{X}_{Fx} - \bar{X}_{Fy}}{\frac{s_{diff}}{\sqrt{2(1-r)}}},$$

where the mean ridge count of one finger ($\bar{X}_{Fy}$) (positioned relatively more in ulnar side to the finger *Fx*) is subtracted from the mean ridge count of another finger($\bar{X}_{Fx}$) (relatively more on radial side) and divided by standard deviation withing groups. This within groups standard deviation can be calculated from the standard deviation of the difference (as shown in equation) where *r* is the correlation between pairs – in our case between fingers. And then calculate fixed effect for each contrast. However, because we work mainly with published secondary data, where there is usually no available published correlation between individual fingers, it is difficult to obtain precise *r*. In the accompanying documentation for the `metafor` package, maintained by W. Viechtbauer, it is recommended to substitute $r = 0$ for this issue. With reference to the work of Gibbons et al. (1993), who consider the change score and its variance as a single sample problem hence the homogeneity of variance assumption and known value of *r* are not required.

To aggregate the resulting effects (results shown in **Figure 5**) we used *random effect model* represented by `rma` function as part of `metafor` package. For evaluating the heterogeneity between the effects of different studies value I^2 is used which indicates the proportion of dispersion between studies to the total dispersion of the effect.

Effect of sexual dimorphism in radioulnar contrasts

Standardized mean difference (*yi*) and corresponding sampling variance (*vi*) of radioulnar contrasts for males and females calculated in the previous step were further used to calculate the effect size of sexual dimorphism (d_{dim}) of each radioulnar contrast by using standardized mean differences of males (yi_M) minus standardized mean differences of females (yi_F) radioulnar contrasts, with `SMD` measure as in this case we consider sexes as independent groups:

$$d_{dim} = \frac{yi_M - yi_F}{s_{pvi}}$$

And divided by their pooled sampling variance (s_{pvi}). Sampling variance for each sex was obtained as $s_f = \sqrt{vi} \cdot \sqrt{n_f}$ for females and $s_m = \sqrt{vi} \cdot \sqrt{n_m}$ for males where n_f and n_m are number of individuals.

Similarly to the previous step, we used *random effect model* represented by `rma` function as part of `metafor` package to aggregate the resulting effects.

For better understanding of the results, we called the abovementioned **meta-analytical** procedure the **approach M** (see **Figure 1**). To sum it up, it is based on a meta-analytical procedure where published mean values of RCs (higher values selected on each finger) are used to compute contrasts between fingers (i.e., differences between mean RCs for contrasted fingers) and these are used to express sex differences as standardized mean difference (SMD). The **approach M** was applied to all available meta-analytical data – secondary data extracted from published literature (**Table 2**), including samples available to us (**Table 1**).

On the four samples with available raw data of individual RCs for both sexes available to us, we expressed sex dimorphism also as standardized mean difference computed from individual-level radioulnar contrast using the procedure described by Polcerová et al. (2022). To be directly comparable with the **approach M**, one version was computed on **selected** higher RCs from each individual finger which resulted into sex differences of 10 contrasts in each hand – we called it the **approach S** (see **Figure 1**). In the second version contrasts with **full** number of raw RC data, both RCu and RCr (45 contrasts on each hand) were calculated at the individual level, and the means and sexual dimorphism of these means were then cal-

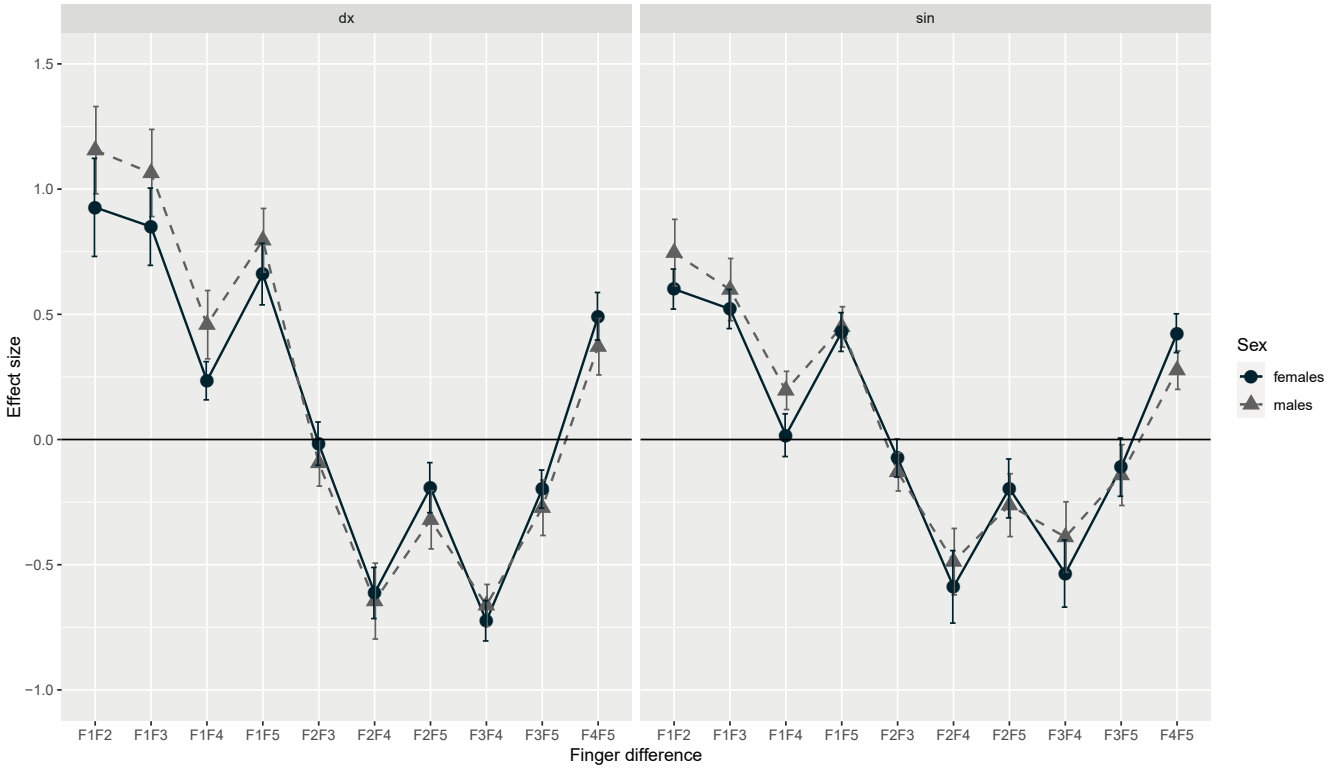

Figure 5: Aggregated effects of standardized radioulnar contrasts (i.e., differences between mean RCs for contrasted fingers of all 9 samples that contains information about both sexes) of approach M, with their confidence intervals (males and females separately). Left field represents results for right hand (*dx*) and right field represents results for left hand (*sin*). On *x*-axis is effect size, *y*-axis represents radioulnar contrasts.

culated – we called it the **approach F**. The available raw data of the four samples allowed us to compute all 45 mean contrast on each hand and were published in the previous paper in full (ref. Polcerová et al. 2022). For the four samples for which we also had individual data (marked [A] and * in **Table 1**), we were able to make this comparison for each sample separately and by individual fingers and contrasts, respectively.

RESULTS

Meta-analysis of published secondary data

The distribution of the mean ridge counts for individual fingers between the meta-analytical samples with respect to sex is available in **Figure 4**. The graph shows that between fingers the changes of these mean ridge counts maintain approximately the same direction in all samples, where the 2nd, 3rd and 5th fingers are below the average ridge count values of the given sample, while the 1st and 4th fingers have higher values than the average ridge count of the given sample. It is also evident that males have mostly higher numbers of ridge counts above and below average ridge count values of the given samples. At the same time, a tendency to lower values in the left hand comparing to the right is evident in most fingers.

Aggregated effect for radioulnar contrasts for each hand and each sex are shown in **Figure 5**. Radioulnar contrasts presented positive mean values with 1st finger (F1) on both hands and in both sexes. The contrast F1F4 on the left hand for females is an exception, as the value is close to zero. Other radioulnar contrasts show mostly negative mean values with the exception of F2F3 contrast (for both hands in both sexes) where the contrast was close to zero, and F4F5 contrast that also presented positive mean values again for both hands in both sexes. Contrasts on the left hand tend to have generally lower absolute values (close to zero) than corresponding contrasts on the right hand.

Population standardized sex differences in radioulnar contrasts (**Figure 6**) range from about -0.5 to 0.5 SD, with aggregated averages ranging from ca. -0.1 to 0.15 SD. Average sex differences are relatively low and close to zero for contrasts F1F5, F2F3, F2F4, F3F4, and F4F5, whereas contrasts F1F2, F1F3, F1F4, F2F5 and F4F5 were relatively far from zero and the resulting confidence intervals of their aggregated effects did not contained zero, so the sex differences can be deemed statistically significant. At the same time, it is evident from both the distributions of population effects and the ranges of the confidence intervals that contrasts differ also in diversity of their effects between populations.

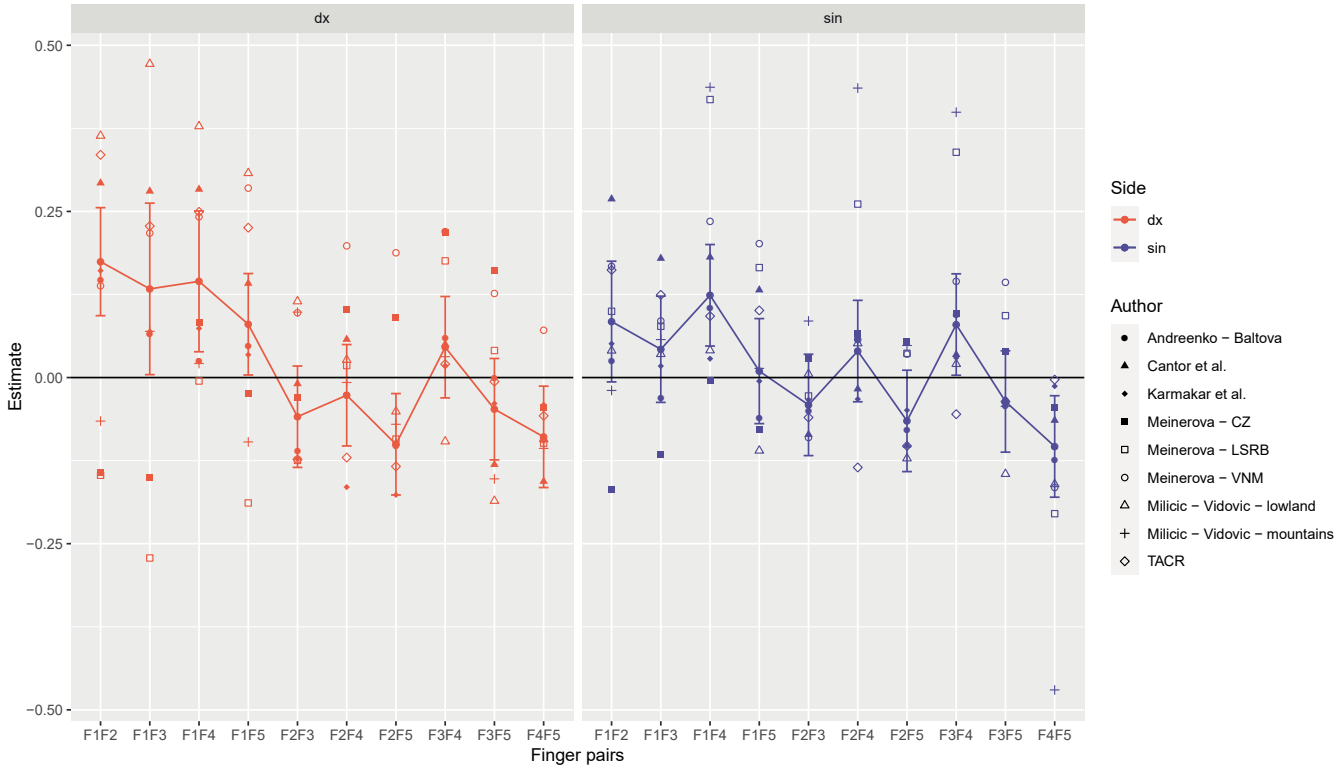

Figure 6: Aggregated effect with their respective confidence intervals of sexual dimorphism in standardized radioulnar contrasts (i.e., differences between mean RCs for contrasted fingers of all 9 samples that contains information about both sexes) of approach M.

Comparison of all three approaches on documented datasets

Meta-analytic effect sizes of sexual dimorphism of radioulnar contrasts (standardized mean difference i.e., contrasts between mean values) were almost absolutely correlated with the values of sexual dimorphism of individual contrast calculated from primary data (the larger value from each finger selected at the individual level) using the method of Polcerová et al. (2022). This was true for all 10 contrasts (**Table 3** and **4**). Therefore, we proved that with selected 10 values (higher value for each finger), contrasts between population means (**Approach M**) are virtually identical to population means of individual contrasts (**Approach S**). However, the results of the paired tests show (**Table 4**) that the mean dimorphisms of all 10 standardized contrasts are systematically numerically higher (Mean Diff systematically positive) for the means of the individual contrasts (**Approach S**) than for the meta-analytic contrasts of the means in the four test populations. In other words, the meta-analytic approach using contrasts of average values provides an overall lower estimate of the effect of dimorphism than when calculated from contrasts determined at the level of contrasts between fingers within each individual hand. In three of the ten contrasts, the result of the permutation test (n = 8) was even statistically significant – F1F2, F1F4 and F4F5.

In **Table 5** we have a comparison of the standardized values of sex dimorphism based on the meta-analytic approach (**approach M**) and these based on the full approach using contrasts of all four original radial and ulnar ridge counts of individual fingers (**approach F**). The effects obtained from the meta-analysis correlates highly variably with the effects from the individual contrasts. Correlations with contrasts composed of RCs of the radial side of the radially placed finger and RCs of the ulnar side of the ulnar finger (ru, e.g., F3rF5u) were generally very weak and all statistically insignificant (even negative for contrast F2rF5u). For comparison, for some contrasts between two RCs from the radial sides of two fingers, the correlations with the meta-analytic results were higher than $r = 0.9$ and statistically significant (F1F3, F1F4, F1F5, and F3F5). Also in these contrasts the meta-analytical effects of dimorphism are systematically weaker than these computed from individual contrasts.

