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Human Body: A Wearable Product Designer's Guide

by Karen L. LaBat and Karen S. Ryan, with illustrations by Le Wen (CRC Press, 2019)

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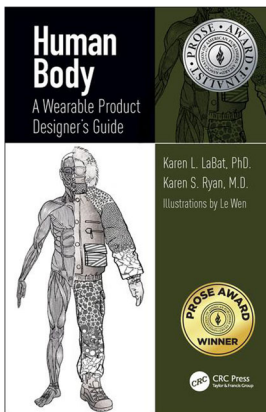
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Reviewed by
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Book Review

***Human Body: A Wearable Product Designer's Guide* by Karen L. LaBat and Karen S. Ryan, with illustrations by Le Wen (CRC Press, 2019)**

Susan L. Sokolowski, PhD is the Founding Director and Associate Professor of the Sports Product Design Graduate Program, at the University of Oregon. She is a global expert in sports product innovation. Susan has been recognized for achievements in design by Nike, Vogue, Sports Illustrated, the New York Times, the Design Museum London, United States Olympic Committee and Volvo.
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Review

Author Karen L. LaBat, PhD is a Horace T. Morse Distinguished Professor Emerita, from the University of Minnesota. Her research practice explores the intersection of how wearable product design, human body systems and dimensions affect fit, sizing and performance. Co-Author Karen S. Ryan, MD, MS is a medical doctor with a specialization in Physical Medicine and Rehabilitation. She also holds a Masters' degree in Apparel Design from the University of Minnesota. Illustrator, Le Wen, is a graduate of the University of Minnesota with a Masters' degree in Graphic Design.

Human Body: A Wearable Product Designer's Guide, published by CRC Press in 2019, is an Association of American Publishers PROSE award winner in the Engineering and Technology category. The book is a comprehensive reference for designers about human anatomy, physiology, biomechanics and anthropometry. It is the first source for creatives about the inner workings of the human body, written and visualized by product creators. The book is logically organized, moving from broad knowledge of the human body and wearable products, to fine details of head to toe systems, concluding with whole body anatomy functionality. There are nine chapters, eight appendices (labelled A-H,) and a glossary to support content.

Chapter One provides a solid foundation. It begins with discussion of how the environment, variety in shape, materials, fit, sizing and measurement dimensions impact how the human body performs, and how designed products have the ability to be a “mediator” between the environment and body. Whenever possible the reader is invited to think about or experiment with the concepts presented throughout the book, to make an emotional and physical connection to the knowledge shared. In Chapter Two, the basics of human body systems are introduced. This chapter is similarly organized to other anatomy books, where the authors present general knowledge about the skeletal system outwards to the integumentary system. Onwards, Chapters Three through Eight take the reader on a journey of the intricacies of the human body, starting with the head and neck, then on to the upper torso and arm, lower torso and leg, mid torso, hand and wrist and lastly with the foot and ankle.

In Chapter Three, head and neck anatomy are described in fascinating detail, starting with the brain – “central control,” and organized analogously to the content in chapter two, from bones, to muscles, fat, nerves, lymphatics and skin. The chapter includes information about the eyes, ears and mouth, as well as best practices for designing products worn on or around these sensing organs. The neck section provides clear details about how the vertebrae architecturally connect to the skull, along with the systems that support neck and brain function, mechanisms of motion, landmarking and measurement methods for product development.

Upper torso (thorax) and arm anatomy are detailed in Chapter Four, inclusive of the circulatory system - heart, arteries and veins, and respiratory system. Rib cage and spine assembly are presented, and designers will find helpful information about developing braces, baby carriers, bras, and impact protection. The chapter also covers the systems and complex motions related to the shoulder and arm – an area of the body that can be difficult to create and fit products to; due to variability in musculature, health and dynamic needs of the user.

Chapter Five reviews lower torso and leg anatomy, including content about digestive, urinary, reproductive systems and wearable product

needs. The information presented is unique, as many of the product topics discussed have never been presented before in an academic textbook. This chapter provides readers with many rich design opportunities to get out of their comfort zone to solve challenging problems. The chapter also reviews pelvis (hip) and leg systems, including knowledge about sex differences and product fit.

For wearable products, the definition of the waist can be a tricky topic, as there are different practices to locate and capture the area. These differences are carefully depicted in Chapter Six, through outlining methods used by practitioners and how the internal anatomy informs that shape, including body type characterizations and changes of the body through pregnancy. Pattern drafting considerations are also discussed for bifurcated products, for different body shapes and users.

In Chapters Seven and Eight, wrist, hand, foot and ankle anatomy are explained. Both chapters are outlined similarly – where the bones and joints are discussed, followed by ligaments, tendons and muscles, nerves, skin, nails and deformities. Because the hands and feet are structurally sophisticated, details of how they are able to form arches to abduct, adduct, flex, point, push and pull are explained. Any footwear, handwear, and tool creative can follow the methods of inquiry to innovate better products. Common to the other chapters, rich examples of wearables, fit, sizing, and anthropometric measuring methods are presented.

Lastly in Chapter Nine, the authors take a “macro” approach of applying knowledge of the human body to products designed for the whole body. Body coverage is explained in relationship to environmental needs, considerations for static and dynamic body positions, including posture, aging and task-related motions. Methods of testing that replicate humans, such as thermal manikins, digital human models, along with physical human wear or “in-vivo” testing are described to demonstrate how products can be evaluated for performance. The chapter ends by describing one of the world’s most fascinating full body wearables – the EVA (Extravehicular Activity) suit. The suit design is used to demonstrate how each body system must be considered as part of the design process in order to keep astronauts alive and functional while working outside of earth’s atmosphere.

The extensive reference list leads readers to peer-reviewed sources that validate the book’s content. The appendices provide specifics on how to locate, palpate, landmark and measure the body for anthropometric research. Appendix A highlights in tabular format, landmarks and measurements by each body region. Appendices B-H parallel chapters 3-9 with precise definitions for measurements of each region. This is the most detailed compendium of anthropometric measurement knowledge available. In addition, there is a thorough glossary, that is a quick reference to look-up information during the design process. The illustrations are carefully drawn, scaled and labelled, making it easy for

designers to see internal details of the body, and how a wide-variety of products from many industries interface with the body. Much like the Watkins and Dunne book *Functional Clothing Design: From Sportswear to Spacesuits* (2015), the illustrations help designers visualize the written information in a way that is relevant to the field.

For wearable product designers, this incredible source has been long needed. In the past, when working on products that interface with the human body, a designer would have to cross-reference several publications in anatomy, biomechanics, physiology, anthropometry just to understand the basic premise of their work and then, they had to interpret how it applies to their research. LaBat and Ryan help to demystify the internal complexities of the body and connect it directly to product design. This book is suitable for students, educators and professionals. For students and educators this is a must-have, reference book for courses in draping, pattern making, textiles, product design and development, and anthropometry. The book would also serve students in engineering, athletic training and human factors, as it would help bridge a gap between science and product. For professionals in the design field, it is a thorough reference and source of advice when developing products for the human body.