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INITIAL STUDIES ON FUNCTIONAL CLOTHING PRODUCTS FOR INDIVIDUALS WITH PHYSICAL DISABILITIES

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Abstract. *The concept of disability has evolved significantly over time and is understood through various models that reflect societal attitudes and ideologies. Traditionally, disability was explained through supernatural causes, moral and religious beliefs, or as a personal tragedy, often leading to stigmatization and marginalization of disabled individuals. These traditional views framed disabled people as different, dependent, and often as objects of charity or pity. The administrative and medical models, which emerged later, define disability through legal certification and medical diagnosis, respectively. These models emphasize pathology and correction, leading to segregation and further stigmatization. The administrative model distinguishes between the "worthy" and "unworthy" poor, while the medical model focuses on treating or isolating the disabled to normalize them. In contrast, modern social models, emerging in the 1970s, view disability as a result of societal barriers and prejudices rather than individual impairments. The social model, endorsed by the UN Convention on the Rights of Persons with Disabilities, advocates for a barrier-free environment and equal societal participation for disabled individuals. Variations of this model include the political-economic model, which links disability issues to social and economic exclusion, and the sociocultural model, which highlights cultural mechanisms defining ability and disability. Disability is a complex term that encompasses functional limitations found in diverse populations and can derive from physical, sensory or intellectual impairments as well as mental health conditions. Law No. 60 of 30.03.2012 of the Republic of Moldova defines disability as an umbrella term for impairments/impairments, activity limitations and participation restrictions, emphasizing the negative aspects of the interaction between the individual and contextual factors. The causes of disability are multiple and include genetic factors, diseases, accidents and health conditions. Disabilities can be classified in terms of severity: mild, moderate, intense and severe.The significance of this topic is highlighted by the increasing recognition of the need to develop functional clothing products for individuals with physical disabilities. Although society has overcome many obstacles, numerous challenges still persist. This paper addresses these issues by examining the current state of adaptive clothing, incorporating definitions from various organizations, including governmental bodies and foundations supporting people with disabilities. This research delves into both the theoretical and practical aspects of developing functional clothing for people with disabilities, aiming to enhance their quality of life. As we know clothing should reflect personal identity and ensure that every individual understands their body and physiognomic features to wear garments that flatter them, create a pleasant image, and maintain psychological and physiological balance. By synthesizing information from various sources, this paper seeks to define and outline the stages involved in creating functional clothing. The focus will be on understanding general classifications and integrating insights from existing research as a foundation for further exploration in this field.*

Keywords: *functional clothing, development stages, textile industry, multifunctional products, quality of life, physical disabilities*

1. INTRODUCTION

Functional clothing plays a pivotal role in improving the quality of life for individuals with physical disabilities by addressing the unique challenge they encounter daily. For these individuals, such clothing is

a practical solution that fosters independence, comfort and dignity. Its development has been driven by technological advancements and a growing societal awareness of the importance of inclusivity.

A key demographic that benefits from adaptive clothing is those with multiple sclerosis (MS), a progressive neurological disorder that affects mobility, balance and coordination. MS is marked by lesions on the central nervous system which impair both motor and sensory functions. As a result, individuals with MS require specially designed garments that meet their specific needs such as easy-to-use fastenings, enhanced mobility features and temperature regulation.

In today's world, the incorporation of innovative materials and design techniques is crucial in creating adaptive clothing that enhances not only functionality but also comfort, self-sufficiency and self-esteem. Over time, adaptive clothing has evolved from basic utilitarian designs to more sophisticated garments, integrating smart textiles, ergonomic solutions and attention to aesthetic details.

This article examines the stages of functional clothing development, with a focus on key design principles and garment classification.

2. UNDERSTANDING AND DESIGNING FUNCTIONAL CLOTHING: EVOLUTION, CLASSIFICATION, AND DEVELOPMENT

2.1. Evolution of Functional Clothing

The history of functional clothing can be traced back to ancient times when disabilities were viewed through religious and social lenses. Early adaptive solutions were primitive, often designed more for survival than comfort. However, as societies evolved, so did the need for more sophisticated solutions [1,3,8,9, 12,13].

By the 20th century, after World War II, the necessity for adaptive clothing grew significantly due to the large number of injured soldiers. This era saw the introduction of functional features such as Velcro fasteners and easy-access openings. The development of functional clothing continued to evolve, eventually integrating both functionality and aesthetics.