DISCUSSION

By searching the literature, we found that despite the large number of dermatoglyphic studies, there are very few studies of RCs on fingers with publication of secondary data divided by RCs of individual fingers and virtually none that publish

	R1R2	y	smd	ru	rr	uu	ur
right	Czechs	0.11	0.13	0.08	0.26	0.03	0.17
	Lusatian Sorbs	0.10	0.14	-0.17	0.22	0.25	0.55
	Slovaks	0.04	0.05	-0.08	0.25	-0.02	0.25
	Vietnamese	0.05	0.07	-0.24	0.53	-0.16	0.42
	L1L2						
left	Czechs	-0.01	-0.02	0.05	-0.02	-0.03	-0.09
	Lusatian Sorbs	0.21	0.31	0.24	0.15	0.14	0.05
	Slovaks	0.05	0.06	0.21	0.01	0.10	-0.10
	Vietnamese	0.15	0.21	0.08	0.20	0.08	0.16
mean		0.09	0.12	0.02	0.20	0.05	0.18

	R1R3	y	smd	ru	rr	uu	ur
right	Czechs	0.13	0.18	0.12	0.14	0.06	0.06
	Lusatian Sorbs	-0.044	-0.062	-0.58	-0.11	-0.04	0.32
	Slovaks	0.164	0.228	0.07	0.25	0.13	0.24
	Vietnamese	0.157	0.209	0.19	0.30	0.21	0.26
	L1L3						
left	Czechs	-0.077	-0.117	0.124	-0.096	0.033	-0.145
	Lusatian Sorbs	0.180	0.267	0.05	0.27	-0.05	0.12
	Slovaks	0.102	0.149	0.24	0.18	0.13	0.02
	Vietnamese	0.068	0.089	0.25	0.11	0.21	0.09
mean		0.08	0.12	0.06	0.13	0.09	0.12

	R1R4	y	smd	ru	rr	uu	ur
right	Czechs	0.07	0.10	-0.17	0.10	-0.19	0.03
	Lusatian Sorbs	0.087	0.127	-0.51	0.07	0.01	0.40
	Slovaks	0.157	0.222	-0.02	0.26	0.04	0.26
	Vietnamese	0.256	0.369	0.32	0.28	0.34	0.25
	L1L4						
left	Czechs	-0.061	-0.089	0.046	-0.051	-0.035	-0.124
	Lusatian Sorbs	0.429	0.645	0.28	0.65	0.20	0.40
	Slovaks	0.069	0.096	0.09	0.13	-0.02	-0.01
	Vietnamese	0.271	0.398	0.28	0.17	0.26	0.14
mean		0.16	0.23	0.04	0.20	0.08	0.17

	R1R5	y	smd	ru	rr	uu	ur
right	Czechs	0.13	0.20	0.23	0.20	0.14	0.09
	Lusatian Sorbs	-0.025	-0.033	-0.24	-0.08	0.24	0.36
	Slovaks	-0.036	-0.051	0.14	-0.04	0.19	0.03
	Vietnamese	0.262	0.377	-0.01	0.36	0.03	0.29
	L1L5						
left	Czechs	-0.101	-0.155	0.150	-0.103	0.043	-0.164
	Lusatian Sorbs	0.239	0.295	0.24	0.32	0.13	0.20
	Slovaks	-0.011	-0.015	0.17	0.00	0.03	-0.12
	Vietnamese	0.220	0.316	0.38	0.24	0.29	0.17
mean		0.08	0.12	0.13	0.11	0.14	0.11

	R2R3	y	smd	ru	rr	uu	ur
right	Czechs	0.01	0.01	-0.13	-0.16	0.04	0.03
	Lusatian Sorbs	-0.145	-0.199	-0.75	-0.36	-0.32	0.07
	Slovaks	0.112	0.181	-0.17	-0.05	0.15	0.28
	Vietnamese	0.100	0.189	-0.23	-0.29	0.54	0.58
	L2L3						
left	Czechs	-0.061	-0.095	0.149	-0.068	0.069	-0.127
	Lusatian Sorbs	-0.032	-0.060	-0.10	0.09	-0.23	-0.02
	Slovaks	0.048	0.084	0.24	0.17	0.02	-0.09
	Vietnamese	-0.096	-0.158	0.10	-0.11	0.18	-0.01
mean		-0.01	-0.01	-0.11	-0.10	0.06	0.09

	R2R4	y	smd	ru	rr	uu	ur
right	Czechs	-0.04	-0.05	-0.43	-0.18	-0.24	-0.01
	Lusatian Sorbs	-0.013	-0.017	-0.75	-0.14	-0.28	0.20
	Slovaks	0.105	0.165	-0.25	-0.03	0.06	0.30
	Vietnamese	0.190	0.324	-0.18	-0.28	0.58	0.50
	L2L4						
left	Czechs	-0.046	-0.069	0.065	-0.026	-0.009	-0.103
	Lusatian Sorbs	0.225	0.338	0.16	0.41	0.05	0.31
	Slovaks	0.019	0.030	0.09	0.11	-0.12	-0.12
	Vietnamese	0.109	0.155	0.12	-0.04	0.17	0.04
mean		0.069	0.109	-0.147	-0.023	0.026	0.142

	R2R5	y	smd	ru	rr	uu	ur
right	Czechs	0.01	0.01	-0.06	-0.13	0.11	0.06
	Lusatian Sorbs	-0.126	-0.182	-0.50	-0.29	-0.03	0.11
	Slovaks	-0.073	-0.112	-0.14	-0.31	0.19	0.06
	Vietnamese	0.199	0.276	-0.56	-0.22	0.23	0.50
	L2L5						
left	Czechs	-0.083	-0.126	0.166	-0.067	0.074	-0.141
	Lusatian Sorbs	0.011	0.016	0.08	0.17	-0.03	0.07
	Slovaks	-0.058	-0.091	0.16	-0.01	-0.07	-0.24
	Vietnamese	0.047	0.071	0.22	0.01	0.20	0.09
mean		-0.009	-0.017	-0.080	-0.105	0.086	0.062

	R3R4	y	smd	ru	rr	uu	ur
right	Czechs	-0.05	-0.08	-0.32	-0.05	-0.31	-0.04
	Lusatian Sorbs	0.133	0.211	-0.51	0.19	0.08	0.59
	Slovaks	-0.006	-0.010	-0.26	0.01	-0.12	0.15
	Vietnamese	0.088	0.139	0.05	-0.02	0.08	0.02
	L3L4						
left	Czechs	0.016	0.031	0.13	0.06	-0.08	-0.19
	Lusatian Sorbs	0.256	0.516	0.07	0.50	0.32	0.50
	Slovaks	-0.031	-0.055	-0.05	-0.04	-0.18	-0.15
	Vietnamese	0.223	0.388	0.23	0.08	0.01	-0.14
mean		0.078	0.142	-0.081	0.091	-0.025	0.091

	R3R5	y	smd	ru	rr	uu	ur
right	Czechs	0.00	0.00	0.11	0.04	0.10	0.02
	Lusatian Sorbs	0.020	0.026	-0.14	0.03	0.50	0.53
	Slovaks	-0.213	-0.317	-0.11	-0.33	0.06	-0.12
	Vietnamese	0.100	0.144	-0.35	0.02	-0.25	0.05
	L3L5						
left	Czechs	-0.020	-0.032	0.26	0.00	0.01	-0.23
	Lusatian Sorbs	0.046	0.071	-0.02	0.10	0.29	0.29
	Slovaks	-0.123	-0.189	0.02	-0.20	-0.11	-0.28
	Vietnamese	0.164	0.241	0.27	0.15	0.07	-0.09
mean		-0.003	-0.007	0.005	-0.021	0.084	0.024

	R4R5	y	smd	ru	rr	uu	ur
right	Czechs	0.05	0.09	0.14	0.09	0.46	0.38
	Lusatian Sorbs	-0.114	-0.185	-0.27	-0.16	0.31	0.46
	Slovaks	-0.205	-0.359	-0.11	-0.39	0.17	-0.01
	Vietnamese	0.017	0.026	-0.28	0.05	-0.32	-0.03
	L4L5						
left	Czechs	-0.036	-0.077	0.21	-0.06	0.11	-0.14
	Lusatian Sorbs	-0.228	-0.402	-0.36	-0.37	-0.12	0.02
	Slovaks	-0.085	-0.148	0.05	-0.17	0.07	-0.10
	Vietnamese	-0.077	-0.150	0.22	0.09	0.06	-0.10
mean		-0.084	-0.151	-0.049	-0.115	0.093	0.059

Table 3: Standardized sex differences. *y* represents **Approach M**, *smd* **Approach S** and contrasts at the individual level (*ru, rr, uu, ur*) represent **Approach F.** The mean for 4 populations is under respective contrasts for respective finger pairs.

	Pearson r	Mean Diff
F1F2	0.997 ****	0.035 *
F1F3	0.998 ****	0.033 .
F1F4	1.000 ****	0.074 *
F1F5	0.996 ****	0.032
F2F3	0.995 ****	0.003
F2F4	0.997 ****	0.041
F2F5	0.999 ****	0.008
F3F4	0.993 ****	0.064
F3F5	1.000 ****	0.004
F4F5	0.999 ****	0.067 *

Table 4: Relationship between the meta-analytical effect size (standardized mean difference, SMD, Table 3) of sex differences in contrasts between means (**Approach M**), and the effect size computed by means of method by Polcerová et al. (2022) using contrasts computed at individual level (Table 3) from higher RCs on each finger (**Approach S**) expressed as Pearson product moment correlation coefficient (Pearson *r*, with p-value) in the sample of values for right and left hand of the four testing populations (hands separately, n=8). Differences between these two methods are expressed as differences between mean values (Mean Diff) and tested by permutation Monte Carlo exact test. Significance codes: '****' 0 '***' 0.001 '**' 0.01 '*' 0.05 ' . ' 0.1 ' ' 1.

	Contrast rr	Contrast ru	Contrast ur	Contrast uu
F1F2	0.121	0.392	0.118	0.521
F1F3	**0.973** ****	0.461	0.321	0.316
F1F4	**0.913** **	0.571	0.692 .	**0.742** *
F1F5	**0.986** ****	0.331	0.576	0.110
F2F3	0.261	0.274	0.600	0.637 .
F2F4	0.364	0.404	**0.763** *	**0.722** *
F2F5	0.127	-0.261	**0.758** *	0.596
F3F4	**0.780** *	0.381	0.496	**0.881** **
F3F5	**0.941** ***	0.122	0.348	0.065
F4F5	0.312	0.163	0.292	0.383

Table 5: Relationship between the meta-analytical effect size (standardized mean difference, SMD, Table 3) of sex differences in contrasts between means (**Approach M**), and the effect size computed by means of method by Polcerová et al. (2022) using contrast computed at individual level (Table 3) from all four original ridge counts (**Approach F**) expressed as Pearson product moment correlation coefficient (Pearson *r*, with p-value) in the sample of values for right and left hand of the four testing populations (hands separately, n=8). Significance codes: '****' 0 '***' 0.001 '**' 0.01 '*' 0.05 ' . ' 0.1 ' ' 1.

statistical parameters of all 20 RCs (from both radial and ulnar sides of fingers). When data are published separately by fingers, they are the mean of the higher of the RCs for that finger which is an intermediate step for computation of TFRC. Then, nowhere is it stated what the combination of radial and ulnar RCs is (moreover, this may be different for each finger, person, and sample). Even these studies with selected higher RCs for each finger were found in very seldom, and therefore, in terms of future development of meta-analysis in dermatoglyphics, the opportunities for studying intraindividual variability by meta-analytical approaches are small.

In general, if we compare the magnitude of the sex dimorphism obtained by the meta-analytic procedure (**approach M**) with the values calculated from individual contrasts (**approaches S** and **F**), the meta-analytic results provide a dimorphism of visibly lower values. In pairwise comparisons, we saw that the meta-analytic dimorphism effects are smaller than the effects calculated for the same samples from individual contrasts of selected higher values for each finger (**approach S**). This is true systematically for all contrasts. Although this shift/bias is different for each contrast, e.g., for F2F3 it is almost zero on average, for some contrasts it can be up to three-quarters of a tenth of a standard deviation (on average out of 8 samples) but up to one-fifth of the SD for individual samples. Given that sexual dimorphism in RC contrasts reaches a maximum of about 1SD overall in individual samples (ref. Polcerová et al. 2022), and moreover, this is just a methodological bias due to purely different inference from exactly the same raw data, it should be concluded that the **approach M** substantially reduces the observed dimorphism compared to calculations based on the **approach S**. However, when we add a comparison with **approach F**, the difference is even more pronounced. The sexual dimorphism calculated from the original radial and ulnar RCs (**approach F**) is often significantly higher than the sexual dimorphism found by meta-analysis (**approach M**), and some combinations of r and u RCs have a dimorphism significantly greater than the dimorphism calculated in the same way but from individually selected higher values for each finger (**approach S**). Both the selection of a higher value for each finger and the meta-analysis of contrasts of mean values of RCs contribute in some way to reducing the effect of the observed sexual dimorphism and thus to the ability of the method to discriminate and compare dimorphism. On the other hand, even in the **approach M** the side difference found in the original paper with the **approach F** is retained (Polcerová et al. 2022) where for most contrasts the sex differences were higher on the right hand than on the left.

Overall, it is evident that one cannot mix and directly compare the dimorphism obtained by any of these three approaches in a single study and infer anything from the differences in dimorphism. One should always maintain the unity of the method used and, if possible, use the original method of contrasts according to Polcerová et al. (2022), or another statistically more advanced procedure.

In any case, however, further advances in meta-analytic studies of radioulnar intraindividual finger contrast cannot be expected, as the data are not suitably descriptive in published studies and all raw RCs at the individual level (i.e., primary data) need to be available.

CONCLUSION

Despite the large number of dermatoglyphic studies, the character of the published data does not usually allow to study trends between RCs of different fingers on the hand and thus to use the studies for meta-analytical purposes to study radioulnar effects. Raw RC data are usually not published at all; if statistical parameters of RCs for individual fingers are available, it is a matter of selecting the larger RC for each finger that is otherwise used to calculate TFRC. Even so, we were only able to find 11 suitable studies.

Comparison of the meta-analytic effects of sex differences in contrasts between RC means with the effects of dimorphism of contrasts computed on individual level showed that meta-analysis of means yields weaker effects. Selecting only one RC per finger then (regardless of how the dimorphism effect is calculated) does not match the original effects from the original finger-side-specific RCs (radial and ulnar), except for a few finger combinations that have larger radial ridge counts in the vast majority of individuals and populations.

