Western European Journal of Historical Events and Social Science
Volume 3, Issue 4, April, 2025
https://westerneuropeanstudies.com/index.php/4
ISSN (E): 2942-1926 Open Access| Peer Reviewed

METROLOGY OF THE PEOPLES OF CENTRAL ASIA

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Annotation. This article explores the traditional metrological systems used by the peoples of Central Asia, with a focus on anthropometric and everyday empirical units of length. It analyzes how early measurement systems were derived from human body parts, such as the handspan (*qarich*), fathom (*quloch*), and cubit (*gaz*), as well as estimated units like *sangpartob* (stone throw distance) and *ovozras* (audible voice distance). The article also emphasizes the cultural and functional significance of traditional measurements in the historical development of scientific knowledge in Central Asia.
Key words: metrology, traditional measurements, Central Asia, anthropometric units, qarich, gaz, quloch, sangpartob, historical science, cultural heritage, measurement systems, ancient technologies

INTRODUCTION.

Just like in other countries, in Central Asia as well, the earliest units of length measurement were based on parts of the human body. The anthropometric measurement system for length included the following main units: finger – lik (also called chilik or angixt), handspan – qarich, fathom – quloch, as well as various cubit-based measurements such as gaz (including chub-gaz and gilim-gaz).

It should be added that alongside anthropometric units, purely estimated everyday measurements were also used. These were imprecise and not physically reproducible—for example, sangpartob (the distance a stone could be thrown), ovozras (the distance at which a human voice could be heard), and others.

The peoples of Central Asia used these length measurements in constructing houses and other agricultural structures, building irrigation canals and roads, measuring land plots and distances, crafting agricultural tools and measuring instruments, and even in children's games. Below are the length measurements used by the inhabitants of this region during the 9th and early 10th centuries.

MATERIAL AND METHODS.

In Central Asia, there were three types of qarich (handspan) used as length measurements:

– Panjlik (“large span”) – the distance between the tips of the thumb and the little finger, approximately 20–23 cm;

– Dulik (“shorter span”) – the distance from the tip of the thumb to the end of the index finger, approximately 18–19 cm;

– Chorlik (“small span”) – the distance between the tips of the index finger and the little finger when the hand is perpendicular to a surface and the other fingers are bent, measuring about 16–17 cm.

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Panjlik Measurement Unit

These three types of spans were widespread small-scale length measurements in Central Asia. Farmers used these units when producing agricultural tools, especially for determining the distance between carved holes on certain parts of the equipment (such as the *mola* or *tirma*).

Additionally, the step was used as a basic unit of length in building construction. The peoples of Central Asia modified the step measurement by tightly linking the movement of both feet to create a standardized construction unit.

There were also other types of measurements based on counting fingers, which differed in size and application.

Measuring with folded fingers was done as follows:
– Chor angixt ("four folded fingers") – this was the distance between the outer edge of the index finger and the edge of the little finger (excluding the thumb), and it was approximately 8–9 cm. This measurement was taken across the outer middle joints of the fingers.

Angixt Measurement Unit

Se angixt ("three folded fingers" – excluding the little finger) – this distance is approximately **6–7 cm**.

Du angixt ("two folded fingers" – excluding the little finger and ring finger)
this distance is approximately **4–5 cm**.

The width of one **index finger** was used as the smallest unit of length measurement, which is approximately **2.18–2.28 cm**. In some regions, it was referred to as **lik** (finger).

Gaz was one of the ancient units of length, derived from the elbow's Persian designation, and was previously called arash zar and zira. According to canonical (sharia) standards, gaz was equivalent to 24 angixt (fingers) or approximately 49.875 cm.

There were two types of gaz: chub-gaz (literally «wooden gaz» or «stick-gaz») and gilim-gaz (literally «cloth gaz»). Chub-gaz was considered one of the primary units of length. It had three variations. The first type of chub-gaz was the distance from the middle of the chest to the end of the extended arm beneath the chin, measuring approximately 83 cm.

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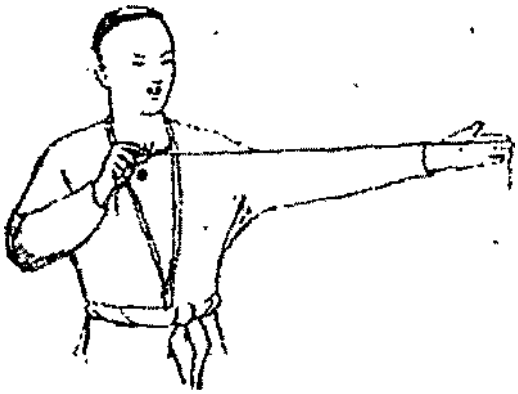
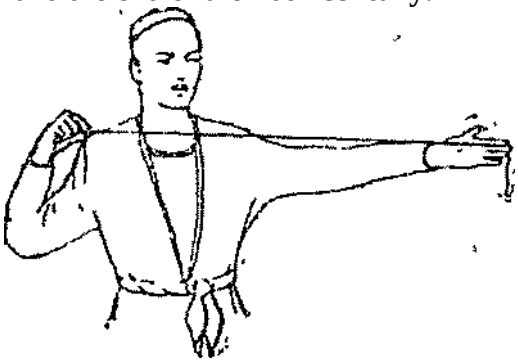


Chub-gaz was a unit of length, equal to 83 cm.

The second type of **chub-gaz** was the distance from the tips of the fingers to the second shoulder across the chest, measuring approximately **100-102 cm.** This unit of length began to be used in the late **9th century** and the end of the **10th century.**



Chub-gaz was a unit of length, equal to 100-102 cm.