Today, adaptive fashion, has integrated technological advancements merging functionality with modern aesthetics. This evolution reflects a shift from purely functional designs to those that also emphasize style and inclusivity [1,3,8,9, 12,13].

Figure 1. Examples of Functional Design throughout History [12,13]

2.2. Classification of Physical Disabilities

Both in Moldova and Romania, the legislation focuses on the protection and promotion of the rights of people with disabilities, aiming to ensure equal opportunities and social inclusion.

In Moldova, the Constitution (Article 16), guarantees equality before the law [16] and the **Law No. 60/2012** regulates the rights of people with disabilities, defining disability and its causes such as general health conditions, congenital conditions, occupational diseases, work-related accidents, involvement in the Chernobyl cleanup and military service [18]. Additionally, **Law No. 121/2012** addresses discrimination and promotes equality [19].

In Romania, the Romanian Constitution (Article 50) provides special protection for people with disabilities [15] and the **Law No. 448/2006** defines disability and provides for environmental adaptations to support social inclusion. Types of disability include physical, visual, auditory, deafblindness, somatic, mental, psychological, HIV/AIDS, associated disabilities and rare diseases [17].

Both countries are signatories to the **UN Convention on the Rights of Persons with Disabilities** which aims to promote, protect, and ensure the rights of people with disabilities [14]. Based on this, we can obtain the following clasification:

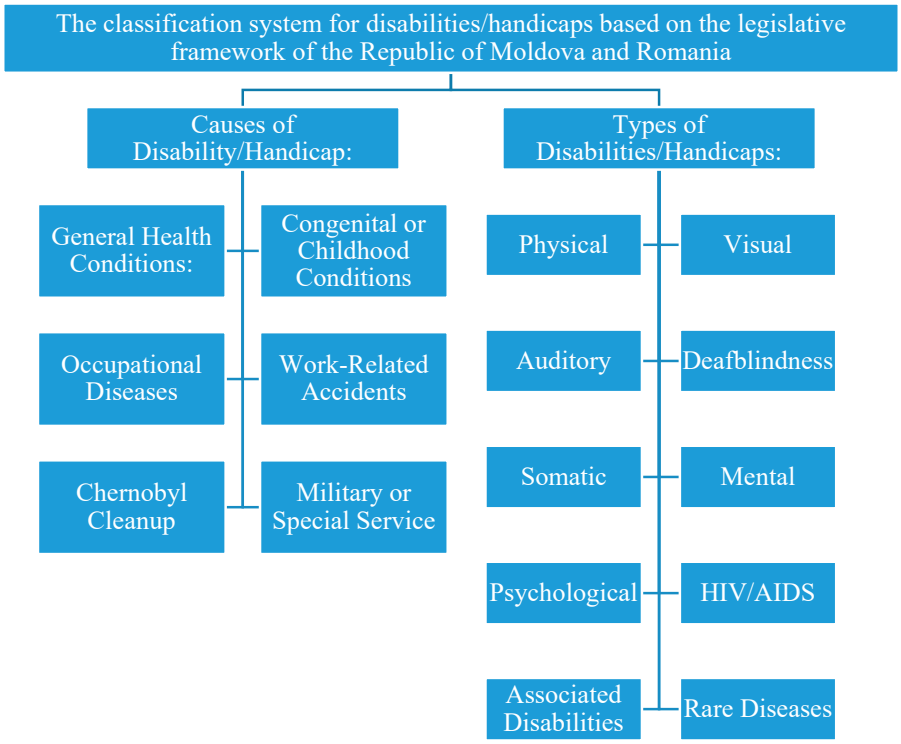

Figure 2. The classification system for disabilities/handicaps based on the legislative framework of the Republic of Moldova and Romania [17,18]

2.3. Design Stages of Functional Clothing

Designing functional clothing, especially for individuals with physical disabilities, requires careful consideration at each stage—from concept creation to material selection and product testing. These stages must accommodate the unique and evolving needs of individuals with multiple sclerosis (MS) [2,10,11]:

1. *Understanding User Needs* - The first step in the design process is to assess the functional limitations of the target users. For individuals with MS, this may include restricted mobility, challenges with fine motor skills and sensitivity to temperature fluctuations. As MS is a progressive condition these needs may evolve over time requiring adaptable design solutions.
2. *Material Selection* - Fabric selection plays a critical role in creating effective functional clothing. Fabrics must be breathable, flexible and durable as individuals with MS often experience heat sensitivity. Smart textiles, which regulate body temperature and reduce skin irritation are increasingly being integrated into designs to address these challenges.
3. *Ergonomics and Adaptability* - Ergonomic features such as magnetic closures, oversized zippers and elastic waistbands are essential for enhancing the wearer's independence by making dressing easier for those with limited dexterity. Clothing should also be designed to accommodate assistive devices like orthotics or catheters.