Overall, we are compelled to conclude that the dermatoglyphic literature does not provide a sufficient number of appropriately presented results on RCs of individual fingers, and to study dermatoglyphic intraindividual hand radioulnar trends, the original raw data – RCs at the individual level – must be available.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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APPENDIX

	males																	
ID	Karmakar et al.	Milicic - Vidovic - lowland	Milicic - Vidovic - highlands	Cantor et al.	Andreenko - Baltova	TACR*	Meinerova - CZA	Meinerova - LSRBA	Meinerova - VNMA	Karmakar et al.	Milicic - Vidovic - lowland	Milicic - Vidovic - highlands	Cantor et al.	Andreenko - Baltova	TACR*	Meinerova - CZA	Meinerova - LSRBA	Meinerova - VNMA
					yi									vi				
n	293	100	63	270	414	51	36	51	57	293	100	63	270	414	51	36	51	57
R1R2	1.328	1.227	1.109	1.396	0.758	1.355	1.219	0.992	1.093	0.010	0.028	0.042	0.011	0.006	0.057	0.076	0.049	0.046
R1R3	1.075	1.345	0.952	1.356	0.699	1.198	1.010	0.879	1.114	0.009	0.029	0.039	0.011	0.005	0.053	0.070	0.047	0.046
R1R4	0.337	0.632	0.257	0.698	0.252	0.583	0.655	0.388	0.494	0.007	0.022	0.032	0.008	0.005	0.043	0.062	0.041	0.037
R1R5	0.830	0.857	0.551	0.897	0.588	1.018	1.123	0.579	1.058	0.008	0.024	0.034	0.009	0.005	0.049	0.073	0.043	0.045
R2R3	-0.266	0.104	-0.139	-0.028	-0.061	-0.154	-0.193	-0.111	0.018	0.007	0.020	0.032	0.007	0.005	0.039	0.056	0.039	0.035
R2R4	-1.044	-0.525	-0.753	-0.499	-0.524	-0.760	-0.520	-0.594	-0.531	0.009	0.021	0.036	0.008	0.005	0.045	0.059	0.043	0.038
R2R5	-0.524	-0.326	-0.493	-0.356	-0.176	-0.331	-0.089	-0.406	-0.031	0.007	0.021	0.034	0.008	0.005	0.040	0.056	0.041	0.035
R3R4	-0.816	-0.709	-0.686	-0.621	-0.606	-0.696	-0.419	-0.615	-0.593	0.008	0.023	0.035	0.008	0.005	0.044	0.058	0.043	0.038
R3R5	-0.271	-0.485	-0.396	-0.433	-0.150	-0.204	0.133	-0.375	-0.053	0.007	0.021	0.033	0.008	0.005	0.040	0.056	0.041	0.035
R4R5	0.408	0.226	0.339	0.175	0.488	0.443	0.497	0.201	0.715	0.007	0.020	0.033	0.007	0.005	0.041	0.059	0.040	0.040
L1L2	0.518	0.760	0.780	0.997	0.636	0.950	0.754	0.834	0.680	0.007	0.023	0.037	0.009	0.005	0.048	0.063	0.046	0.039
L1L3	0.416	0.629	0.561	0.840	0.485	0.731	0.574	0.763	0.547	0.007	0.022	0.034	0.009	0.005	0.044	0.060	0.045	0.038
L1L4	0.219	0.133	0.561	0.210	0.112	0.157	0.188	0.435	0.191	0.007	0.020	0.034	0.007	0.005	0.039	0.056	0.041	0.035
L1L5	0.513	0.347	0.421	0.507	0.351	0.504	0.522	0.491	0.648	0.007	0.021	0.033	0.008	0.005	0.042	0.059	0.042	0.039
L2L3	-0.092	-0.118	-0.195	-0.138	-0.131	-0.234	-0.200	-0.072	-0.137	0.007	0.020	0.032	0.007	0.005	0.040	0.056	0.039	0.035
L2L4	-0.270	-0.564	-0.195	-0.690	-0.453	-0.845	-0.627	-0.409	-0.505	0.007	0.022	0.032	0.008	0.005	0.046	0.061	0.041	0.037
L2L5	-0.005	-0.371	-0.320	-0.430	-0.246	-0.475	-0.257	-0.351	-0.033	0.007	0.021	0.033	0.008	0.005	0.041	0.056	0.040	0.035
L3L4	-0.166	-0.492	0.000	-0.619	-0.409	-0.660	-0.435	-0.321	-0.429	0.007	0.021	0.032	0.008	0.005	0.043	0.058	0.040	0.037
L3L5	0.082	-0.279	-0.142	-0.327	-0.146	-0.260	-0.059	-0.266	0.122	0.007	0.020	0.032	0.008	0.005	0.040	0.056	0.040	0.035
L4L5	0.290	0.220	-0.142	0.303	0.305	0.363	0.389	0.055	0.522	0.007	0.020	0.032	0.008	0.005	0.041	0.058	0.039	0.037

Table A1: Results of meta-analysis (measure = SMRC) for individual male samples (A – archival, * ongoing research): *yi* - standardized mean difference; *vi* - corresponding sampling variance.

	females																	
ID	Karmakar et al.	Milicic - Vidovic - lowland	Milicic - Vidovic - highlands	Cantor et al.	Andreenko - Baltova	TACR*	Meinerova - CZA	Meinerova - LSRBA	Meinerova - VNMA	Karmakar et al.	Milicic - Vidovic - lowland	Milicic - Vidovic - highlands	Cantor et al.	Andreenko - Baltova	TACR*	Meinerova - CZA	Meinerova - LSRBA	Meinerova - VNMA
					yi									vi				
n	254	119	58	253	480	69	44	45	19	254	119	58	253	480	69	44	45	19
R1R2	1.062	0.655	1.217	0.914	0.538	0.813	1.465	1.231	0.871	0.010	0.019	0.047	0.010	0.004	0.034	0.070	0.061	0.125
R1R3	0.965	0.595	0.844	0.897	0.601	0.835	1.257	1.322	0.764	0.010	0.018	0.041	0.009	0.005	0.034	0.063	0.064	0.121
R1R4	0.231	0.083	0.227	0.282	0.216	0.221	0.532	0.395	0.140	0.008	0.017	0.035	0.008	0.004	0.029	0.049	0.046	0.106
R1R5	0.778	0.398	0.695	0.681	0.518	0.670	1.162	0.865	0.606	0.009	0.017	0.039	0.009	0.004	0.032	0.061	0.053	0.115
R2R3	-0.092	-0.059	-0.279	-0.015	0.095	0.022	-0.150	0.067	-0.121	0.008	0.017	0.035	0.008	0.004	0.029	0.046	0.044	0.106
R2R4	-0.786	-0.564	-0.742	-0.583	-0.487	-0.579	-0.673	-0.621	-0.827	0.009	0.018	0.039	0.009	0.004	0.031	0.051	0.049	0.123
R2R5	-0.269	-0.253	-0.391	-0.215	-0.030	-0.139	-0.219	-0.272	-0.300	0.008	0.017	0.036	0.008	0.004	0.029	0.046	0.045	0.108
R3R4	-0.843	-0.566	-0.733	-0.696	-0.694	-0.726	-0.745	-0.882	-0.925	0.009	0.018	0.039	0.009	0.005	0.033	0.052	0.053	0.128
R3R5	-0.215	-0.217	-0.177	-0.245	-0.149	-0.195	-0.098	-0.435	-0.234	0.008	0.017	0.035	0.008	0.004	0.029	0.046	0.047	0.107
R4R5	0.467	0.360	0.494	0.399	0.625	0.527	0.563	0.343	0.608	0.008	0.017	0.037	0.008	0.005	0.031	0.049	0.046	0.115
L1L2	0.444	0.699	0.810	0.586	0.599	0.701	1.019	0.682	0.429	0.008	0.019	0.040	0.009	0.005	0.033	0.057	0.050	0.110
L1L3	0.391	0.577	0.477	0.570	0.528	0.545	0.747	0.646	0.421	0.008	0.018	0.036	0.009	0.004	0.031	0.052	0.049	0.110
L1L4	0.179	0.075	-0.073	-0.047	-0.036	0.025	0.195	-0.170	-0.146	0.008	0.017	0.035	0.008	0.004	0.029	0.046	0.045	0.106
L1L5	0.521	0.507	0.401	0.317	0.440	0.357	0.638	0.251	0.347	0.008	0.018	0.036	0.008	0.004	0.030	0.050	0.045	0.108
L2L3	-0.044	-0.125	-0.317	-0.017	-0.060	-0.148	-0.240	-0.033	-0.008	0.008	0.017	0.035	0.008	0.004	0.029	0.046	0.044	0.105
L2L4	-0.224	-0.640	-0.842	-0.665	-0.538	-0.640	-0.728	-0.799	-0.589	0.008	0.019	0.041	0.009	0.004	0.032	0.051	0.052	0.114
L2L5	0.065	-0.197	-0.390	-0.282	-0.135	-0.325	-0.336	-0.404	-0.083	0.008	0.017	0.036	0.008	0.004	0.030	0.047	0.046	0.105
L3L4	-0.209	-0.521	-0.580	-0.670	-0.545	-0.578	-0.578	-0.827	-0.642	0.008	0.018	0.037	0.009	0.004	0.031	0.049	0.052	0.116
L3L5	0.127	-0.072	-0.081	-0.275	-0.086	-0.209	-0.114	-0.401	-0.084	0.008	0.017	0.035	0.008	0.004	0.029	0.046	0.046	0.105
L4L5	0.309	0.452	0.539	0.395	0.484	0.368	0.455	0.349	0.769	0.008	0.018	0.037	0.008	0.004	0.030	0.048	0.046	0.121

Table A2: Results of meta-analysis (measure = SMRC) for individual female samples (A – archival, * ongoing research): *yi* - standardized mean difference; *vi* - corresponding sampling variance.

	Karmakar et al.	Milicic - Vidovic - lowland	Milicic - Vidovic - mountains	Cantor et al.	Andreenko - Baltova	TACR	Meinerova - CZ	Meinerova - LSRB	Meinerova - VNM
R1R2	0.161	0.364	-0.066	0.293	0.147	0.335	-0.143	-0.147	0.138
R1R3	0.069	0.472	0.070	0.280	0.066	0.228	-0.150	-0.272	0.217
R1R4	0.074	0.378	0.021	0.283	0.025	0.249	0.083	-0.005	0.242
R1R5	0.034	0.308	-0.097	0.142	0.047	0.226	-0.024	-0.189	0.285
R2R3	-0.123	0.115	0.098	-0.009	-0.110	-0.123	-0.030	-0.125	0.098
R2R4	-0.165	0.027	-0.007	0.057	-0.026	-0.120	0.103	0.018	0.198
R2R5	-0.177	-0.051	-0.070	-0.099	-0.103	-0.134	0.091	-0.093	0.188
R3R4	0.018	-0.096	0.031	0.050	0.060	0.020	0.218	0.176	0.220
R3R5	-0.039	-0.186	-0.152	-0.131	-0.001	-0.006	0.162	0.041	0.127
R4R5	-0.041	-0.093	-0.107	-0.156	-0.094	-0.058	-0.044	-0.099	0.071
L1L2	0.051	0.041	-0.019	0.269	0.025	0.162	-0.169	0.100	0.167
L1L3	0.017	0.035	0.057	0.179	-0.030	0.124	-0.115	0.077	0.085
L1L4	0.028	0.041	0.437	0.181	0.105	0.092	-0.005	0.418	0.235
L1L5	-0.005	-0.110	0.014	0.132	-0.061	0.101	-0.078	0.165	0.202
L2L3	-0.034	0.005	0.085	-0.086	-0.050	-0.060	0.028	-0.028	-0.090
L2L4	-0.032	0.051	0.436	-0.017	0.058	-0.135	0.067	0.261	0.057
L2L5	-0.049	-0.122	0.048	-0.102	-0.078	-0.103	0.055	0.036	0.035
L3L4	0.030	0.020	0.399	0.035	0.094	-0.055	0.097	0.339	0.145
L3L5	-0.032	-0.145	-0.043	-0.036	-0.043	-0.036	0.039	0.093	0.143
L4L5	-0.013	-0.161	-0.470	-0.064	-0.124	-0.003	-0.045	-0.205	-0.165

Table A3: Aggregated effect of sexual dimorphism in standardized radioulnar contrasts (i.e., differences between mean RCs for contrasted fingers of all 9 samples that contains information about both sexes) of **approach M**.

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Movimento Negro in Salvador de Bahia: an alliance between things

Paola Rizzo

Graduate in Cultural and Social Anthropology, University of Milano-Bicocca, Italy

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MOVIMENTO NEGRO V SALVADORU DE BAHIA: ALIANCE VĚCÍ

ABSTRAKT Při procházce ulicemi Salvadoru de Bahia je možné vnímat přítomnost symbolů kultury boje, kterou propaguje hnutí Movimento Negro, jež v reakci na místní strukturální rasismus vyzývá k zaplnění prostoru oslavnými reprezentacemi afrického původu. Pokus o pochopení toho, kdo nebo co je Movimento Negro, byl učiněn prostřednictvím terénního výzkumu. Ukázalo se ústřední postavení materiálního a senzitivního rozměru jako prostoru boje mezi ekonomickými a rasovými skupinami (Rancière 2004). Rasismus i formy odporu v reakci na něj jsou viditelné a materiálně se projevují v tělech, prostorech a předmětech. Movimento Negro je hyperobjekt (Morton 2018). Je to "vícedruhová asambláž" (Haraway 2015): zachycena ve svých smyslových projevech nás nutí zpochybňovat místní systém významů a samotná epistemologická paradigmata, na nichž je založena modernita (Gilroy 1993).

KLÍČOVÁ SLOVA de-kolonialismus; černošství; rasismus; prostor; Movimento Negro; aliance věcí; městské umění; pixação

ABSTRACT Walking through Salvador de Bahia's streets one perceives the presence of symbols of the culture of struggle promoted by the Movimento Negro, which invites to *encher o espaço* ("fill the space") with celebratory representations of Afro-descent, in response to local structural racism. An attempt was made to understand who or what the Movimento Negro was through fieldwork. The centrality of the material and sensitive dimension, as a space for struggle among economic and racial groups (Rancière 2004), has emerged. Both racism and the forms of resistance in response to it are visible and materially manifest in bodies, spaces, and objects. Movimento Negro is a hyperobject (Morton 2018). It's a "multispecies assemblage" (Haraway 2015): caught in its sensual manifestations, it forces us to question the local system of meaning and the very epistemological paradigms on which Modernity is based (Gilroy 1993).

