

# “L'Italia Si Misura” Project: Twenty Years of Study and Research on the Measurement of the Italian Population with an Ergonomic Perspective

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**KEY WORDS:** anthropometry, human variability, International Standards.

## Introduction

The study of the human body shape, the size and assessment of metric relations between various components has been the subject of interest and study for very different purposes and motivations as one of the main groundwork of Anthropology. From the middle of the XX Century a wide interest for Anthropometry grew around the Ergonomics/Human Factors field; the Società Italiana di Ergonomia was founded in Rome in 1961, the same year of the International Ergonomics Society foundation. On January 27, 1966 was founded the Italian Ergonomics Association (based at the Clinica del Lavoro, Milan), that on July 1, 1968 emerged into the Italian Society of Ergonomics, resulting in the current Society.

Hence the anthropometric research from its ancient origins is renewed over time with interest to very current applications, in which the thread is the odd man's attention to the extreme variability of his own species, the only one of its kind in the living world, who can not separate the physical interpretation from the cognitive and cultural expression. In a World in which the principle “we are all equal” is widely accepted in front of the Laws, Rights, and God...it is just as scientifically ethical to emphasize the great value of human diversity. While it is true that human variability must be respected, it is also suitable that variability should be studied and monitored over time, due to its ever-changing nature. This is particularly evident for the anthropometric aspects of which general culture, among other things, has certain awareness. It is common knowledge, for example, the secular trend of the stature of the younger generation due to nutrition and living conditions (Masali and Venturini, 1964; Ellison and Kelly 2005). With regard to the specificity of anthropometric research, it is clear that it is essential a consistent and standardized measures system and monitoring human geographic variations and changes over time not only for the mere basic anthropological research on our species,

but also for very practical application in living and working environments. Every day we have, in fact, to deal with very different people, but also with objects, structures, environments and several more things throughout our built world that does not always seem designed “just for us”. It is therefore necessary to adapt our built structures through a specific ergonomic design of artifacts and environments, taking into account users' anthropometric parameters. This need for structured references and principles for good design comes from the statement that modern man does not make itself the used objects, but delegates their manufacture to a variety of designers and builders. If one wants the tools to fit, they need to be produced through a scientific methodology based on man, his characteristics, his needs, his habits (Bandini Buti, 2008). As stated by the International Standard ISO 7250-1 (2008/2010) people's well-being heavily depends on their relationship with various geometric elements such as clothing, jobs, transportation, housing and recreation. For the ergonomic design of working and living environments it is therefore essential to have anthropometric data collected *ad hoc*, because it is essential to know the body size of the user to define the dimensional characteristics of the parts of systems that interface with the human body. Significantly the knowledge of the anthropometric variability is of great importance, because from the ergonomic view point the average man does not exist. In this regard, very interesting is the image of Edmund Churchill reported by NASA/Web (1978), citing a statistical pioneer, Sir Francis Galton (1822-1911) who said that “it is difficult to understand why statisticians commonly limit their interests to averages. Their souls seem as dull to the charm of variety as that of a native of one of our flat English countries whose retrospect of Switzerland was that, if its mountains could be thrown into its lakes, two nuisances could be got rid of at once”. All design problems stem from the fact that people are more like Switzerland than a flat country like England and that, whatever the charm of variety, we need statistics that allow us to quantify this variety. Re (1995) devotes a chapter to “the anthropometric man”, conceived as ergonomic design of spaces and volumes

from the data obtained by anthropometry experts... "a fundamental element in the design of residential areas, open spaces, offices, schools and in the interior design of cars, furniture and everyday objects". Also a chapter in the recent "Guide to Human Factors and Ergonomics" by Helander (2006) is dedicated to anthropometry for jobs design: it points out that the use of design principles based on anthropometry allows a large number of people to have comfortable jobs, avoiding awkward postures that can cause fatigue, loss of productivity and, sometimes, accidents. The first part of the book "Bodyspace" by Pheasant (1986) is dedicated to the relationship between ergonomics, anthropometry and work design, while the second consists of a series of tables that show 5<sup>th</sup>, 50<sup>th</sup>, 95<sup>th</sup> percentiles and standard deviation of a series of anthropometric variables from samples of both sexes of various world populations, but not of the Italians, as at that time "L'Italia si misura" project wasn't yet carried out.