MS predominantly affects individuals between the ages of 15 and 40 and is a leading cause of non-traumatic neurological disability of young adults. Fatigue is one of the most prevalent symptoms of MS affecting approximately 65% of individuals. 15-40% of them report it as their most disabling symptom. Additionally, more than 60% of people with MS experience worsening symptoms due to changes in body temperature with heat sensitivity being a common concern [7].

MS is categorized into four primary types, each with distinct patterns of disease progression [5,7]:

1. **Relapsing-Remitting MS (RRMS)**: Characterized by acute episodes of neurological symptoms followed by periods of partial or complete recovery.

2. **Secondary-Progressive MS (SPMS)**: Initially presents as relapsing-remitting but eventually progresses without periods of remission
3. **Primary-Progressive MS (PPMS)**: Involves a constant progression of symptoms from the onset, without relapses and remissions
4. **Progressive-Relapsing MS (PRMS)**: A combination of progressive deterioration and acute relapses

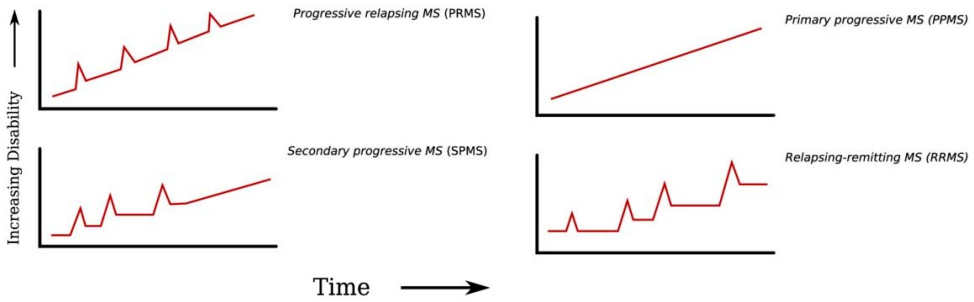

Figure 3. The four types of Multiple Sclerosis [7]

2.4. Functional Clothing Classification

Functional clothing is designed and tailored specifically to meet predetermined requirements and functionalities. This type of clothing offers protection in harsh environments, during work or sports activities and against extreme hazards or challenging conditions. It may also include clothing used for monitoring and assessing risks in situations where everyday attire is insufficient. Functional clothing can be classified into four main categories depending on its final use [2,5,6]:

1. **Protective Clothing**: Engineered to offer protection against physical and chemical hazards.
2. **Sports-Functional Clothing**: Built to support performance in various sports activities and to address the specific physical demands of athletes.
3. **Medical-Functional Clothing**: Intended for use in medical settings, providing features tailored to patient care and comfort.
4. **Clothing for Special Needs**: This can be further detailed as follows:
   - *Based on the disability-causing condition:* Tailored to meet the specific needs of individuals with various disabilities.
   - *Based on ease of dressing and undressing:* Adaptive products with modular and interchangeable elements such as magnetic closures, zippers or Velcro strips.
   - *Based on comfort and size:* Adaptation and prototyping of products using advanced software to ensure optimal fit.
   - *Based on thermal and sensory needs:* Integration of sensors for temperature monitoring and regulation.
   - *Based on selected materials:* Use of smart textiles and innovative materials with features specific to disability requirements.
   - *Based on seam types used:* Design of seams to ensure durability and comfort.
   - *Based on mobility and functionality:* Adaptation of clothing to support freedom of movement and to meet specific functional requirements.

