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Ergonomic Indicators And Their Lexical-Semantic Properties And Specific Aspects

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Abstract: In recent decades, ergonomic indicators have become essential components in assessing and enhancing human-system interaction across various domains, including industry, healthcare, education, and information technology. This article explores the nature of ergonomic indicators not only as technical tools but also as lexical-semantic constructs that possess unique terminological and cognitive dimensions. The study emphasizes the classification of ergonomic indicators—physical, cognitive, and organizational—and investigates the semantic properties embedded in the terminology used to describe them. Furthermore, it analyzes how metaphorical language and interdisciplinary usage affect the interpretation and application of ergonomic concepts. Drawing from insights in ergonomics, linguistics, and cognitive science, the article highlights the need for terminological clarity and standardization in the field. The findings suggest that a deeper understanding of the lexical-semantic features of ergonomic indicators can improve cross-disciplinary communication and contribute to more human-centered design approaches.

Keywords: Ergonomics, ergonomic indicators, lexical semantics, terminology, metaphor, cognitive ergonomics, interdisciplinary language, human-system interaction.

Introduction: Ergonomics, or human factors, focuses on optimizing the interaction between humans and systems to improve safety, comfort, and efficiency. As this field has evolved, the role of ergonomic indicators has become increasingly important in evaluating system design and user experience. These indicators are often viewed through a technical or physiological lens, yet their linguistic and semantic characteristics also deserve scholarly attention. This article aims to bridge the gap between ergonomic science and linguistic analysis by examining ergonomic indicators in terms of their lexical-semantic properties, including their metaphorical underpinnings, terminological variations, and context-specific meanings. Understanding these aspects can contribute to more precise communication among professionals and enhance the practical application of ergonomic principles. In the era of rapid technological progress and digital transformation, the importance of ergonomics is increasingly being recognized across diverse fields—ranging from industrial design to linguistics. Ergonomics, originally stemming from the Greek words ergon (work) and nomos (law), refers to the scientific discipline concerned with understanding the interactions among humans and other elements of a system. It applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance. One of the central aspects of ergonomics lies in ergonomic indicators, which serve as measurable attributes that reflect the efficiency, comfort, and safety of human-system interactions.

Definition and Nature of Ergonomic Indicators. Ergonomic indicators are used to evaluate the degree to which a particular environment, system, or product supports effective human functioning. According to Pheasant and Haslegrave, ergonomic indicators encompass a wide range of variables including physical (e.g., posture, muscle load), cognitive (e.g., mental workload, attention span), and organizational (e.g., work-rest schedules, team interaction) factors. These indicators are essential for designing workplaces that

reduce fatigue, prevent injury, and increase productivity. From a linguistic perspective, the term "indicator" implies a semiotic function: it denotes something that serves as a sign or pointer to an underlying condition or quality. In ergonomics, indicators often reflect latent factors such as stress levels, usability, and user satisfaction. The semantic richness of ergonomic indicators lies in their multifunctionality—they are not only technical measures but also linguistic constructs embedded in discourses of health, productivity, and design.

Lexical-Semantic Properties of Ergonomic Terminology. In examining the lexical-semantic properties of ergonomic indicators, one must consider how these terms function in both specialized and general language. Ergonomic vocabulary is characterized by terminological precision, often borrowing from domains such as physiology, psychology, engineering, and computing. Terms such as load capacity, repetitive strain, postural stability, and task complexity are semantically dense and context-dependent. Linguist John Swales emphasizes that specialized discourses rely heavily on genre-specific lexical bundles and collocations. In ergonomic texts, for example, the phrase human-system compatibility frequently co-occurs with words like design, efficiency, and error reduction. These collocations contribute to the cohesive and interpretive framework within which ergonomic indicators are understood. Furthermore, semantic shift is another notable property. As ergonomic knowledge evolves, terms often undergo semantic narrowing or broadening. For instance, the term usability once referred narrowly to software interfaces, but now extends to include the overall user experience in various physical and digital environments.

The lexical-semantic properties of ergonomic terminology refer to the linguistic features and meaning structures that characterize terms used in the field of ergonomics (human factors engineering). These properties ensure clarity, precision, and consistency in professional communication. Below are key aspects:

1. Lexical Properties. Terminological Specialization: Many ergonomic terms are borrowed from general language but acquire specialized meanings (e.g., workload, posture, fatigue). Some terms are unique to ergonomics (e.g., anthropometry, biomechanics, usability).

Morphological Structure: Compounding: Frequent use of compound nouns (human-machine interface, cognitive workload). Derivation: Prefixes/suffixes modify meaning (macro-ergonomics, user-centric). Abbreviations & Acronyms: Common in technical discourse (e.g., HCI – Human-Computer Interaction, RULA – Rapid Upper Limb Assessment).

