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## Studying form and ergonomics of metal tallow-burners during Seljuk Empire, the case study of Iran's Reza Abbasi Museum

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### Abstract

Metalworkers encouraged and supported by Seljuk court despite the limitations in choosing metals (due to the sanctions against the use of gold and silver in Islam) taking advantage of metals “brass and bronze”, with a high amount of tin, have been able to make unique objects, including “Tallow-burners” whose functional and yet decorative features, bring to mind this question: how craftsmen lacking academic education of product design and ergonomics issues of today's style have been able to consider form and ergonomics appropriate to the user at that time? In the current research to answer the question, a number of Tallow-burners of Seljuk period (12 AD) were studied in Tehran Reza Abbasi Museum to recover and introduce their aesthetic and ergonomic values. Thus, with the help of library, field-observational and documentary studies, the hypothesis that “form and decorations of these pieces have been established in accordance with ergonomic standards the technical principles” has been tested and the findings have been collected using an analytic-descriptive method. The result is that: in an object such as metal Tallow-burners which is a moving lighting tool, design is intended at simplicity of instrument and light weight, safety, and as much light emission as possible, all of which have been well considered in examined works of this study, as all components of the Tallow-burners, even elements that merely seem decorative are subject to ergonomic principles. Using a variety of instrument modes have also allowed easy and safe transportation, as out of the six examined works, four have made use of fine digital instrument and the rest of the power instrument.

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## 1. Introduction

During Iranian developments in metalworking, the main difference with the pre-Islam period, was the replacement of “bronze and brass” instead of gold and silver, therefore, changes and developments have occurred in technology, shape, and design, as artists of Seljuk era following the deep national Sassanid tradition and Islamic teachings as well, have decorated innovatively dishes of silver, brass and bronze with beautiful and new shapes.

“Tallow-burners” are kind of lighting instruments that produce light by burning animal or vegetable oil, and since it was commonly used by rich people and sometimes was a custom product, the highest degree of art was used for its manufacture.

Because the metalwork of Seljuk era are full of glamorous decorations, most researchers have been unaware of the technical principles and have investigated the decorations, particularly that their resources were the works of non-Iranian museums and the works of Reza Abbasi museums have not been mentioned, thus the present study is of major importance. Obviously, in such circumstances, this is a field research, and the findings are collected by describing samples of Fat-burning of Iran’s Reza Abbasi Museum, relying on theories and laws of ergonomics and anthropometry and technical critiques.

## 2. Seljuk and metalworking art

Iranian artisans had skills in making metal objects before and after the Islamic era and exquisite works have remained from them. During the Seljuk period, the middle class of the community, despite an improvement in their economic situation, used completely freestanding and simple metal objects in their daily lives, but nobles and princes and courtiers used exquisite metal objects, most of which are masterpieces now kept in museums and private collections. [1]

One type of metal object is Tallow-burners that a collection of this type of lighting device is placed at Reza Abbasi Museum in Tehran for visiting. "Muslim Seljuk metalworkers because of Islamic law forbiddance rarely used gold and silver, and metals such as brass for its golden shine and bronze through its silver look were used through, which is in fact, the most significant change of metal working to the pre-Islamic era".[2]

But as it is evidenced and “Ward” [3] also reports: most of their work was presented to the devotees of the valuable art with drawings and designs of gold and silver.

All Tallow-burners of Reza Abbasi Museum are made of bronze that according to the above is the best material among the options of the 6th century AD.

## 3. Ergonomics and technical principles of product design

Because there is a very close relationship between man and hand tools, it directly impacts on occupational health and safety and the optimizing of the relationship is achieved through the use of “ergonomics, anthropometry, and other related sciences”. Anthropometry is the science of collection of numerical data relating to the physical characteristics of human; especially size, shape, and power and the information are used in design purposes. In fact, it can be said that the anthropometry deals with quantities. [4]

The goal of ergonomics is to reduce work stress and fatigue caused by work and to adapt and modify devices with the correct body position leading to protect the health of workers and increase productivity. [5]

One element of the relationship between man and object is “handle” that the optimization of this relationship through correct design helps to achieve goals of ergonomics.

"The handles are used to facilitate transmission of force from the human musculoskeletal system to the object held in hand. In general optimization of force transmission requires the optimization of handle design." [4]

The main issue of suitable handle design is the “instrument type”. “Holander” [6] essentially divided instrument into power and fine types: in power instrument, the first is clenched, so that four fingers of a hand are on one side and the thumb is placed on them. In fine instrument, the object is held inside the hand or between thumb, index finger and middle finger.

“Pheasant” [4] also described the basic principles of handle design:

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