KEY WORDS de-colonialism; blackness; racism; space; Movimento Negro; alliance of things; urban art; pixação

INTRODUCTION

Ethnic building (Barth 1998) in Brazil is closely linked to structural racism. The term refers to racial discrimination as a mechanism that organizes interactions and economic relationships between people in a given society (Bastide – Florestan 1959). The position of individuals in the hierarchy in Brazil has its roots in the local structure during colonialism (Nascimento 1975; Batista da Silva 2020). The racist discourse that spread from Europe to Brazil around the nineteenth century under the influence of Social Darwinism was instrumented to maintain the same asymmetrical power relations of the slave system within the nascent nation-state of Brazil. Subordinate groups have moved from former slaves to exploit works and various citizenship criteria have been created (Schwartz 1993, 16). The result has been a profound socio-economic divide among the population, which still exists today (Baggio – Resadori – Gonçalves 2018; Veliq – Magalhães 2022). In the contemporary local context, there is a growing awareness and sensitivity to these issues of inequality of access to resources and full recognition of citizenship rights, which permeates the social fabric outside the scientific community (Graças Gonçalves 2009). This is due to the work of various socio-political organizations that have struggled to improve the living conditions of individuals since the eighties of the twentieth century. Among these, an important

role has been that of the Movimento Negro (Ribeiro Corossacz 2007), the main promoter of the discourse of denouncing racial discrimination as a political responsibility and actions of re-education of the population (Gomes 2005). It's part of the politico-cultural macro-movement of afro-descendants dislocated outside of Africa (Gilroy 1993), which includes the Black Panthers and the current Black Lives Matter. The first problem faced was to identify who this Movimento Negro was in Salvador de Bahia. All field work has been built around this difficulty. Considering the mutability of these afro-descendant movements with the historical moment and the specific geographical place in which they are examined (Hall 2006), it must be premised that by "contemporary Movimento Negro" we mean the specificity with which this is configured from the 1970s onwards (Araujo Pereira – Silva da Lima 2019). Nilma Lino Gomes (2017) defines it as a heterogeneous set of political, academic, cultural, religious, and artistic groups united by the intent to enhance and affirm negro's history and culture in Brazil, by breaking "the racist barriers imposed on negros and negras in the occupation of different spaces and places in society"[1] (Gomes 2017, 24). A recent study (Araujo Pereira – Silva de Lima 2019) shows that the Movimento Negro in the present day is characterized by its widespread diffusion within the social fabric and its use of aesthetics as a favorite tool of action (Araujo Pereira – Silva de Lima 2019). While that study focuses on the diffusion of new "anti-racist" narratives and cultural codes through digital tools and media (Araujo Pereira – Silva de Lima 2019, 8), here it will be proposed an analysis of diffusion strategies through the material dimension of reality. The places, bodies, and spaces of the city are configured as core elements to understand ethnic and racial tensions and the workings of the Movimento Negro. The ethnic construction of *negritude* ("afro-brazilianity") will be considered here in the sense of Gilroy's (1993) *blackness*: a complex representation of a black particularity divided by ethnicity, gender, and political consciousness. This will be presented through the material implications of the daily life of the so-called afro-descendants in Salvador de Bahia. We will reflect on the materiality of places as valuable clues to analyze and understand the strategies of action of the Movimento Negro and its configuration.

METHODOLOGY

This article is an excerpt from my Master's thesis in Anthropological and Ethnological Science[2]. Data and case studies reported here were collected by a field work from July to December 2019 in Salvador de Bahia. Back home, bibliographic research continued until December 2020. Face-to-face interviews were collected. Learning about the phenomenological dimension of culture was a privilege. As Csordas (1994) reminds us, taking up Merleau-Ponty (1945), culture resides as much in objects and representations as in the bodily processes of perception through which the same representations are created. For this reason, it was necessary to observe the being-in-the-world of the interlocutors, through the anthropology of the body (Malighetti – Molinari 2006) in which the researcher's corporeality was configured as an instrument of investigation and place of reflection. Individual's bodies have been considered continuity of space, the first place of socialization and resistance (Low 2017). To focus on the materiality of human existence, a video camera was used[3] to document interviews, and events and to keep track of peculiar elements reminiscent of blackness scattered throughout the city's places.

RACIALIZATION OF SPACES: *LUGARES BRANCOS AND LUGARES NEGROS*

Although traditionally in Brazil a *color continuum* is used in the censuses to classify the ethnicity of individuals (Corossacz 2007; Fry 2019) during my field period in Salvador, people tended to adopt the polarizing model: "white or black". The representations are opposed: *branco* ("white") is the economically and politically dominant group, *negro* ("black") is instead who is in a subordinate position concerning the first. For a long time, bodies were manipulated to conceal the phenotypic traits attributable to the African populations, such as frizzy hair and fleshy lips (Do Nascimento 1978; Sansone 2003). In the 1990s, shifting toward the "black pole" began (Barba 1999; Sansone 2003; Malighetti 2004): people increasingly manipulated their bodies to highlight and enhance Afro aesthetic qualities, which had previously been concealed. This mutability of aesthetic canons[4] is part of the wider process of deconstruction of the local system of thought - based on a racist vision - and of denouncing the discrimination of certain social groups. The color of the skin is not only an index

1 My translation.

2 The Thesis has been discussed on 16th March 2021.

3 In another forum, we could look deeply into how to use of technologies and images could influence the construction of the ethnographic field (Pink 2011), but for the time being, the subject of the article is not mentioned here.

4 Since colonial times, the local population has had a varied set of phenotypic traits and skin tones, due to the widespread sexual unions between Portuguese settlers and indigenous women, and enslaved Africans. In those times, an individual's status was inferred from the way they dressed and the items they wore; what distinguished masters of slaves was therefore a performance of social status (Samson 2015). At that time, skin color alone was not a distinctive quality. The "speech of race" reached Brazil later, around the 19th century, under the influence of European social Darwinism (Corossacz 2007). It is from this time that biological explanations of the socio-economic status of individuals, an almost obsessive focus on the phenotypic characteristics of the body (including skin color) began to spread, and a conception of "being a master" and "being a slave" was created in terms of the opposition between a Euro – descendant, and Afro-descendant. By the local mentality in which the status has been made also the equation of "whiteness" as a right to inherit privileged status and wealth has become something to display aesthetically.

of physical distinction but the symbol of the supremacy of the "white" and the irreducible inferiority of the "black race" (Bastide – Florestan 1959, 83). Vito, the young 25-year-old boy who describes himself as Afro-Brazilian and who lives in a precarious economic condition, explained to me that being a pack is a matter of inheritance of comfortable living conditions and not something determined by genetics.

> Paola: "Like the Mercado Modelo where they took the slaves?"
> Vito: "(...) When we say *branco* ("white"), we don't talk about the color of the skin, you know! The *brancos* who live in this *favela* ("shanty towns"), are descendants of *niggers*, of Indians, and people end up not understanding this: despite that, they also have *branco*'s blood. What is required to be a *branco* is that they are not inside the slum. They have inherited: they are people who have already been born with money, who have already been born with a legacy as much money as history."[5]

When Vito talks about "the legacy of money and the history of *brancos*", he refers to the invisibility of the collective memory (Halbwachs 1990) of Afro-descendants in national history (Do Nascimento 1978; Bastos 2020). The practices of the Movimento Negro aim to restore visibility to subjectivities (Ortner 2005) from these groups, in both the historical past and the living present. Vito's words also introduce another central theme of this reflection: the overlap between being *negro*[6] and living in the *favela*. As we shall see, the ideology of stratification (Matera 2015) is something that is inscribed in the materiality of the urban fabric and that creates a *coincidence between race and the space* of the city that individuals are allowed to occupy.

In Salvador de Bahia, the individual's racial categorization determines his or her access. Attention to urban space helps to capture the manifestations of structural racism. Salvador de Bahia is composed of conurbations of very different buildings: from the opulent churches of the Pelourinho[7] to areas with modern buildings where rich families live. Then there are the *favelas* ("shanty towns"): precarious concrete towers with bare bricks that extend under the large bridges that connect the city, near the overpasses, and in areas far from the urban center. Moving from one zone to another, the feeling is that of being literally in a constantly changing city. Marcello Balbo (1993) invented the term fragmented city to refer to the *magalopolis* of developing countries like Brazil. Their peculiarity is their chaotic fragmentation, in which urban unity disappears and a juxtaposition of elements completely different from one another occurs (Balbo 1993). Lefevbre (1970) defined the city as the projection of society on the territory and its practical--sensible and social morphology at the same time, as a reflection of a precise political project (Lefevbre 1970, 75). In the conformation of the town, the class distinction (Harvey 2016, 10) between *brancos* and *negros* is materialized. The "dual" feeling of these postcolonial urban areas embodied the duplicity of the citizenship of the colonial political project (Balbo 1993, 26). The difference is experienced in a space form: racialized forms of social relationships are part of the landscape (Wade 2020). My callers used the phrase *lugares brancos* ("white areas") to indicate areas frequented by individuals in the middle and upper segments of the population. This is especially the latest built coastal areas where there are numerous discos and tourist places. Another *lugar branco* par excellence is the center of commerce. In addition to being localized. Mostly close to residential areas rich brancos, it is a place where prices are much higher than in small neighborhood retail stores. I mean, there's this whole network of restaurants whose costs are too high for a black. Besides the lack of affordability, the device of derogatory representations associated with the black body also acts as a filtering mechanism. In malls they go find mainly *brancos*: the few *negros* will often be confined to the role of scavenger or security. This point was also brought to my attention by Marcos, a black museologist and anthropologist (40).

> Paola: "So in the Ads for job offers they write "good looking"?
> Marcos: "you can go around the city, you can go to the shopping malls here, the ones closer and the ones further away: you go into the shops and see girls who are lighter [in skin tone] than you, with straighter hair than yours, standing there. But isn't the population of Salvador the blackest! Where are those [negras]? You'll also meet them persons [negras], clean the street. And you will meet these guys.[negros] in malls: clean the street or for safety. So it's like this: is It is the blackest city [in Brazil]?! Yes, it is; but with major problems. With that issue to be resolved: Where should these men and women [blacks] stay?"[8]

When Marcos questions "where should women and men be", he brings up a major issue of the negros' condition of existence: they experience a situation of non-recognition (Bastos 2020, 679). This disavowal of their role in society creates an

5 My translation.

6 In the words of colloquial usage of people in Salvador de Bahia, this conception of race often emerged as a joint of the socio-economic condition of the individual with the aesthetic morphology of his body (Mitchell 2017). Although the close dialogue between the Afro-descending movements located outside Africa in the twentieth century influenced the Brazilian context with the concept of the North American race (Fry 2009), in Salvador there are two terms to indicate Afro-Brazil: *negro* and *preto*. The difference is that the priest - in a biological sense - connotes the aesthetic morphology of the body and involves a black and dark skin color. The term Negro is rather a macro, fluid category, connected with the socio-economic condition of the individual. *Negro* means "to be poor", *preto* no. The priest may be rich, but he is united to the *Negro* through the stigma inherited from Africans. In Salvador de Bahia expressions such as preto pobre ("poor black") or preto de favela ("black of the favela") are used, to emphasize the double stigma of the person: black of economic condition, but also for the color of the skin. Recent genetic studies on the demographic composition of the Brazilian population (Maio – Santos 2005) exemplify the significant impact of theories of social biologists on the concept of race at a local level, but the overlap of these categories with the distinctions of social class is evident.

7 Salvador de Bahia's old town.

8 My translation.

area of non-existence (De Genova 2002) which is both material and social. They are materially confined to places other than brancos and at the same time they experience social confinement: when they are allowed to frequent "places of prestige" they assume a subordinate position to brancos. You don't see them eating in restaurants, but work as safety. So it is not just. a question of being able to physically and materially be in a space, but it is also the social status that the individual can claim at that moment. Being Afro-Brazilian is an experience and cannot be removed from the economic, political, and historical dynamics that gave birth to this category (Hall 2003). If it is in a state way of doing and thinking (Foucault 1997, 262), then it is not surprising that it is precisely the racist system of thought - underlying the conformation of the nation state (Quijano 2005) - that regulates the lives of Brazilian citizens (Do Nascimento 1978; Almeida 2018). In Brazil, racism acts as a political micro-technical, regulatory body (Sales 2006). It works through the seal stereotyped and denigrating representations of *negritude* ("blackness"), creating a non-existent space for individuals and placing them in a well-defined socioeconomic and physical-geographical space. That is a racialization of spaces the creation and maintenance of separate locations for the various economic and racial categories (Low 2017). This is why 'space structures can be seen as the outcome and means of [building] social relationships which have a racialized discourse" (Wade 2020, 34). The gap in terms of quality of life and citizenship between brancos and negros is also manifested in the differences in services and facilities present in the geographical space in which they live. According to Balbo (1993), those who do not have a sewer service at home may not be considered citizens, even if they are the majority (Balbo 1993, 29). It made me reflect on the house of Gleids (30), a black graffiti artist who I followed for a lot of the field work. He is a well-known artist.in his region and is often tasked with painting local markets to attract customers. Despite the very economic income in his apartment, which is equipped with amenities when compared to those of his neighbors, basic services are lacking. The domestic space consists of a small bedroom with a small window and standing iron bars, a mattress upstairs for sleeping, and a gas cooker. The bathroom is a corner, separated from the rest with a plastic curtain. Gleids has a bathroom, however, is no water. Definitely a different situation from the average. A combination of inefficiencies that strengthen the cumulative disadvantage between *brancos* and *negros*: distinctions that are perpetuated until they become peculiar features of the same landscape (Harvey 1989, 142). As will shortly be seen, living in the *favela* exemplify the condition of *negritude*: an experience of socio-political marginalization inscribed in the materiality of places.

