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Social Beliefs and Ergonomics on Traditional Seat of Wooden Furniture Review of Related Literature

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Abstract

The main purpose of this review paper was to highlight Social Beliefs and Ergonomics on Traditional Seat of Wooden Furniture Review of Related Literature. More specifically, the review of limited literature on traditional seat of wooden furniture in view of ergonomics which characterized the basic structure, safety, functions and aesthetics properties. The paper then provides possible solutions to redesign traditional seats that promote healthier sitting behaviours centered on appropriate configuration of its components. The paper also explores the cross-cultural considerations associated with traditional seat furniture design.

Introduction

An estimated 50% of people in the industrialized world suffer some form of back complaint and many of these are related to poor seat design. How we sit and what we sit on affects the health of the spine. The vertebrae in the lumbar region are the largest in the spine. (Acharya et al., 2010).

The early chairs were using hard materials such as wood and rock, thus as time passed, sofas and armchairs were brought into sight (Grandjean et al., 1983). Traditional Seat design solution consists of several basic components - the basic construction of a traditional seat, ergonomic properties of the artifact, safety properties and aesthetic properties of the artifact.

The quality of traditional seat furniture, their features, performances, functions, method of use, durability, reliability, and satisfaction with the use depend directly on the above-mentioned components (Bridger, 2008). The basic construction of the traditional seat furniture implies the basic structural characteristics of the artifact, that is, its basic structure, which allows the fulfillment of the basic functions of the artifact, as well as the realization of the basic performances.

The ergonomic properties of the traditional seat imply those characteristics that determine the human interaction with the artifact. The safety properties of the traditional seat furniture imply those properties that allow safe operation of the artifact, that is, a functioning that prevents the

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emergence of injuries to the user and the occurrence of damage to property or the environment (Grandjean et al., 1983).

The aesthetic properties of the traditional seat furniture imply those characteristics of the artifact that enable the sensory experience of the artifact in terms of liking. Without any doubt, each of the mentioned components of industrial design has its own function and importance. However, the mentioned components do not exist separately from one another.

In certain cases, a design solution of a component may affect the function and performances of another component, or all of the other components. For this reason, it is very important to carefully consider the function and importance of each component during the designing of a product, as well as their individual impact on other components of the product design solution. Although Industrial and Product designers make aesthetic design decisions largely based on their intuitive judgments, "talents," and "educated guesses" (Littman, J., & Kelley, 2001).

This primarily refers to the relation that exists between the basic construction and ergonomic properties of traditional designed artifacts. Traditionally, ergonomists had to wait until the prototyping stage, to be able to apply certain ergonomic design solutions (Norris et al., 2014). The aim of this chapter is to point to the connection that exists between ergonomic, safety and aesthetic properties of design solutions traditional seat furniture. 2.0 Historic Perspective of Traditional Seat Design The history of seating design can be traced back to 3000 BC (Pynt, 2001).

Studies conducted by researchers on human's posture contribute to chair design. In Cranz's, book The Chair: Rethinking Culture. Body and Design quoted in his article "The Alexander Technique in the world of design: posture and the common chair". It is stated, "it is evident to understand that the evolution of furniture, its constructive details and concepts by means of study of postures and man's aspirations in compliance with values, cultural standards, customs and the analysis of social and economic standards." (Cranz, 2000).

Throughout the history of modern architecture, furniture has served the most concise representation of an architect's principles. In contemporary society, sitting is a big part of people's lives, and it remains an invaluable daily necessity. The influence of poor seating design can lead to many problems, such as dysfunction, pain, and disability. (Pynt,, 2001).

