

# A Review on Fabric Smoothness-roughness Sensation Studies

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## Abstract

This paper aims to review the latest researches on smoothness-roughness sensation of fabric, which is considered as one of the important factors that affect clothing comfort. To begin with, the definition of clothing comfort and position of smoothness-roughness sensation within clothing comfort were classified. Further the physical and neurophysiological understanding of sensation with research gap was reviewed. Lastly sensation evaluation methods were reviewed for further development of new instruments. This paper aims to be a reference in future for related studies.

*Keywords:* Fabric Smoothness; Fabric Roughness; Neurophysiological Sensation Study; Review; Evaluation Methods

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## 1 Introduction

Fabric smoothness-roughness has been considered as one of the most important factors of clothing comfort [1-10]. It is also a significant factor in today's consumer buying decision [11].

This paper reviewed over 60 related researches from 1930 until 2010. These researches can be divided into several categories. The following Fig. 1 indicates different categories of smoothness-roughness sensation studies and the relationship between them.

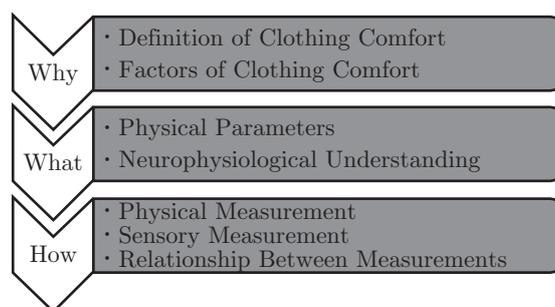


Fig. 1: Framework of smoothness-roughness sensation studies.

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Revision in this paper started from the basic concept of clothing comfort. Reasons for studying fabric smoothness-roughness sensation can be found from definition and factors of clothing comfort. Researches from the second category studied physical and neurophysiological definition of smoothness-roughness sensation in order to classify the qualitative identifications. The last categories of researches include physical and sensory evaluation, psychological explanations and neurophysiological understanding. These studies performed quantitative analysis of smoothness-roughness sensation and designed varieties of instruments used for sensation evaluation.

This review paper aims to systematically summarize the previous fabric smoothness-roughness sensation studies and clears the existing research gaps identified so far. It can also be used as a reference for future research.

## **2 Definition of Clothing Comfort**

Clothing comfort is attracting consumers' attention nowadays. Research shows that comfort is already the most important factor for consumers in Australia, Asia and Europe in 2002 [11].

Clothing comfort was first described as a kind of consumers' perception by Peirce in 1930: The comfort perception is generated when consumer wear clothing. And such perception depends on multiple factors such as time, place, season, fashion and personal preferences." [12]. However Peirce's definition excluded factors related to physical properties of clothing. Relatively in 1975, LaMotte described that clothing comfort was greatly influenced by the tactile and thermal sensation arising from the contact between skin and the immediate environment [13].

To combine physical definition and previous consumers' perception definition, Kawabata made a new evaluation method that contains both mechanical interactions and material's intended end use to describe fabrics' comfort level. And this system (KES-F) is still widely used in today's hand feeling evaluation of clothing [14].

Later on, Slater and Li summed up to give a more clear definition of fabric comfort, which is "Comfort is affected by multiple interactions with the surrounding environment including physical, psychological and physiological factors." [15, 16]. This concept has been further developed as comfort generated when clothing interacts with the skin on the body dynamically and continuously while wearing. It was affected by interaction of thermal ventilation construction and assessment factors [17].

As Li summarized, perception of clothing comfort includes physical, psychological and physiological factors [15]. Within these three sensation levels, Li and Wong described the mechanisms of clothing comfort perception in four stages: Physical processes; Physiological process; Neurophysiological process; and Psychological process [17].

## **3 Factors of Clothing Comfort**

In the first level – physical process, where consumers "feel" the fabric properties, researchers managed to specify these physical properties into different categories in order to obtain better understanding and investigation. Howorth and Oliver distinguished the physical properties to 7 categories in their research from 1958 to 1964 as smoothness, softness, coarseness, thickness, weight, warmth and stiffness [6, 7].