EU SOU *FAVELA*

In Salvador de Bahia's *favelas*, defined as *lugares negros* ("black places"), there is a high coincidence between the density of the population living there and the number of people considered Afro-Brazilian. One of the reasons is certainly the gentrification process (Zukin 1987) that occurred in the 1990s. The result was a near-complete replacement of the black population - of physiognomy and socio-economic status - in Pelourinho (De Albuquerque 2021). Many of these families, such as Sagaz's (26 years old), received government money to move from the center to the suburbs of Salvador (Albuquerque Ribeiro 2021). It was a real ghettoization of *blacks* and their association, in the local collective imagination, with the condition of *ser favelado* ("being of favela"). Even the *favelas* which are located in a geographically central area of the city, exhibit the particular characteristics of the "suburbs" as a place of deterioration and institutional abandonment. Due to the lack of transportation that easily links the neighborhood to other parts of the city, residents rarely travel from their area of residence. In addition, when the *favela* is located in a central area of the city, the inhabitants are discouraged in their movements by military surveillance (De Souza – Serra 2020). For example, in front of the atelier where Fernando (28 years old, a black artist) works in an area that is very popular with tourists, there are always three or four armed soldiers lurking there. I found out later that the back street is the entrance to a *favela*. Their presence discourages poor *negros* from entering the main street, where *brancos* and *gringos*[9] ("foreigners") stroll to admire the architectural beauty of the buildings. It is difficult for the police to get into these areas because they are considered dangerous and under the control of drug trafficking. You may enter only if you are accompanied by a resident or someone who has the confidence of the community. I was also taught that to move alone in the city I should never deviate from the main route already known because there was a risk of entering 'dangerous *favelas*'; connected to the safe streets by small roads. Because of the detention and closure outside, these are places that are not well known. Brazilians who have never been to conceive of them as they are presented by the media in sensationalistic programs: places of violence, where there is no 'culture'. Vito, among others, told me about a television program in which the military police kill drug traffickers in *favelas*, who are portrayed as *negros* (of skin and economic status). This is just one example of how the vision of the *negro* from *favela* is disseminated, understood as "an imaginary subject dramatized as a young man from a deficient *comunidade* (literally "community") who would escape the fate of an early death through [...] drug trafficking"[10] (Durão – Coelho 2013, 922). However, the first favela I went to with Gleids and his colleague artist Ocio (44 years), had a large iron door guarded by a local man. Looking back, I realized that the community fears the violent incursion of the army from the outside. The stories that come from those who live in these neighborhoods are different from those released by the me-

9 This term is used at the local level as a derogatory term for "foreign tourists". It's mainly used to indicate those who seem to have more purchasing power, such as Europeans.

10 My translation.

dia. I often participated in poetry events, where the accidental death of the inhabitants of the same *favela* as the competing poets was made public. Accidental death, brought about by the state army, is a daily fact. The expression "bala perdida" ("stray bullet") is used in local colloquialism to describe these opaque situations in which officers shoot and kill civilians (Da Lima 2013). It isn't uncommon that during military operations in and near *favelas*, an individual believed to be a *negro* (dark skinned and modestly dressed) is killed because he or she is mistaken for a criminal. Through the Internet, analogous episodes involving also very young civilians twelve or ten years of age are always more divulged (Anunciação – Bonfim – Ferreira 2020). All of them were mistakenly killed. I remember being astonished when in a theatrical performance, a news episode that happened a few days before was told. One black man walked down the street at night. He was shot on sight: the soldiers confused the umbrella he was wearing with a gun. I learned many similar stories, especially at Black cultural and artistic events, like in the poetry slams I mentioned or like in this play. It's hard to get that information out of the official media. We don't see them, we don't know them. There is a government of physical and moral existence (Foucault 2004, 31): *branco* and *negro* imply moral meanings. The former is the norm, the ideal citizen while the latter is deviance, the a-normal (Malighetti 2004; Sansone 2015; Fernandes de Souza 2016) who must be confined far from the police; rejected as a potential threat to society (Foucault 2017). So being a *negro* "has little to do with skin color, but more essentially with the condition of living for death, of living with fear, expectation, or of living truly poor and miserable"[11] (Almeida 2018, 96). Starting from Foucault's (1977) concepts of *biopolitics* and Mbembe's (2003) concepts of *necropolitics*, Fatima Da Lima (2013) explains that in colonial contexts

life (bios) has not been the place where historically power networks have found a privileged ground, but it is death and the possibility of killing that has constituted the organizing principle of social relations[12] (Da Lima 2013, 22).

The *negro* is the homo sacer - following Bauman's (2007) notion - of the Brazilian nation: "the main category of human waste created in the course of the modern production of ordering sovereign spaces"[13] (Bauman 2007, 42). The black body becomes doubly stigmatized and cannot be visible (Do Nascimento 1959). The coincidence of race, social class, and territorial affiliation in the identification of suspicious individuals during police investigations (Anunciação – Bonfim – Ferreira 2014), recalls the situation in the suburbs of Paris where young Parisian blues, mistaken for criminals, are killed during police checks (Fassin 2013). These examples demonstrate how "the hierarchical social order often intersects a spatial understanding of difference" (Ciavolella 2013, 185). It turns out that my interlocutors used the residence space as a determining parameter of an individual's racial class, which in turn is an implication of socio-economic status. The term "negro" is frequently associated with the term *favelado*. We can also grasp this overlapping of categories from Vito's explanation to me that: "a white man, of skin, that comes from the *favela* is always descended from Africans"[14] (conversation with Vito, 22nd July 2019). The descent is a relational matter (Ingold, 2000), not biological. If you live in the *favela*, even if you have a light skin tone, it means that you are descended from those who experienced a situation of subordination before you: the Africans.

In response to stigmatization, violence, and marginalization, *favelas* residents are working to fill gaps in the state and deconstruct prior judgments about them (Goffman 2004). In doing so, they challenge the hegemony of the *brancos*: the terrain in which the generalization of representations expands as a condition for the constitution of social order (Butler – Laclau – Žižek 2000). This process is also marked by the current debate on the possibility of ceding the very term *favela*. Someone like the *negro* educator and scholar Edoardo (44 years old, a resident of the *favela* of São Jõao Cabrito) wants the word *comunidade* ("community") to be used. This choice of terminology underlines the network of relations in the neighborhoods and the solidarity at the root of their political and cultural initiatives. Others, such as Sagaz (26 years old, black artist), continue to use the word 'favela'. Naming a place is a practice that places people in space/time (Low 2017). In the name of places is encapsulated the memory of the social group; in turn, the identity of the group is reproduced and maintained in the link with the territory and the memory conveyed to it (Tassan 2017). Consistent with the current historical moment of de-stigmatization of everything that refers to *negritude* (Sansone 2003; Malighetti 2004), we are also witnessing the valorization of the peripheral neighborhoods *lugares negros* par excellence. Coming from the *favela* (or *comunidade*) has become a source of pride: they are places to build a community based on solidarity and mutual assistance (Coelho – Durãoe 2013). Individual and group identity is shaped by external recognition or misrecognition (Taylor 2013, 25), which is why the material and immaterial self-representation that *negros* diffuse in the urban fabric takes on great relevance.

MATERIAL CAPILLARITY OF THE MOVIMENTO NEGRO

Recognizing oneself as a *negro* implies "taking on a whole aesthetic discourse that is destabilizing, even in silence"[15] (Araujo – Silva 2019, 24). This is why the artistic and sensory elements disseminated in the spaces of the city reminiscent of *negritude* are of great importance. Gilroy (1993) also recognized in the art forms of Afro-descendants a very strong political protest. As in the North American context he described, hip hop plays

11 My translation.

12 My translation.

13 My translation.

14 My translation.

15 My translation.

a crucial role in Brazil. In Salvador, the social critique of the capitalist system is decoded and mobilized to call into question the local racist system. *Rap* (rhythmic poetry), a dance style called *breakdance*, and *graffiti* are part of Hip Hop (Gomes – Pontarolo 2009). Graffiti is large frescoes on the walls of public spaces, which are translated into images of the social protest that animates this counter-culture (Gilroy 1993). The suitability of the graffiti in Brazil is given by the fact that they act in the field of the memory of the *negro* struggle, representing the poor and their spaces and identity in the construction of a racial consciousness of its precarious (Araujo de Oliveira 2009, 85). During the field, I accompanied in the *comunidades* several *graffiteros* ("graffiti's artists") *negros*, who freely contributed to the rehabilitation of the neighborhoods through their art. I have worked with Cabuloso (36 years old) amongst many artists. He is an internationally famous artist: for twenty-one years he has been producing graffiti, as well as art installations and creations of various kinds. He has dark skin, a round nose, and long dreadlocks. He claims to be *negro* because he spent many years of his life selling water bottles on the beach to pay for his studies at the Art Academy. I asked him what it means to him to paint in public spaces and he responded by describing the sense of well-being he gets by improving the lives of people who have no access to institutional art spaces.

> Paola: "Very cool! I used to know your art for a long time, [I met it] in the street, graffiti! […] What is "*rua*" ("street")? How would you explain "rua"?
> Cabuloso: "[...] When I do a wall painting, I pay tribute to the city, I also make a social contribution to my art. And that's what inspires me, you know? To feel me as a creator, to feel like a part, a protagonist of the cityscape, you know? The happiness of transforming a trail, the facade of.a house of poverty. When you go into a favela and make one painting on the facade of a house or a public school or an association of inhabitants or... an organization that... you deserve. Sometimes with art you don't have the [economic] opportunity to paint and it comes as a surprise and it shows up and it boosts the self-esteem of these people, you know? You're waking them up for hope, you know? Happiness, he'll be more proud to inhabit this house and he'll maybe feel motivated to conquer other things and get. *Graffiti* art is a 'mobilizing' art, beyond information. [...] They don't leave their place, their neighborhood to go to a museum to see the art: so it's the art that's going to them and for them, on that day, it's a happy day you know! It's very rewarding to go and paint where there are people without the conditions to see art. It's very rewarding.[16]

This kind of activity permits the dissemination of art outside of institutional and elitist spaces and, as in the case of the *pixação* that we'll observe, redefines what art is (Bargna 2013). Cabuloso also relates the question of the physical non-mobility of residents of the *favelas* and the question of "art as a mobilizing force". He uses this term to refer to the role of aesthetics as an instrument of subversion and socio-political mobility. By directly influencing the sensory perception of space, the hegemonic sense system that shapes people's perception is called into question (Rancière 2004). The environment is not "space" like a linear vacuum, apart from the rest (Dorato 2019; Van Aken 2020); it's more of a relational context (Ingold 2000, 192). People are formed by the environment in which they are submerged, together with other entities (Low 2017).

"LET IT FLOW": THE *PIXAÇÃO*

Let us conclude this reflection with *pixação*, a typical Brazilian artistic practice. Contrary to *graffiti*, whose aim is to embellish public spaces, *pixação* is *brutal como o sistema* ("as brutal as the system") (Fig.1). These are stylized writings and letters, spray-painted on the walls. Big and black, "essential" signs and incomprehensible[17] stand out on the historic buildings, on the well-kept buildings where the *brancos* live, on the walls in the street, and beside the overpasses. Everywhere. The aim is to fill all areas of the city, as the Movimento Negro intends to do. As Baudrillard (1979) writes of the early graffiti that appeared in New York in the 1970s, even *pixação* is like a "polymorphous perversion of children, who ignore the limit of the sexes and the boundary of erogenous zones[18]" (Baudrillard 1979, 322).
Organized in small groups, the artists make nocturnal incursions in areas of the city inaccessible during the day and scribe their names. The colors used are black, white, or blue and the wall to be painted is referred to as a *tela*. *Telas'* placed in a high visibility position, such as on the eaves of buildings, are preferred. With no harnesses, flip-flops, or barefoot, the boys climb. The higher the writing, the greater the danger to the creator. The level of mastery of the artist is given by his agility and ability to climb, but especially by making his name visible. Starting from the right, on each canvas are placed: the names of the artists, then a long open wavy line, and at the end the name of the crew to which they belong. Besides the *pixações* sometimes there are the names of the boys who died in these raids (Fig. 2). Many people are dying as a result of danger. Sometimes there are also messages written in a way that people can understand. Most are complaints directed at the military police and racist system, some examples are: "preto ("black") not a rat", "Pixador vandal, PM (military police) murderers". As they have explained to me, the motivation behind this type of incursion is the marginality of creators. A socio-economic marginality, whose effects for many of them are expressed concretely in the physical and spatial confinement of the *favela*. Most of them are young *negro* from the suburbs, who during the day work as garbage men in the Pelourinho and at night, armed with spray cans, climb up the historic buildings to demonstrate against the local system. As Sagaz explained to

16 My translation

17 Each Brazilian state has developed its own alphabet, making it indecipherable to those who are not part of Pixo's art scene.

18 My translation.

Figure 1: *SisTema BRUTAL !!!* ("Brutal System !!!"). Pixaçao in Salvador de Bahia 2019.

Figure 2: *OBZO VIVE* ("Obezo lives"), pixaçao in memory of the death of pixador Obezo. Salvador de Bahia 2019.

Figure 3: *U16 SCANK + OM CiBORG* (names of local street artists), fill the urban space with your own identity. Salvador de Bahia 2019.

me, besides denouncing the local administration's negligence, there is the need to make his individuality visible. It's the possibility - through these writings - of denouncing one's existence as a peripheral *negro* and of making it materially manifest.

> Sagaz: "The truth is that many people end up doing it [the pixação] as a question of identity. You see, as you said, these are people who risk their lives... To get upstairs. Some people just died. I think one year ago [Obezo is dead], he is dead [...]. But this question of 'risking their lives are people... mostly, I think... 90-95% are *pretas* ("black women") e *pretos* ("black men") from the suburbs of Salvador. Even if they are not *negras* [on a phenotypic level] they are still people who live on the periphery. [...] Those who end up risking their lives I think most are the people from the periphery of Salvador, who end up risking their lives because of being invisible by society. They feel unseen. [...] The fact that young people want to mark, imprint their name in a place that you pass by and [say] 'ah! But this is my name! '[...] I think this is what finally brings them [the pixadores] to questions of manifestation too, about the system. Much of it has been turned against the government for the negligence of the state. Beyond the protest against the government, we need to see another voice.... but most importantly, it's about visibility [...] Mark your name not as 'space is theirs', but write your name on the whole city.

Sagaz's words testify to the frequency of death of someone during the production of *pixações*. Just as incidents of "stay bullet" in *favelas* involving the state army are not disclosed, likewise, the death of these artists is always uncertain. A few months after my return to Italy from the camp period, exactly on 12th February 2020, I was informed of Skank's death. He was an artist from the *favela*. He did not dedicate himself only to *pixação*, but he was known throughout the city for the immense writings of his stage name, Skank, with which he materially filled the city (Fig. 3). He was one of the most prominent contemporary exponents of this art movement in Salvador. Many young people feel represented by his writings and, for them, he embodies the hope that they can make visible their black subjectivity. His death, like so many others, remained in obscurity: we know that he died during an artistic incursion at night. Before he could even climb the walls of the building, he was met by five gunmen and shot to death.