For measuring cloth, a local type of gaz was used, which was equivalent to half of a quloch, i.e., the distance from the tips of the fingers to the middle of the chest, measuring 83 cm.

The step was a unit of length used by the peoples of Central Asia in building construction. They used it to measure the width and length of buildings when laying foundations, as well as for measuring land areas. In some cases, the step was used as a unit to measure the distance between temporary channels dug in the field to ensure the land was sufficiently saturated with water. The step measurement was also used in the preparation of stakes (mola) for planting grain crops (usually the length was 6-7 steps). One step was approximately 76-80 cm.

The quloch was a unit of length measured from the tips of the fingers across the shoulders. This measurement can be considered as an average standard for Central Asia, though the actual size of the quloch could vary. However, exact data show that for Bukhara, the quloch (used for measuring cloth) was equivalent to 2 arshin or 56 English inches, which is approximately 142.24 cm. This unit was mainly used for measuring textiles. Additionally, there was a half quloch measurement, which was the distance from the tips of the fingers to the middle of the chest, equal to 83 cm. Therefore, the total size of the quloch was approximately 168 cm.

In some areas, the quloch was used as a length measurement in construction as well. In agriculture and other areas, the quloch was also used. For example, in agriculture, it was used

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for measuring ropes, carrying compressed bread, and transporting hay in carts. For these purposes, each rope was approximately 3-4 qulochs in length. Weavers used the quloch most often to measure cotton and woolen fabrics.

Lik or chilik was a length measurement corresponding to the width of the middle joint of the index finger, which was approximately 2-3 cm.

Depending on the positioning of the fingers, the lik measurement had several types: – Dulik ("two fingers") – the distance between the tips of the index and middle fingers, which was approximately 9-10 cm; – Selik ("three fingers") – the distance between the index and ring fingers, which was approximately 11-12 cm; – Chorlik ("four fingers") – the distance from the index finger to the little finger, which was approximately 14-15 cm.

Musht – a unit of length, approximately 12-15 cm. When the hand is clenched into a fist, the distance between the outer edge of the index finger and the little finger is measured. The measurement is taken from the outer folds of the fingers.

Ovozras (literally «the distance at which human voice can be heard») is a unit of length corresponding to the Turkic call distance measurement and was approximately 1–1.5 km.

Pay (literally «foot») is a unit of length, approximately 25-26 cm. At the beginning of the Xth century, this unit was seldom used, mainly retained for measuring distances in children's games. This unit was typically used to measure the foundation of houses, and also in children's games, and was measured by placing one foot's sole (extended forward) against the big toe of the other foot (standing behind). Farmers often used this unit to measure the circumference of grain piles (chosh) in granaries. If the circumference of the grain pile was equal to ten feet, they could determine how much grain was in the pile.

Farsang – one of the most ancient units of length in Persian-Tajik languages, mentioned in Avesta literature, and also referred to as farsakh, sang, togi, or yog'och. This unit was also used in ancient Greece and was equated to 5549 m. Most researchers consider the farsang to be between 6 km and 8 km in length. However, some sources mention that one-third of a farsang equaled 4000 steps taken by a person with a good stride, which means (3 x 4000) farsang equals 12,000 steps. In some places, it was called farsang or sang, and this unit of measurement was equal to 10,000 full steps, approximately 6-7 km.

In Central Asia, field measurements such as ambun, uloq, rastay, por, and toqi have been used since ancient times. In practice, these measurements were mainly used to determine the size of land plots. The largest land plot was 1 ambun, which corresponded to 96 kg of sown grain. For medium-sized plots, 12-18 rastay (48-72 kg) of seed grain were required. Very small plots were rare, requiring only 1-2 rastay (2-4 kg). Additionally, units like botmon, tanob, taboq, darza, yak ro'za darav ("one-day harvest"), and yak ro'za djuft ("one-day drive") were also used.

CONCLUSION.

As in other countries, Central Asia was one of the first regions where length measurements based on parts of the human body were introduced. The system of anthropometric measurements included the following primary units: the finger – lik (chilik) or angixt, the palm – qarich, forearm, and also various elbow measurements – gaz (chub-gaz, gilim-gaz).

It should also be noted that alongside anthropometric-based measurements, there were also rough estimations used in everyday life, which were vague and not materially

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reproducible, such as sangpartob (the distance at which a stone could be thrown), ovozras (the distance at which human voice could be heard), and others.

The peoples of Central Asia used these length measurements in the construction of houses and other household buildings, irrigation canals, roads, land measurements, and distance measurements, as well as in making agricultural tools, measurement materials, and even in children's games. The following outlines the length measurements used by the inhabitants of this region during the 9th-10th centuries. It is important to note that although these measurements were used by peasants during land irrigation to measure field size, they were not used in certain regions for determining large land areas, as they were used in other regions.

The peoples of Central Asia used weight and volume measurements in everyday life for paying taxes, trade, and other economic activities. The primary volume measurements were standardized containers and other vessels, and once uniformity in volume was achieved, they started to be used in trade operations, measuring the quantities of goods (grain, taboq) and liquids (gazdon, piyola).

During this period, trade was conducted without money. Value measurements were used for payments for craft learning and also for compensating the labor of craftsmen. In Central Asia, craftsmen (blacksmiths, carpenters, turners, shoemakers, furriers, jewelers, weavers, wool workers, barbers, hunters, etc.) were not paid in money.

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