Multilingual Influence: Many terms derive from Greek (ergon = work, nomos = law) and Latin (anthropo = human). English dominates as the lingua franca of scientific ergonomic discourse.

2. Semantic Properties. Polysemy & Contextual Variation: Some terms have multiple meanings depending on subfields (e.g., stress can refer to mechanical forces or psychological strain). Example: "Feedback" may mean sensory input in biomechanics but user responses in interface design. Hyponymy & Hypernymy (Hierarchical Relations): Broader and narrower terms form taxonomies (e.g., "Musculoskeletal disorders (MSDs)" includes carpal tunnel syndrome, tendinitis).

Synonymy & Near-Synonymy: Some terms are used interchangeably (e.g., ergonomics vs. human factors), though nuances may exist regionally or disciplinarily.

Metaphorical Extension: Terms from other domains are metaphorically applied (e.g., cognitive load borrows from engineering).

3. Functional Properties. Standardization & Norms: ISO standards (e.g., ISO 6385 on ergonomic principles) regulate terminology to avoid ambiguity. Professional bodies (e.g., IEA – International Ergonomics Association) promote terminological consistency. Interdisciplinary Borrowing: Ergonomics integrates terms from psychology (attention, situational awareness), engineering (torque, leverage), and medicine (repetitive strain injury).

Specific Aspects and Classification of Ergonomic Indicators. Ergonomic indicators can be broadly categorized into three major types:

Physical Ergonomic Indicators – These pertain to bodily interaction with physical environments. Common examples include muscle fatigue, joint stress, repetitive motion, and workstation layout. According to Karwowski, improper design in these domains may lead to musculoskeletal disorders, which are among the most common occupational injuries.

Cognitive Ergonomic Indicators – These relate to mental processes such as attention, perception, memory, and decision-making. Indicators such as cognitive workload, information processing time, and mental fatigue are critical in high-stakes environments like air traffic control or surgery. Wickens and Hollands argue that cognitive overload can significantly impair performance, leading to errors and accidents.

Organizational Ergonomic Indicators – These involve systemic and social factors such as team coordination, communication flow, task scheduling, and ergonomic

culture. Indicators in this category often reflect the efficiency of workflows and the degree of employee engagement. Researchers like Wilson highlight the need for a socio-technical approach, where ergonomic indicators are integrated into organizational policies and training programs. Each of these categories encompasses a set of key terms and concepts whose semantic structures are shaped by disciplinary contexts. For example, mental workload in psychology might differ semantically from its usage in human-computer interaction literature.

Metaphoric and Cognitive Dimensions. Another layer of analysis is the cognitive and metaphoric dimension of ergonomic terminology. As Lakoff and Johnson observed, much of technical language relies on metaphorical mappings. Terms such as load, stress, fatigue, and strain are physically grounded but are metaphorically extended to describe psychological and cognitive states. These metaphors not only facilitate understanding among professionals but also shape conceptual frameworks. For instance, speaking of a "cognitive bottleneck" evokes the metaphor of a constricted passage, which intuitively illustrates limitations in mental capacity. The metaphorical richness of ergonomic indicators plays a role in interdisciplinary communication and in pedagogical settings where complex ideas need simplification.

Challenges and Considerations in Lexical Standardization. Despite the usefulness of ergonomic indicators, the lexical ambiguity and cross-disciplinary usage of terms present challenges. Different fields may use the same term differently, leading to potential misunderstandings. For instance, workload in occupational health focuses on task quantity and intensity, while in aviation it may refer to the operator's perceptual and cognitive burden. There is a growing need for standardization and glossary development. International organizations such as the International Ergonomics Association (IEA) and ISO have worked toward harmonizing terminology, yet the dynamic nature of the field often outpaces these efforts. The involvement of linguists and terminologists in the development of ergonomic lexicons is crucial for enhancing clarity and cross-domain integration.

CONCLUSION

Ergonomic indicators, while initially grounded in technical and physiological measurements, possess rich lexical-semantic properties that reflect their interdisciplinary relevance. They serve not only as empirical tools for assessing human-system interaction but also as linguistic constructs embedded in broader narratives of health, efficiency, and well-being. As the field continues to evolve, attention to the semantic precision, metaphorical usage, and contextual variability of ergonomic terminology becomes increasingly vital. A thorough understanding of these aspects will enhance both practical application and scholarly discourse, fostering a more holistic approach to ergonomics in the 21st century. Ergonomic indicators are linguistically diverse, with specialized terminology and semantic relationships. Their specific aspects vary across physical, cognitive, and organizational domains, requiring precise measurement techniques. Understanding their lexical-semantic properties helps standardize ergonomic assessments and improve human-centered design.

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