During the first periods of fieldwork, before my cartographer friend Felipe (25 years old) explained something about *pixo*, I perceived these writings as aesthetically ugly. Finding myself immersed in spaces that knew all these things instead, completely changed my perception. In front of me, I didn't have incomprehensible black "scribbles" anymore, but subjectivities (Ortner 2005). I remember as if it were now the feeling I had when at a bus stop where I went every day, for the first time I saw on the wall behind me no longer "ugly" writing, but hundreds of thousands of bodies in motion. The vital energy was printed on the walls of people who had climbed to the top of buildings, risking their lives. I found myself immersed in the denunciations of a different story of the Brazilian nation. The dissemination of a social memory that tangibly tells the story of the violent exclusion of *negros*. As Felipe told me: "*negros* are the ones who go the highest, they have the least

Figure 4: A letter of pixaçao's alphabet on the street. Salvador de Bahia 2019.

to lose[19]". Art is a way for them to channel frustration and cultural sense of anger over their condition. *Pixação* fulfills this task as an "outlet valve," as Bob (35 years) told me. He also began to do it to canalize frustration. Now he deals with *graffiti* and he also works for free for the requalification of *comunidades*.

> Paola: "How did you get onto the street [to do art]?What about the rua?
> Bob: It was a pretty complicated thing. I was at a bad time in my life, and I was like this: I was trying to find something to give me something to live for. I already knew the alphabet of pixação, I knew a few pixadors and I liked being with those people [...] and from there I started pixing (he moves with his hand moving the air, emphasizing that he was "painting everything") and I loved it! It helped me and it lifted me out of an [negative] emotional situation, it gave me self-esteem [...] and I started pixing [...] my mother told me I had the face of a crazy person, I spent a year pixing in the street, all day, I would only come home at night all sweaty and dirty with paint. And it was helpful, you know? Get my pride back. I think it was the relief valve I needed at that time for various things that happened to me in my life [...] The *pixação* itself helped me, and then it came right after the graffiti and I never stopped, and I don't want to stop anymore."

What we see on the canvas are long waves and incomprehensible writing, but we look at the adrenalin and anger with which the *pixador* created his artwork. *Negros* do not represent any of those on these high walls, but *they join* (Ingold 2013) these buildings. Based on the idea of 'correspondence' of Ingold (2013), we do not interact with the environment but we correspond with it. The *pixador*'s spray can become a *transducer* (Ingold 2013): a tool that converts the vital energy and propulsion of the body into an aesthetic-visual code. The quick climbing and adhering to the wall of the buildings, pressing on the tips of the toes not to fall, along with the danger of the situation are translated into the open, undulating line that remains on the wall. Felipe told me that "you have to let it flow"[20] and that the body has to "follow the wave of the moment"[21] in moving fast and stealthy in the silence of the night. Because of the dangerous situation, the writing can not be repeated. In a single gust, push the can, run the length of the wall, and escape. The body finds itself immersed in a flow of movement: influenced by the morphology of inorganic elements such as the walls of buildings perpendicular to the ground, exposed to the action of atmospheric agents, social actors that can interrupt its process of creation, and must master the spray can by calibrating the pressure on the cap to leave a trail. *Pixação* is made by this mixture, in which the sentience and the materials are interwoven until they become indistinguishable (Ingold 2013, 182). The artist doesn't focus on producing a picture, but on the situation in which he or she is physically involved (Costa-Moura, 2005). It's necessary to

19 My translation.

20 My translation.

21 My translation.

adapt to the environment and the "things" that are immersed there; each body motion must be well calibrated. In *pixo*, the lines are *gestural*: they do not represent images, but express the quality of the body's motion during its production (Cain 2010, 126). It's a description of a movement in space/time that makes us look wet (Ingold, 2013) (Fig. 4). It comes out of the correspondence between *negro*'s body, the physicality of the city and the aerosol can. *Piaxação* is not *propositional:* it isn't an established picture, but something that derives from the situation (Ingold, 2013). It's the conversion of the vitality of the experience and the rhythmic gait of the individual (Lefevbre 2004) involved in the environment, into an aesthetic-visual code. Human beings are irreducibly part of the processes of the world (Ingold 2013), they are constantly immersed in the environment (Van Aken 2020) and this makes it inevitable that their becoming men and women are inseparable from the context in which they find themselves immersed (Remotti, 2011) But there is more: as Ingold (2000) wrote, through the exercises of descending and climbing, and their different muscular entailments, the contours of the landscape are directly incorporated into the bodily experience (Ingold 2000, 203). Starting from the idea that the city is a reflection of society (Lefebvre, 1970), it's reasonable to think that in the act of producing *pixação* we can capture the precariousness of the *negro's* body in the Bahiana city. To fully experience the urban space, they have to make dangerous nightly incursions. Setha Low's (2017) concept of "embodied space" is useful in this regard. Following this "heuristic model" we can rethink the "both experiential and material aspects of the body in space as well as to the fusion of body/space understood as a location that can communicate, transform and contest existing social structures"[22] (Low 2017 in Tassan 2017). More than the space inscribed in the body, the case of *pixação* looks like a "spatialization of the body". Once the production of the work is complete, the physical body of the *pixador* leaves the palace, but its subjectiveness remains on the heights of the palaces. Watching the landscape, we catch new *pixação* every day. This lets you understand where the body has moved, and in which space it has gone. The urban space is the artist's journal: it tells his daily travels. It becomes an open-air monument and memorial (Crapanzano 2004, 172), reminding us of the existence of these individuals and of all those who die day after day in the silence of indifference. According to Alfred Gell (1999) a person and a person's mind are never confined to particular space-time coordinates, but consist of diffusion of biographical events and memories of events, and a category of dispersed material objects, traces, and departures (Gell 1999, 222). As with *graffiti*, it's a process of territorial appropriation that situates culture in movement and space, through one's life experience and aesthetic tool (Barrozo, Bertoloto, Lorensoni, and Davies 2020, 11). However, in the case of *pixação*, they export the *favela* and enter in "white town" with their alphabet as if it were a rebellion of signs (Baudrillard 1979, 311). The symbolic value of the crew is also ascribed to the remoteness of their neighborhood (Franco 2009, 23).

Pixação is strongly discouraged and persecuted for his violation of private property. In violating the right to private property, the *negros* of Bahia question not only the local Brazilian system but the very foundations of Capitalism on which the "monument of Modernity" stands. They do it in a public place and this gives it a very strong political charge, a revolutionary potential that defies authoritarianism (Butler 2017, 253). As is done with *negros*, even in the case of *pixação* the dominant group spreads a series of stigmatizing representations about him[23]. I close with Sagaz's reflection on the analogy between the stigmatized condition of the *negro* and the *pixação*.

> Sagaz: "In truth, because of this whole process, to be criminalized, it ends up that many people do not like [the *pixações*]. Like this has already been done for many years, like it's been done the same with the *negro*: the discourse that the *negro* is always marginal, and like a person who goes in the street hides his bag, etc... like, it's already been placed [in the sense of fixed] in the minds of many people and they believe that all negras people are like that... and from there it's kind of how the *pixações* have been criminalized."[24]

The "black group" wants to be the main actor in re-writing the national present, denouncing and telling the story of unspoken violence experienced by its people. High up on the buildings the suburban *negro* is in the "place of speaking"[25]: in a position to denounce these issues not only metaphorically, but also materially. By being placed at the bottom of the economic hierarchy and physically confined to the ghettos, the top of the tallest buildings becomes the "*lugar de fala*" ("place of talking") they choose. The night ends and the spaces return to being *lugares brancos* ("white places"). *Negros* don't have physical access to them, but what remains imprinted in the buildings is what is most vital in a human being: his energy and propulsion to action.

22 My translation.

23 On the last day in Salvador I met on the bus two negros boys from the favela. They were doing the *rap du buzù* ("bus rap"). Basically, they would make passengers suggest words and compose poetic texts, right there. They'd end up asking for cash. They have mostly written poetry on racism and social injustice. I ended up joining them and doing a lot of bus lines, filming them at their company. As we paused at a bus stop, we began talking about pixação. We practiced deciphering the letters on the wall behind us. Two ladies wait as our bus, hearing our speeches approached intrigued. They wanted to know about it. They were surprised to find out that they were words rather than scribbles. That they were a social denunciation, not "vandalism".

24 My translation.

25 *Lugar de fala* ("place to talk") is an expression that reports who can speak about somenthing, expecially when people talk about racial and gender issues. The afro-brazilian phylosopher Djamila Ribeiro (2017) explains how important for *negros* and women is to reclaim of theire political "place of talking" and to represent oneself.

CONCLUSION

The case of *ser favelado* ("from the slum") makes explicit the materiality of *negro's* violent *space of nonexistence* (De Genova 2002). The deconstruction of the pre-judgment towards being a *negro* from a *favela* and the use of *pixação* to denounce the reality experienced by the local population, are just a few examples of the action of how Movimento Negro "fill the spaces" with representations that contrast with hegemonic racist discourses.

As *lugar de fala* (Ribeiro 2017) points out, representation in the sense of sociopolitical presence in the *polis* must be forged by *negros*. In doing so, *negros* deconstruct what is *taken for granted* (Bourdieu, 2000), both local and global. Afro-Brazilians are challenging the capitalist economic system, violating private property. In addition to that, *pixação* forces us to rethink the reductionist epistemology on which Modernity is based (Benasayag 2015), such as the separation of the subject from space and the removal of the interdependence between things immersed in the environment (Ingold 2000; Haesbaert 2005, Low 2017; Van Aken 2020). *Pixador* joins with the buildings: his subjectivity fills the spaces and reclaims the political place denied to him. Popular sovereignty is only possible by an *alliance* not *of bodies* (Butler 2017), but *things*. Life is a continuing and dynamic process given by the correspondence (Ingold, 2013), co-existence and co-presence of the organic, inorganic and superorganic; a non-separation between people, animals, plants, and vessels (Hallam – Ingold 2014, 3). It appears necessary to admit "the agency of other-than-humans in our experience of the world" (Bollettin 2021, 25). The writings on the walls, the poems, the songs, the architectural drawings, the clothes, the people, and the space-time take part in the struggle to recognize the dignity of existence.

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List of abstracts

The hybrid globalisations of traditional Chinese medicine. An ethnographic analysis of practitioners in Milan.

Daniele Mario Buonomo

PhD candidate in Cultural and Social Anthropology, University of Milan – Bicocca, Italy

In the last two decades, the use of traditional Chinese medicine (TCM) has grown significantly both in Eastern and in Western countries. According to the World Health Organization, nowadays TCM is performed by more than 300,000 practitioners in about 100,000 Chinese medicine clinics in over 100 countries worldwide. Beyond its flourishing application, TCM attracts the growing attention of anthropologists. If International scholars have shown how, in China, the Western biomedical model highly influence both the academic teaching and the practice of TCM, specific studies within Europe, especially in Italy, are still lacking today. Based on an analysis of how TCM is practiced in the city of Milan, my aim is to scrutinize the relation between TCM and biomedicine and, broadly, between modernity and tradition. Through an ethnography conducted in Milan between November 2020 and May 2021, I explore the different ways of translating the knowledges and interpreting the practices by local TCM doctors. By means of interviews and observations of medical practices of ten different practitioners, my research led me to identify three different categories in relation to TCM practitioners in Milan: the "Purists", the "Integrators" and the "Hybridisers". Within this contribution, I focus on their similarities and differences, showing how TCM assumes the shape of a hybrid and localized practice.

Ambiguities and contradictions in the discursive negotiation of the ontology of psychiatric diagnoses

Alexandra Snohová

PhD candidate in Sociology, Faculty of Social Studies, Masaryk University, Czech Republic

The discussion on the nature of psychiatric diagnoses is a broad multidisciplinary field full of ever-negotiated ambiguities and unresolved questions. Are psychiatric diagnoses caused by nature or culture? Are mental disorders just brain dysfunctions or neurochemical imbalances? Does a psychiatric diagnosis mark deficit or difference? Against the mainstream conviction in both academic and popular circles, most of these questions are not answerable by scientific means. They are rather philosophical or ethical questions determined by our beliefs about what it means to be a self and a human being. There is a multiplicity of paradigms framing and narrating psychiatric diagnoses either as individual deficits or socio-cultural problems, or natural cognitive diversity, each coming with inevitable exclusions. I will track how the three main paradigms I distinguish in the discourse on the ontology of psychiatric diagnoses treat these and other essential questions. This debate does not point just to scientific practices. It is connected to many important anthropological themes like the nature/culture divide and the meanings we attach to these categories. It illustrates the complex and fluid relationships between biological, social, and technological and their significance in identity politics, and it also reaches the role of corporeality in modern personhood.

Multiple histories, one resistance: alternative perspectives for the interpretation of Brazilian indigenous ethnographic objects

Anna Bottesi

PhD candidate, Global History of Empires (Unito/IT), Programa de Pós-graduação em Antropologia (UFPE/BR)

For some decades now, museum workers are trying to rethink their practices and conceptions to turn the institutions where they work into inclusive places of dialogue and production of shared knowledge. Ethnographic museums in particular are involved in a strong debate about innovative and more appropriate ways of treating objects, as to respect cultural ownership and reveal histories and narratives silenced by Western hegemonic perspective. In this paper I shall present three case studies concerning some objects belonging to Brazilian indigenous peoples and currently preserved in three European museums: a bamboo tablet used by Kambeba people of the Solimões river to flatten children's head and preserved at the Academia das Ciência of Lisbon; a version of the Porantim, sacred oar belonging to the Sateré-Mawé people and preserved at the Museu da Ciência of the University of Coimbra; a group of Munduruku feather objects wore, in the past, by warriors during head-hunting ceremonies and preserved at the Weltmuseum of Vienna. The objective is to show how involving native representatives is a basic prerequisite to the implementation of any study. Indeed, it allows plural, diversified discourses to emerge around the objects, both in the attribution of cultural meaning and in their potential use as tools for a common fight for social, political, and territorial rights. Ultimately, the production and dissemination of alternative narratives inside and outside the space of the museum might have positive consequences in the "re-education" of the society and of the State in terms of civil and political inclusiveness.