In the analysis of the **"Human – Clothing – Environment"** system, clothing is in direct contact with the body and continuously interacts with it significantly impacting the wearer's comfort and overall well-being. This interaction involves three key components [4]:

- ***Human Component****:* Individuals with MS have specific needs related to mobility, balance and psychological comfort. Functional clothing must accommodate these particularities by offering ergonomic support.
- ***Clothing Component****:* The design of the products must provide physical and medical needs, ensuring ease of use and providing adequate protection for the wearer.
- ***Environmental Component****:* Factors such as temperature, accessibility and social perceptions influence how functional clothing is perceived and used. The design should strike a balance between functionality and aesthetics.

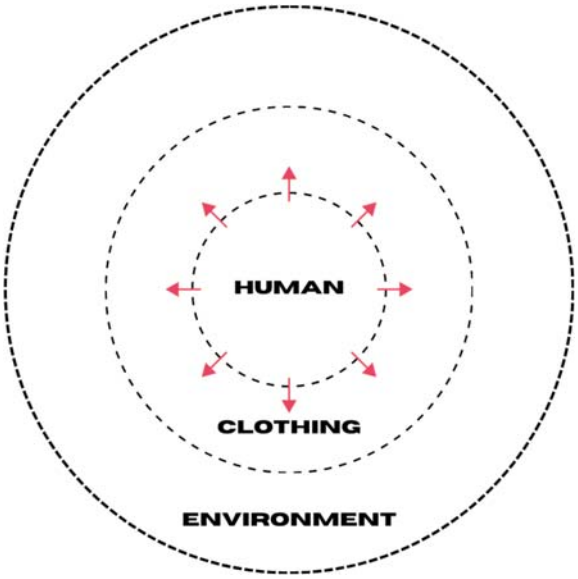

Figure 4. The "Human – Clothing – Environment" system [4]

3. RESULTS AND DISCUSSION

This study highlights the critical role that functional clothing plays in enhancing the lives of individuals with physical disabilities, particularly those affected by conditions like Multiple Sclerosis (MS). Technological innovations have greatly improved the ease of use for individuals with limited mobility. Moreover, advancements like smart textiles have enhanced both functionality and visual appeal, marking a significant step toward more inclusive and fashionable adaptive clothing. A key finding of this research is the importance of designing clothing tailored to the specific needs of users. For individuals with MS, this means addressing challenges such as reduced mobility, heat sensitivity, tiredness and difficulties with fine motor skills. The selection of materials plays a pivotal role here with breathable and temperature-regulating fabrics being essential to ensure both comfort and usability. By focusing on these factors, adaptive clothing can significantly improve the wearer's daily experience, offering greater independence and mitigating the impact of MS-related symptoms.

In addition to fabric selection, the ergonomic design of functional clothing is crucial. Features such as oversized zippers, magnetic closures and elastic waistbands make dressing and undressing easier for individuals with MS. Importantly, these adaptive designs must also be flexible enough to accommodate the progressive nature of MS, where the wearer's needs may evolve over time. Ensuring that clothing can be easily adjusted or modified as symptoms change is a key consideration in the design process. The classification of functional clothing reveals its diverse applications, ranging from protective and sports-functional garments to medical-functional and special needs clothing. For individuals with disabilities, clothing that is tailored to their specific needs not only improves functionality but also contributes to their sense of dignity and self-reliance.

While functional clothing has made significant progress in improving the quality of life for individuals with disabilities, challenges remain. Balancing functionality with aesthetic appeal, ensuring accessibility and making adaptive clothing affordable are ongoing issues. However, with continued advancements in technology and design, the potential for further enhancing the inclusivity and usability of adaptive clothing is promising.

4. CONCLUSIONS

This study underscores the vital role functional clothing plays in enhancing the quality of life for individuals with physical disabilities, particularly those with Multiple Sclerosis (MS). By addressing specific needs such as limited mobility, heat sensitivity and difficulties with dexterity, functional clothing offers a practical solution that fosters independence, comfort and dignity. The evolution of functional wear from basic survival garments to sophisticated designs that incorporate innovative technologies like smart textiles,

reflects the growing emphasis on both functionality and aesthetics. The ability of functional garments to adapt to the progressive nature of conditions like MS further enhances their value ensuring that users can continue to rely on these products as their needs change over time.

Despite these advancements, challenges remain in ensuring that functional clothing is accessible, affordable and widely available. The balance between practicality and aesthetic appeal is crucial as it is the continued integration of new technologies to further improve usability. Looking ahead, the development of more inclusive, adaptive clothing holds significant promise for promoting greater social integration and improving the overall well-being of individuals with disabilities.

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