Social Beliefs and Ergonomic Controls

People in technologically advanced societies are not fundamentally different from those in existing or past pre-industrial societies and are only rational in an objective sense some of the time and in particular contexts. However, irrational religious and superstitious beliefs that influence many aspects of our daily behaviour (such as the purchase of lottery tickets and the belief in 'luck' in the western industrial milieu) are suppressed in the workplace by formal education and training. This may not be the case in pre-industrial societies where an animistic religious outlook endows everyday objects with religious as well as practical significance. The distinction between religious and superstitious thinking and objective nature may be blurred as custom; ritual and taboo infiltrate working life and impede correct understanding of phenome unembellished by mystical conceptions.

Sanwo (1996) has described positive and negative ergonomic consequences of the social beliefs of the Yoruba, an indigenous people in Nigeria. These beliefs consist of normative beliefs, superstitious beliefs, taboos, proverbial beliefs, and religious beliefs. An understanding of these beliefs can have practical utility in designing safety slogans and other propaganda and practices for work design. Irrespective of differences in education or social status, belief in the supernatural is endemic among the Yoruba and the animistic outlook pervades all aspects of

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life. Sanwo (1996) argues that ergonomics can be promoted in developing countries, such as those found in Africa, by building on existing beliefs and their associated controls. Normative beliefs, which are the most binding, can be built on although new normative beliefs are difficult to create. Superstitions can be exploited to support guidelines for efficient and safe work practices by means of appropriate slogans displayed in local languages (e.g. 'spirits do not control work, where common sense does'). Religious beliefs can also be used to convey ergonomic advice (as in 'God protects a careful worker'). Religious beliefs can have negative consequences when expressed in a fatalistic way to suggest that 'God protects all' and the worker may depend on good luck charms, prayers, etc. to ensure safety rather than correct work practices and the use of protective clothing. The view that nothing unpleasant will happen if God is on our side is pervasive in many cultures and is illustrated by the habit of appending phrases such as 'God willing' or 'Si Dios quiere' to statements or predictions. In a Mexican factory investigated by Lazcano (1996), an altar to the Virgin of Guadalupe is found at the entrance to all production areas and is used daily by workers at the beginning of their shift in order to feel protected. Lazcano emphasizes the need to achieve compatibility between the cultural conceptualizations of workers and the needs of industry.

Characteristics and Influence of Seat Designs and Positional Behaviors

Historically, sitting positional behaviors have been used to provide the best affordances for completing specific tasks: squatting to gather, chop, mash, and clean (Pope, 1985). The sitting positional behaviors or modes from which our pre-industrialized ancestors could select include crouching, kneeling, and squatting (Pope, 1985; Sanwo, 1996). Nevertheless, where did the chair originate? Anthropological evidence suggests that the chair or seats were first used for status within a group such that higher-ranking individuals were seated above individuals of lower rank. (Sanwo, 1996). Karl et al (2001) provide an account of how chairs came to be used in China.

Cultural relics from the Shang through the Han dynasties (1600 BC to 220 AD) show people sitting on mats in either kneeling or sitting positions. The opening of the Silk Road allowed travel to western Asia, where Chinese visitors were introduced to chairs. Folding stools appeared in the Chinese imperial court around the 3rd century AD.

By the 4th century, stools in China were about the same height as those used in the Western hemi_sphere. During the 7th to 10th centuries, the use of mats gradually disappeared and the use of stools for sitting became popular. Around the year 1200, complete sets of raised furniture existed in China. Unfortunately, prolonged sitting has the same negative effect on the musculature of the torso that prolonged standing has on the musculature of the lower body, contributing to the development of musculoskeletal disorders (MSDs). Research has associated prolonged sitting with lower back pain and discomfort (Kroemer, & Grandjean, 2005; Kuorinka, 1995; Vieira, & Kumar, 2004).

In addition to the effects, prolonged sitting has on the musculature of the back, the associated compression of the intervertebral discs decreases nutrient flow into those tissues. It is suggested that frequent changes in posture allow for changes in both musculature demands and intervertebral pressures (Karl, et al., 2001; Bridger, 2008).