Denouncing colonial injustice in Sápmi: Sámi artistic activism at the beginning of the 21st century

Erika de Vivo

PhD candidate, Università di Torino, Italy

At the northernmost fringes of Europe, Sápmi is at the core of current geo-political discourses centered on the global race for resources in a context of escalating climate change. This is the ancestral homeland of the Sámi people, the only indigenous peoples of Europe. Through centuries of colonial encroachment, Sápmi has been partitioned among Norway, Sweden, Finland, and Russia, which have since then been exploiting the rich local natural resources. In Arctic Europe, colonialism is not over but is still perpetuated, albeit in new and often subtler ways. Environmentally damaging infrastructures like mining, windmill parks, dams, other forms of land-grabbing as well as top-down regulations imposed upon Sámi peoples, restrict Sámi access to their own land or limit their ability to perpetuate culture-specific way of living and economic activities such as reindeer-herding
The pervasive effects of colonial processes have been met with forms of resistance that have taken various shapes and forms. In recent decades, Sámi politically engaged artistic expressions have gained a role of prominence in the articulation of indigenous Sámi resistance against the colonial overtones that still permeate Nordic societies. Art has become a locus of Indigenous contestations and as such it often addresses thorny topics such as stigmatization, colonial oppression, and asymmetric power relations by means of a strong visual language. Sámi art is gaining growing importance as a form of empowerment and Sámi artists are presenting their work not only in Fennoscandinavia but also around the world. For instance, for the first time since its establishment, in 2022 the Venice Biennale will host Sámi art in the Nordic pavilion.
In this paper I address specific Sámi artistic expressions that have had a prominent role in promoting Sámi causes in recent Sámi history both at a pan-Sámi and at a local level. Since Sámi festivals have been crucial arenas for the articulation of Sámi artistic expressions while also providing safe-spaces for the transmission of Sámi cultural values, the starting point of my reflection will be a local Márka-Sámi festival with strong political overtones: Márkomeannu. The paper, based on the materials I collected during a 16-month fieldwork and on interviews with Sámi cultural activists, addresses from an anthropological point of view how politically engaged "artivism" has become a means for Sámi people all over Sápmi to fight for a more inclusive Nordic society.

Softer Landscapes, Mossy Screens: Tumblr Natures

Hana Drštičková

Master's student, Faculty of Fine Arts, Brno University of Technology, Czech Republic

An outcome of qualitative research exploring the terrain of nature-themed internet aesthetics and their communities on the Tumblr social media platform. This terrain presents a romanticized image of the non-human environment, reproducing colonial and nationalistic ideas about "pure" nature as a distinct site from culture. However, it also supports processes of queering nature and its re-enchantment that are entwined with making of empathetic kinships. Interviews with participants and study of shared content reveal complex ways of relating to the non-human online, using technology to create spaces of trans-species care as well as alienation in a time of climate crisis.

At Home on Zoom: Theatre Shows during the Quarantine Time

Jean-Lorin Sterian

Anthropologist, researcher, writer and artist currently based in Bucharest/Romania

This paper aims to analyze the totality of connections between space, performers and audiences created during artistic performances taking place on the Zoom platform during the lockdown. After Facebook & YouTube *live* events, these types of shows, most often theatre performances but also contemporary dances, poetry shows, concerts, or performance art, became one of the most popular artistic manifestations of March-May 2020. In conjunction with cultural institutions being closed and artists and spectators confined to their homes, the two-month lockdown led to the emergence of a *quarantine culture* marked by online artistic manifestations. What I call *quarantine culture* is a kind of *homemade culture* that involves art performances at home, a theme I have been studying for the past eight years. Here I take up the example of the HomeFest events, which, due to the pandemic, took place on the Zoom platform in 2020. Focusing on the online HomeFest, I examine the differences, as well as commonalities, between the work for a show created for the traditional stage or the black box and the work for the in-house productions broadcast online, where artists have adapted themselves to the domestic, as well as to the virtual space. I explore the interconnections between the elements of the zoom theatre performance (also read as *e-homemade culture)* questioning, as well the relationship between the final work and the cultural market which led to the emergence of *e-homemade culture*.

Movimento Negro in Salvador de Bahia: history of an alliance between things

Paola Rizzo

Graduate in Anthropological and Ethnological Science in University of Milan- Bicocca, Italy

The nation-state Brazil is built on the foundations of the socio-economic hierarchy at the time of colonialism. The effects produced and perpetrated by the slave mentality are still visible and manifest today in the deep conditions of inequality experienced by local population. Salvador de Bahia called "the first African city outside Africa", it's characterized by the high rate of occupation by Africans freed after the abolition of slavery in 1888. In fact, it's today the focal point of the contemporary local process of Africanization, or enhancement and re-discovery of the Afro-Brazilian component of the nation. The main social actor that promotes this political-cultural movement is the Movimento Negro.

This research aimed to study Movimento Negro's components and the macro dimension of local ethnic-racial conflicts. The focus is on techniques of response and resistance to dynamics of oppression by subordinate groups and on the relationship between bodies, space, time, and objects in the process of building the ethnic feeling of belonging.

This research project was conducted from July 2019 to December 2020. The first part was field research in Salvador de Bahia. Starting from the phenomenological concept of culture, frontal interviews were made using the camera. Different social actors were involved to understand political and cultural dynamics through their everyday life. The second part was a bibliography work.

In SSA the socio-economic gap between citizens takes on the connotations of ethnic construction and polarization between groups of individuals - brancos ("white people") and negros ("black people") - highlighting how ethnic construction is a social phenomenon, which is based on the conflict of access to resources.
This polarization is also manifested in the double of the city: the richest places where the residential buildings on brancos are located and the areas abandoned by the institutions and more dilapidated – such as the favelas – where negros used to live. Like this, space is also racialized: places in the city are called lugares brancos ("white places") and lugares negros ("black places"). This is why Movimento Negro operates by filling the spaces: both the physical-material space of the city and the political and academic space.
Through the aesthetic manipulation of bodies, the aesthetic-visual diffusion on walls, in art galleries, museums, on billboards, musical and poetic production, this movement shows representations that enhance Afro-Brazilianity and claim equality between citizens.
Movimento Negro is not reducible to specific social actors but is characterized by being a hyper-object: an entity widely distributed in space and time, which can only be grasped in its concrete manifestations and accessible to human perception. It emerges from objects, bodies, walls with graffiti, local artistic-musical production, museum exhibitions and local performative poetry events and it takes up space.
In fact, this political-cultural movement is configured as an alliance of things: living and non-living beings, and space-time together, showing the impossibility of separating the different entities, one from the other.
All this opens up new spaces for reflection and the need to question the epistemological assumptions on which the current academic-scientific production is based and, from a macro point of view, the same imperialist vision on which the global political--economic order of Modernity stands.

My children tell me I should not spend so much time on Facebook because I am old

Priyanka Borpujari

School of Applied Linguistics and Intercultural Studies (SALIS), Dublin City University, Ireland

In India, the elderly—those above the age of 60—have been slowly catching up to the Internet: those who did not need to use the computer or the Internet until they retired from their professional lives, are doing so with the smartphone. Older persons who surf the Internet have found to experience increased feelings of social support and connectivity. Boosted by the cheapest internet connections in the world, India today has 504 million Internet users; the rate of female users, across all age groups, going up rapidly than male users both in urban and rural India. In the context of the existing research about older persons' use of social networking sites and the role it plays in their lives, there has been little research conducted specifically in India, let alone any research that is focused entirely on older women's use of this technology: about what they post, or what they consume. My research explores new forms of socialization among older women in India, through their engagement with Facebook on the smartphone. This opens the doors for a form of unintended everyday resistance: in making their presence felt on social media, they are reclaiming their own sense of agency beyond the ascribed markers of identity of age. This paper is from my existing research; this paper will specifically engage with the reflections from the research participants on how they navigate their time, their daily chores, their new online interactions, and possibly, their addictions to the smartphone and Facebook.

Towards household sustainability: food practices in suburban Netherlands

Renate Schelwald

Erasmus School of Social and Behavioural Sciences Rotterdam

This paper explores (sub)urban household food practices to better understand which tangible and intangible elements relate to sustainability. We conducted an ethnographic study with 12 Dutch households over a 7-month period, consisting of video and audio recording, in-depth interviews, food diaries and observations. The systematic organization and ecological and social entanglements of food practices were analyzed using practice theory, looking at meanings, materials, and skills. Several groups

with distinct food practice elements where derived from the data. Within these groups, we link tangible elements such as financial resources and infrastructural access to sustainable food options, as well as intangible elements such as social position and connection to nature. Concludingly, it is discussed how this data could shape future research in food practices to ultimately inform local level climate policy interventions.

Gastrointestinal parasites in Bwindi Impenetrable National Park, Uganda - *our latest findings and future research challenges*

Kelly Marie Sambucci

PhD candidate, Department of Anthropology, Faculty of Science, Masaryk University, Czech Republic

Gastrointestinal parasites pose a significant health risk to humans, particularly in tropical regions. Oesophagostomiasis is a parasitic disease caused by nematodes of the genus Oesophagostomum, commonly referred to as nodular worms. The disease is characterized by nodular lesions in the intestines resulting from larval migration. It is a known zoonotic pathogen transmissible between humans and non-human primates (NHPs). Bwindi Impenetrable National Park (BINP), Uganda is home to approximately half of the world's population of endangered mountain gorillas. The area surrounding BINP is densely populated with livestock grazing and a limited buffer zone. Mountain gorillas are habituated for tourism and research, and therefore come into close contact with humans. The populations of Bwindi gorillas are known to be parasitized by Oesophagostomum and therefore could be a potential reservoir for infection. I will present our latest findings from BINP and analyse the potential implications of these. The second half of my presentation will highlight the challenges for primatology in the future. BINP is situated in South--West Uganda, one of the poorest areas in Uganda, yet the area which provides the greatest income from tourism. In this presentation I will address the future challenges for the field of primatology, infamous for its neo-colonial approach to research and dark history. As the future of primatology, we have the duty to face this uncomfortable truth and change how research is conducted. At present most research conducted on primates is carried out by western scientists from the global north, despite the home ranges of the world's primates predominantly residing in the global south. Helicopter research is a term used to describe research conducted by wealthy western scientists in countries in the global south and leave with their data and provide nothing in return to the local population. I will explore these challenges and present solutions for a more ethical future for primatology.

Radioulnar contrasts in the ridge counts in the context of prenatal sex differentiation

Lenka Polcerová

Faculty of Science, Department of Anthropology, Laboratory of Morphology and Forensic Anthropology, Masaryk University, Brno, Czech Republic

Radioulnar contrasts (numerically: differences) between ridge-counts of individual fingers of the human hand have been identified as promising features in respect of prenatal signalling. In this study, we compared the results of a meta-analysis of intersex differences in radioulnar contrasts between published mean values of dermatoglyphic ridge counts on the fingers of the hand (calculated from the higher RC of each finger) with intersex differences obtained from radioulnar contrasts already calculated at the individual level.

Searching the NCBI-PMC, ScienceDirect databases, and archival resources, we found a total of 273 dermatoglyphic studies (after merging duplicates in databases). However, only 11 of those studies were suitable for meta-analysis after application of all selection criteria, including our own four studies. Considering the effort spent in searching for articles, we were able to find very few studies that published statistical parameters of ridge counts by individual finger and that would thus be suitable for studying contrasts between fingers. When statistical parameters have been published for individual fingers, they do not represent the descriptions of all ridge counts from the radial and ulnar sides of the fingers (i.e., 10 values on each hand), but only the ridge count with the higher value is selected for each finger (i.e., 5 values on each hand) at the individual level.

The meta-analytically obtained sex dimorphism (contrasts between the mean values of the ridge counts) are virtually indistinguishable from the dimorphism from the contrasts calculated at the individual level (means of the contrasts). However, the step of selecting one (higher) ridge count from each finger blurs the dimorphism and makes interpretation of the sex differences difficult. The results cannot then be compared with those obtained from the complete set of all ridge counts on the fingers. Combined with the small number of studies with suitable data published on a finger-by-finger basis, we therefore cannot recommend meta-analysis of published studies as a suitable means of studying interfinger radioulnar contrasts. For this purpose, primary/raw ridge count data at the individual level must be available.

Isolated skeletal remains of anatomic modern humans from Central European Upper Palaeolithic

Vojtěch Zábojník

1. University of Hradec Králové, Faculty of Art, Department of Archaeology, Czech Republic
2. Institute of Archaeology of the Czech Academy of Sciences, Czech republic

Isolated skeletal parts of anatomically modern human (AMH) are the most frequent finds at Upper Palaeolithic (UP) sites. The research was aimed on database of isolated AMH remains and the understanding and interpretation of these finds from selected Central European area, namely Germany, Austria, Czech Republic, Poland, Slovak Republic, and Hungary. Beside their isolation, the AMH's skeletal remains are highly fragmented to such a degree, that it is often difficult to interpret the taphonomic processes causing such a state, especially if we expect results after the intentional human activities or accidental traces after other abiotic and biotic agents, e.g. erosion, bioerosion, anthropogenic or wildlife activities etc. The isolated finds are seldom colored by red ochre, grave goods are mostly missing and there are remnants of human activities in the localities, which prove the re-use of the sites. As a result, we can state, that the fragments of limb bones diaphyses prevails in the AMH material, although these bone types are represented by a lower amount at sites. If we take bone and tooth density into the account and compare it with a general morphology of individual skeletal parts, then the craniodental elements are more likely to remain preserved, which demonstrates a broader range of sites with their distribution, contrary to their lower skeletal element number if compared to the limb bones. These disposal traits we can observe within all main UP periods. However, slight decreasing number in limb and craniodental elements occurs in Magdalenian period.

Keeping the digital plates spinning – experience from a research expedition in Antarctica

Lucie Ráčková

Environmental Health Sciences, Faculty of Science, Masaryk University, Brno, Czech Republic

Technology advances changed not only the means of data collection and data handling practice but also protocols for data privacy and security in human sciences. However, these changes are increasingly dependent on internet connection and could be problematic in its absence. This creates a challenge for researchers who wish to work with modern and innovative methods in terrain with no internet connection. Some of these challenges are for example: combining traditional and modern research methods, selecting an off-line friendly technology and software, means of data collection, distribution and analysis with respect to personal privacy, ethics and well-being. This talk discusses some of these aspects based on experience from a research expedition in James Ross Island in Antarctica.