### The Italian Survey "L'Italia si misura"

"L'Italia si misura" survey allowed to fill an obvious gap in anthropometric data of a populous European country. "L'Italia si misura" research allowed us to investigate and understand the variability of anthropometric Italian adults in the late twentieth century, their gender, age and geographic area differences. The research project concludes his long career in the anniversary of 150 years of our national unity with the release of a final report, in the form of e-books, (Masali *et al.*, 2011; Pierlorenzi *et al.*, 2012) and the inclusion of the main results in the International Standard ISO TR 7250-2 (first edition in 2009, currently 2011), both helpful for future comparisons on a population that has now very different gene pool that will be further modified in the new generations as a result of immigration and globalization. We will see whether the new genetic mixing will change the anthropometric parameters and new mathematical-statistical processing may provide different benchmarks for the human factor design on our territories. The scope goes further the praxis of designing or "tailoring" the artifacts, also simply to show how it's difficult, even for quantitative data, to match variability into tables, indexes and probabilistic computation that can truly be exhaustive and representative of the variability itself. Knowing the human dimensional variability, body proportions, secular trends by age and area, the description of models may be a scientific way to guess the meaning of the limits of the categories, created by man himself, and so extremely unstable and changeable. Tracing a quantitative approach seems equivalent to "full controllable" and appears to reduce the interpretation error. However, in a human scale design, even when an "adjustability" is foreseen and adequate to the specific anthropometric sample of users, a particular posture, or a different grip attitude, or a not expected use, can give rise to a different perception of the relationship with the artifact, a different level of success and/or pleasantness of use. The relationship between man and his surroundings is too multifaceted to be fully predictable, to be restricted

and forecasted in absolute categories and classification systems. It is merely the wish to understand the variability and the desire to shape the surrounding man-made environment that fascinates anthropologists, psychologists, engineer, designers, and ergonomists: a new spyglass to better comprehend man and to improve his life quality developing better artifacts. The man has surrounded himself with artifacts since his origin, since the hands, free from ambulatory function, were able to perform other tasks making them available for a renewed wittiness: the hands and the artifacts... the great evolutionary opportunity of *Homo sapiens*.

### The creation of an anthropometric database

Standardization, the final aim of ergonomic anthropometry, is now also possible in terms of establishing anthropometric databases through the *UNI EN ISO 15535-2007 "General requirements for establishing anthropometric database"* standard that establishes detailed rules for implementing an anthropometric database and the data output requirements.

The international use of this standard may actually solve the problems of comparability between operators and scholars, often difficult to deal with anthropometry and allows more reliable comparisons in terms of stochastic variability. The International Standard provides the general requirements for establishing a database and takes into account the anthropometric parameters (measures definitions, techniques and conditions) in ISO 7250-1 standard *Basic human body measurements for technological design* (2008/2010).

We used most of the criteria established by the International Standard for the construction of an Italian anthropometric data base utilizing "L'Italia si misura" data to prepare a Technical Report that was approved by UNI (Ente Nazionale Italiano per l'UNificazione) and then by ISO. Our task was difficult as our forms did not follow exactly such methodology, because the survey was made at least ten years earlier, nevertheless most variables are exactly comparable or easily convertible as the "L'Italia si misura" technique is based on classic authors such as Martin and Saller (1956-66) and/or especially Hertzberg *et al.* (1963). In this way, most of the anthropometric data of the Italian project could be merged into the database of ISO International Standard ISO 7250-2 (2009/2011). As required by ISO 15535-2007 parameters that define the survey scope and methods were specified. We performed data cleansing, mathematical and statistical processing applications using the SPSS software.

### Conclusion and Perspectives

After more than 20 years from the beginning of the research here presented it is clear the need to plan a new Italian survey that might be comparable with the past data and in perfect accordance with the current international standards. In the long elapsed period since

the first survey both data and methodology have been widely used for targeted searches and for design studies mainly in automotive and computer hardware background (Ferrino, 1997; 2002; Fubini et al., 1993; Coniglio et al., 1991; Eynard et al., 2000), but also in other very different anthropological fields such as the comparison with ancient Italian populations (Masali et al., 1996). We also recall, in particular, the development of virtual mannequins in the Outer Space context and we like to remember the contribution to the early studies on the neutral posture in Outer Space. The neutral posture has been defined, *inter alia*, by 'experiment EUROMIR 95 T4 (spacecraft MIR) which represented the first opportunity to quantitatively monitor the adaptation of the "machine man" in long-lasting microgravity with the aid of optoelectronic technologies (Ferrigno et al., 2004). Our collaboration, albeit restricted to anthropometric methodology to measure the astronaut and the provision of the anthropometer, has allowed our group to get to the heart of the problem by stimulating the search for behavioural archetypes (Ferrigno and Masali, 2005). Whether it is important to check human postural and anthropometric changes in weightlessness to refine the Space design, it is equally important to monitor our species changes on Earth continuing the research on the anthropometric characteristics of our constantly evolving population. In addition to forecast and plan a new campaign of traditional anthropometric measurements in the national territory, it is paramount to consider with particular interest the studies that have been developed by other methods, such as CAESAR (Civilian American and European Surface Anthropometry Resource, (a survey civilian populations of three countries: USA, Netherlands and Italy) research carried out mainly on stereographic scanning that allows to get three-dimensional data of body surface.

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