Other investigations suggest that work-related musculoskeletal disorders (WMSDs) can be reduced by managing the biomechanical factors associated with sitting and evaluating the task to be performed and the seat design (Bridger, 2008; Vieira, & Kumar, 2004). For example, tasks such as line assembly or bench work allow the worker to use a semi sitting positional behavior, thus allowing the worker to change between sitting and standing and consequently changing the musculature recruit_ment and intervertebral pressures (Bridger, 2008).

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The design of the seat, such as height and inclination, and position of the armrest and backrest are of primary importance because these factors affect the posture-seated user assume to complete their task, essentially creat_ing positional or postural affordance. 2.3 Factors Contributing to Postural Discomfort Some studies examine chair dimensions and anthropometry of traditional wooden seat, it was found that a substantial frequency of mismatch especially for chair height, seat height and seat depth, contributing factor to increase accident rates, health problems and leads to users discomfort (Reitenbach, 2009).

The discomforts of muscle contracture of neck and back problems are due to sitting for a long time at inappropriate posture. Bad habits or bad using chair is not consistent with anthropometric characteristics (Zhang et al., 1996). (Nag, 2008). Sitting design requires control to maintain stability, for example when the feet do not reach the floor, consider using a footrest. Chairs should be of an appropriate height to allow the individual's feet to rest flat on the floor with no pressure behind the knees. Elaborated later on, was the use of accessories like cushions on their chairs. The seat back plays a critical role in supporting the spine and must adjust to accommodate these differences among people (Grimes & Legg, 2004). 2.4 Mechanical Sitting and Back Pain The act of sitting can place many stresses on the body.

About 65 percent of the total change of angle takes place in the hip joint; the rest happens mainly through pelvis rotation. [5]. Spinal shrinkage (fig. 1) is affected by unloaded movements and therefore to what extent the freely moving. Synchronized mechanism on contemporary traditional chairs affects shrinkage and by inference disc degeneration. Found mechanism that drives user to change position or is postural activity determined primarily tasks. A suitable range of movements has the border between dangerous and beneficial movement types or the optimum frequency of change. The forward slope of the seat should open the angle between the thighs and the body and thus, by reducing the pull of the thigh muscles on the pelvis, allow an upright position of the pelvis using a chair with a horizontal or slightly backwards sloping seat (the traditional chair) is associated with a backwards-tilting pelvis. The thigh-torso angle is mostly less than 90° and the lumbar curve is kyphotic (flattened) (Acharya, 2010).

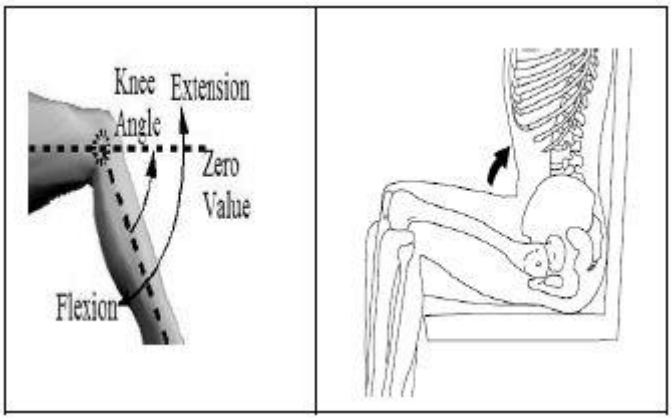

Figure 1. *Posterior Rotation*

In addition, the skin and other tissues (muscle, fat, blood vessels, and nerves) of the buttocks, thighs, and back need a constant flow of blood to stay healthy. Too much external pressure for long periods can reduce the blood flow and cause other kinds of damage, ranging from wringing fluids out of cells to impeding the transmission of nerve signals (Weisman et al., 1980).