Growth of the Metacarpal Bones of Children from The Wrocław Growth Study

Anna Škultétyová, Sławomir Kozieł, Miroslav Králík

Faculty of Science, Department of Anthropology, Masaryk University, Brno, Czech Republic

Introduction: The human hand represents a morphological and functional complex that is sensitive to variations in ontogenetic factors. Hand development is genetically controlled, and the expression of these genes is influenced by a number of central and local controlling factors (e.g., hormones, cytokines) whose effect is modified by external influences, including socioeconomic status or the environment. All these factors can therefore influence the growth and development of the hand bones or their timing, which can be monitored during longitudinal studies and also recorded, for example, by means of X-ray images.
Goals: Our aim is to compare the timing of growth and growth curves of the metacarpal bones of the children who participated in the Wrocław Growth Study, using the length of the bone at the point of peak velocity, age at peak velocity, and more.
Materials and Methods: X-ray images of the left hand taken between 1961 and 1972 during the Wrocław Growth Study (a total of 435 girls and 425 boys aged 7 to 18 years) were scanned into two-dimensional images using a special scanner. Traditional and geometric morphometry (landmark methods) were used to quantify the size and shape of the bones and to analyse the proportions of the entire metacarpal region of the hand.
Results: In particular, detailed differences in the timing and completion of growth of individual metacarpal bones and the possible association of these differences with available anamnestic factors are expected.

3D assessment of bone microstructure and microdamage of violent injuries

Veronika Kováčová

Faculty of Science, Department of Anthropology, Masaryk University, Brno, Czech Republic

Bone tissue is a hard anisotropic organic composite material with complex interrelated arrangement of its structural elements at multiple scales. These characteristics condition the overall bone properties, such as its capacity to persist external forces, and thus determine the biomechanics of skeletal trauma and resulting bone damage. Therefore, comprehensive knowledge of bone microstructure and its variability in combination with assessment of bone microdamage characteristics is essential in understanding the process of bone biomechanics under the action of external forces. Up to now, however, the microstructure variability, microdamage characteristics in case of violent injuries and especially their relation has not been fully examined.
The present study aimed at imaging, describing, and analyzing of bone microarchitecture and skeletal microdamage, particularly the examination of microcracks, in the forensic settings. Ten cases of cranial gunshot trauma from real forensic and mock cases were scanned on GE Phoenix v|tome|x L 240 and Heliscan microCT. For each case, morphological and spatial characteristics of bone microstructure (for instance thickness, orientation, arrangement and branching of Haversian canals) and microdamage (for instance skeletal damage pattern; microcracks surface, volume, thickness, and orientation) were assessed using Avizo software.
The results were confronted with those acquired using calcified thin sections, which represented low-cost and complementary option to the microCT procedure. Here, additional to the basic characteristics the course of microcracks with respect to the Haversian systems, detectable in thin sections unlike our microCT data, was evaluated.
The results showed the morphological characteristics of bone microstructure with respect to inter- and intraindividual variability and presence of quantitative and qualitative differences of observed microdamage in various types of skeletal trauma.
The presentation will demonstrate the benefits of bone microstructure and microdamage assessment in the context of biomechanics of bone and skeletal trauma as well as the potential of observed distinctions of microdamage patterns in differentiating between types of skeletal injury

Does parental similarity degree affect the development of their offspring?

Linda Koníková

Faculty of Science, Department of Anthropology, Masaryk University, Brno, Czech Republic

Similarity in facial and other physical characteristics has been recognized as one aspect of reproductive mate choice in humans. Despite the fact that parental similarity degree may affect offspring already in the early stages of their prenatal development, just a very few empirical studies have focused on the consequences of this non-random process so far. This study included three goals: (1) to test the hypothesis of body assortative mating in humans, (2) to find a relationship between physical similarity of parents and the growth curves of their offspring and (3) to find specific trends in the growth of offspring connected to parental assortative mating. Therefore, the similarities of parents in physical features were analysed in relation to the descriptors of the growth curves of their offspring (n = 184 mother-father-child triads from the Brno Growth Study database). In comparison to randomly generated pairs, real partners were not more similar to each other in any of the observed trait. However, some physical features correlated (mostly positively) between partners. Relationships between physical similarity of parents and the descriptors of the growth curves of their offspring were found. However, parental similarity in various features affected the growth of their offspring differently.

Virtual approach to estimating stature from in situ skeletal length

Michaela Brázdová, Mikoláš Jurda

Faculty of Science, Department of Anthropology, Masaryk University, Brno, Czech Republic

Stature is one of the key demographic characteristics analyzed in biological anthropology along with the age, sex, and ancestry estimation. Estimating stature helps the anthropologists to understand developmental differences between historical or recent populations or serves as an indicator of individual developmental well-being. Essentially, there are two ways to estimate stature: osteological methods based on bone measurements and in-situ measurement of the skeleton. The method of Boldsen (1984) represents the latter approach, since it estimates stature based on the distance between the farthest point of a cranium and the most distal point of talus. This method was designed to be performed in situ and is hardly replicable on photographs or sketches because the measurement must follow the curvature of the skeleton in the grave. We propose reproduction of this method using a combination of virtual 3D model of the grave and measuring tools. The aim of the study is to compare the estimation of the "virtual Boldsen" measurement and its alternatives to the "in-situ Boldsen" measurement and assessed the accuracy and usability of the 3D models for this method of stature estimation.

The studied sample consisted of skeletons excavated during the seasons 2020 and 2021 at the Anabaptists cemetery in Přibice dating back to the 16/17th century. The graves were measured in-situ and documented using photogrammetry software Agisoft Metashape Professional. The accuracy of the virtual measurements was assed based on the repeated measurements and absolute (TEM = 0,79 cm) and relative (0,52 %) technical error of measurement. Subsequently the in situ and virtual measurements were compared in terms of average values and variability of errors (average error –1,59 cm). Since the virtual Boldsen measurement could be quite tedious, a simplified approach using a linear regression function was proposed.

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2.1. U příspěvku v českém nebo slovenském jazyce následuje za jménem autora a kontaktem název a krátké shrnutí v angličtině (abstract), jehož rozsah by měl být 100 až 200 slov (do 1500 znaků); pod abstraktem 5–8 klíčových slov v anglickém jazyce (keywords). Za abstraktem a klíčovými slovy v angličtině následuje abstrakt a klíčová slova v češtině (ve stejném rozsahu).
2.2. U příspěvku v cizím jazyce následuje za jménem autora a kontaktem název a krátké shrnutí v češtině (abstrakt), jehož rozsah by měl být 100 až 200 slov (do 1500 znaků); pod abstraktem 5–8 klíčových slov v českém jazyce. Za abstraktem a klíčovými slovy v češtině následuje abstrakt a klíčová slova v angličtině (ve stejném rozsahu).
3. Krátký životopis zařazený na konci příspěvku v rozsahu 20–30 slov (ve stejném jazyce jako text příspěvku).
4. Odkazy na položky literatury ze seznamu literatury v textu jsou v kulatých závorkách – odkazy mají podobu: … (Boas 1908, 25–28).
5. Příklady základních druhů bibliografických hesel v seznamu literatury:
5.1. knižní monografie
Aldred, Cyril (1971): *Jewels of the Pharaohs. Egyptian Jewellery of the Dynastic Period.* London: Thames and Hudson.
Vachala, Břetislav (2009): *Staroegyptská Kniha mrtvých. Překlad.* Praha: Dokořán.
5.2. studie ve sbornících
Störk, Lothar (1984): Rabe. In: Helck, Wolfgang – Westendorf, Wolfhart, eds., *Lexikon der Ägyptologie, V.* Wiesbaden: Otto Harrassowitz, 74–75.
5.3. články v časopisech
Borofski, Robert (2002): The Four Subfields: Anthropologists as Mythmakers. *American Anthropologist*, 104(2), 463–480.
5.4. elektronické dokumenty
Hoder, James (1999): The Development of Anthropology in the Sciences and Humanities. (online). http://www.hoder.com.
6. Poznámky pod čarou umístěné na téže stránce v textu označujte horním indexem a jejich vlastní text doplňte odkazy na literaturu (citují se shodně jako odkazy na položky literatury).
7. Citaci uvádějte doslovně (včetně případných chyb v původním textu; označte je: sic) a vždy vkládejte do uvozovek. Chcete-li část citace vynechat, napište kulaté závorky a v nich tři tečky.

Pokyny technické
1. Rukopisy musí být vytvořeny v textovém editoru Word nebo jiném kompatibilním editoru a mít formát .doc nebo .rtf. Měly by používat velikost písma 12, řádkování 1,5 a odsazení na obou okrajích 2,5 cm. Stránky musí být očíslovány na dolním okraji strany uprostřed.
2. Slova na konci řádku nedělte a nezarovnávejte. „Tvrdé" zakončení řádku (pomocí klávesy ENTER) užívejte pouze na ukončení odstavce nebo titulku a podtitulku.
3. K zvýraznění určité části textu používejte kurzívu, nikoli tučné ani podtržené písmo.
4. Internetové adresy nekopírujte přímo z internetu, ale opište je jako text.
5. Ilustrace – všechny dokumentární materiály (fotografie, diagramy, kresby, nákresy, mapy) musí být předloženy v elektronické podobě. Každá ilustrace je samostatným souborem s patřičným označením: (obr. 1), (fig. 1). Vyhovující bitmapové formáty ilustrací jsou TIFF, JPEG, BMP, GIF, EPS, PSD (minimální rozlišení barevných ilustrací je 300dpi při šířce obrázku alespoň 9 cm, u vyobrazení černobílých či ve stupních šedi je vhodné rozlišení až 600 dpi při výše uvedené šířce). Vhodné formáty vektorové grafiky: AI, EPS, PDF, WMF, CDR. Redakce nepřijímá ilustrace vložené do aplikace MS-Word. Pokud chce autor zařadit ilustrace s nedostatečným rozlišením (klíčové ilustrace v lepším rozlišení nemá), učiní tak po dohodě s redakcí. Ilustrace by měly být zasílány elektronicky (redakční systém, e-mail, úschovna atd.) nebo na CD společně s textovou částí, ve výše doporučeném rozlišení a formátu. Odkazy v textu na všechny dokumentární materiály musí být v následujícím formátu: (obr. 1), (fig. 1). Názvy příslušných souborů na CD musí mít stejné znění, jak je vyznačeno v textu (obr1.tiff). Popisky k obrázkům je vhodné dodat v samostatném souboru.
6. Tabulky a grafy budou předkládány v elektronické podobě jako samostatné soubory. Nejvhodnější je dodat je v podobě souboru vektorové grafiky (AI, EPS, PDF, CDR), případně jako soubory bitmapové grafiky (tiff, jpeg) s vysokým rozlišením. Akceptovatelné jsou tabulky jako samostatné soubory programu MS-excel a MS-word. V textu uváděné odkazy na tabulky a grafy musí být v následujícím formátu: (tab. 1), (graf 1). Názvy příslušných souborů na CD musí mít stejné znění, jak je vyznačeno v textu (tab. 1.xls). Popisky k tabulkám a grafům je vhodné dodat v samostatném souboru.
7. U obrázků, tabulek a grafů, jejichž autorem není autor příspěvku, je třeba za popiskem uvést autora, případně původní pramen (formou citace, která je pak uvedena jako plné bibliografické heslo v seznamu literatury; u fotografií se uvádí autor v každém případě): … Pramen: Klíma 2010, 12. … Foto: Jiří Němec. … Kresba: Jana Černá.

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The journal *Anthropologia integra* publishes scholarly texts (in the Czech, English, German and Slovak languages) which correspond to its interdisciplinary orientation.
The editor's office accepts manuscripts submitted via either the Open Journal System (for more information on registration process, see https://journals.muni.cz/anthropologia_integra).

Peer review process
Contributions published in the *Anthropologia integra* journal are subjected to a peer review process. International peers will expertly review all submissions, with potential author revisions as recommended by reviewers, in order to publish papers that represent new, previously unpublished work, advance the state of knowledge of the field, and conform to a high standard of scholarly presentation.

Formal guidelines
In the journal, original papers, essays, notices, book-reviews and contributions popularizing science and art are published. The contributions' length shouldn't exceed 20 standardized text-pages (for original articles), 10 pages in case of other contributions and 3 pages for reports(a text-page is understood to contain 1800 characters including spaces).
Content and structure of contributions
1. Contribution's title
2. Author's name, full designation and affiliation (including contact and e-mail addresses).
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3. A short curriculum vitae is included at the end of the contribution in the range of 20–30 words (in the language of the contribution).
4. Notes to the text referring to bibliographical entries in the literature list are in round brackets – text references consist of the last name of the author/s or editor/s and the year of publication of the work, with no punctuation between them, followed by a coma, and a specific page, section, or other division of the cited work in the following form: … (Boas 1908, 25–28).
5. Examples of basic bibliographical entries in the reference list:
5.1. book monographs
Aldred, Cyril (1971): *Jewels of the Pharaohs. Egyptian Jewellery of the Dynastic Period.* London: Thames and Hudson.
Vachala, Břetislav (2009): *Staroegyptská Kniha mrtvých. Překlad.* Praha: Dokořán.
5.2. proceedings papers
Störk, Lothar (1984): Rabe. In: Helck, Wolfgang – Westendorf, Wolfhart, eds., *Lexikon der Ägyptologie, V.* Wiesbaden: Otto Harrassowitz, 74–75.
5.3. journal articles
Borofski, Robert (2002): The Four Subfields: Anthropologists as Mythmakers. *American Anthropologist*, 104(2), 463–480.
5.4. electronic documents
Hoder, James (1999): The Development of Anthropology in the Sciences and Humanities. (online). http://www.hoder.com.
6. Footnotes placed on the same text-page should be numbered consecutively using the upper index and their text should contain references to respective sources (cited in the same manner as text references to the bibliographic entries).
7. Citations are to be quoted literally, word for word (including eventual mistakes in the original text followed by sic written in brackets) and always between quotation marks. If a part of the citation is to be omitted, insert round brackets with three dots inside.

Technical guidelines
1. The manuscripts have to be created in the MS Word text editor or other compatible one and should have the file format denoted by file extension .doc or .rtf. The authors should use font size 12 (points), 1,5 size vertical spacing and 2,5 cm offset on both sides. The pages are to be be numbered at the bottom, in the centre.
2. Words at the end of the line should not be divided and aligned. "Hard-set" line ending (using the ENTER key) is to be used only to end a paragraph or title and subtitle.
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