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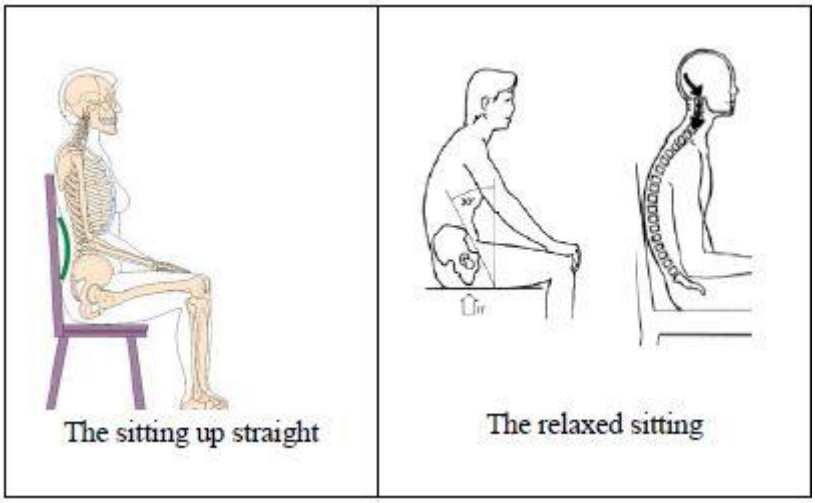

Figure 2. *Sitting positions*

A shallow seat (fig. 2) may make the chair unstable, especially when the chair angle of the forward slope was relatively large. The balance chairs have a seat angle of approximately 15°. Resulting forward thrust of the body makes some additional support necessary. From a biomechanical viewpoint, the immobility of the flexed knees is not recommended. It is also not in an optimal posture to support a load. To be able to alternate between periods of leaning backwards and sitting upright may have effects that are more positive. for example, that a fixed backrest angle of 120° increases disc hydration compared to sitting upright (Zemp, 2014).

It is necessary for the body to lean on the chair and be stabilized against gravity. When the body will fall forward and become unstable, causing the person to feel "pain." The user to feel pain (this painful feeling is considered as an unstable element (Jun, 2014).

Back pain will result from seated due to inter vertebral disc degeneration. This degeneration results from the continuous load imposed by long-term sitting and produces increased pressure on surrounding nerve roots and other paraspinal tissues. In an invivo experiment, the influence of movement on spinal load was investigated by varying the settings of chairs (fixed or freely moving seats) and comparing this with short periods of standing. It was concluded from the study that chairs with a freely moveable seat angle facility, so-called synchronized mechanism chairs, produce no substantial difference to the total compression on inter vertebral discs (Jensen & Bendix, 1992).

Compared comfort and the amount of movement on traditional wooden chairs compared to fixed chairs with 5° forward and 5° backward sloping seats. Scientists found no differences between the groups in terms of either comfort or the amount of movement.

Movement of the lower spine is thought to change pressure in inter vertebral discs and seems to be beneficial for the vertebral disc nutrition process. Movements may be dictated either by the task requirements or by a physiologically driven need for position change. They can therefore be a measure of discomfort rather than mobility. Then in an ideally comfortable chair at an ideally designed, no postural changes should take place and this is physiologically undesirable. It is important to evaluate the comfort ratings, adjustability, and safety (Al-Saleh, 2013).

The lumbar supports can reduce load on the spine. By tilting vertebra, it also increases pressures at the front of the discs. The lumbar supports have little effect on the contours of the lumbar spine. Rather, they found that the lumbar curvature is primarily affected by the pelvic angle.

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The elevation was inclined by 5 degrees at back for the buttock to receive proper support in the sitting posture and permit easy movement during the change in posture to minimize strain under the knee and to permit free movement of leg. (Alrashed, 2016). Therefore, a primary goal of designing traditional wooden chairs is to promote the spine's natural curvature. Traditional wooden chairs have an impact on back comfort and health to the extent that they affect the major ergonomic risk factors of sitting (Webster, & Snook, 1990).

Applications of Redesigning Traditional Seats

Sitting in general have continued to be equated with the use of a chair with legs, seat pan, backrest, and armrests. Discussion on chair designs that promote healthier sitting behaviors has centered on the appropriate configuration of these components (Lazcano, 1996). Thus, research findings related to the biomechanics and physiology of sitting posture have been inter¬preted within the constraints imposed by traditional chair design. This has limited innovation in sitting design, and it is possible to find defined lists for what constitutes good traditional chair design.

Practical Guidelines

In order to limit risk for WMSDs, we must consider the traditional chair and talk about design. First, a discussion of anthropological factors and design of the sitting substrate should be viewed from a bottom-up rather than a top-down perspective. That is, consider what are the fundamental physiologi¬cal, anatomical, and morphological requirements of sitting rather than what the task requires (Jun, 2014). The take-home message is that the constraints of the traditional chair are unrealistic. Seating design is for context, not the interaction. The traditional chair was designed without knowledge of physiological, anatomical, or morphological factors. Additionally, the traditional chair constrains our perception of what chairs are, and solutions are viewed from the top-down perspective. (Shea, 2017).

Cross-Cultural Considerations

The environment in which people grow up and the formal and informal educational Processes to which they are exposed have a major influence on the cognitive structures they develop. Merely to state that people from different cultures think differently is trivial – much of human behaviour (and physiology) is clearly an adaptation to the particular surroundings. Beliefs that may be appropriate in one culture may be inappropriate in another. Cognitive differences between cultures are important when people whose cognitive structures have developed in a particular sociotechnical milieu are exposed to new technologies or industries. (Karwowski, 2005). This can happen when technologies or work systems from industrially developed countries are transferred to industrially developing countries without taking into account the knowledge and beliefs of workers in the recipient country. Different thinking styles and the beliefs associated with them can become an important consideration during times of change. There may be mismatches between the knowledge and cognitive styles of the users and the operational requirements of the technology being introduced, which will result in severe cognitive incompatibilities. In industrially developing countries, people's formal exposure to technology as well as to the infrastructure that makes it possible to own and use technology may be lacking. They therefore do not have the opportunity to internalise many key concepts about how technology, and more generally technological society, actually works. A common coping strategy for the operator or user when faced with a mismatch of this nature is to learn by rote, developing only a minimal form of 'mental model' or high-level representation of technology, the context in which it operates and the environment that supports it. This workable strategy enables the individual to function and to interact with machines on a routine basis. It breaks down, however, when the individual is presented with novel situations or programmed events beyond the scope of the learnt behaviours. This is one of the reasons why technology

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transferred from developed to industrially developing countries may fail – often spectacularly and because of behaviour that may seem bizarre or inconceivable to someone with appropriately internalised concepts.

The cognitive mismatch between the user and the system can be profound. In cases of such severe mutual incompatibility, there may be a need to 'fit the worker to the job' by means of appropriate training and upliftment via exposure to enriching technological experiences. Alternatively, designers must attempt to select intermediate technology that will fit the cognitive structures of the workforce in the recipient country (Karwowski, 2005). This may be extremely difficult as it nearly always involves making assumptions about the operator's knowledge and the boundaries within which 'common sense' can be expected to prevail, as is aptly illustrated below.

Conclusion

Sitting in general has continued to be equated with the use of a chair with legs, seat pan, backrest, and armrest. A good ergonomic chair design has promoted healthier sitting behaviour that is centered on appropriate configuration of various components of a seat. The contribution of this paper is to investigate the ergonomics of traditional wooden seat and demonstrate a heuristic method to quantify the ergonomics of traditional wooden seat parameters base on traditional users preferences about the concept of ergonomics among traditional chairs used as thrones. As a result, the best ergonomic traditional wooden seat would be designed and it would help the indigenous industries to find out the strengths and weakness of their own products which lead them enhance or improve their traditional wooden seat design. Religious beliefs can also be used to convey ergonomic advice as in God protects a careful worker. Religious beliefs can have negative consequences when expressed in a fatalistic way to suggest that God protects all and the worker may depend on good luck charms, prayers, etc.

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