

Design Science and Innovation

Series editor

Amaresh Chakrabarti, Centre for Product Design & Manufacturing,
Indian Institute of Science Bangalore, Bangalore, India

The book series is intended to provide a platform for disseminating knowledge in all areas of design science and innovation, and is intended for all stakeholders in design and innovation, e.g. educators, researchers, practitioners, policy makers and students of design and innovation. With leading international experts as members of its editorial board, the series aims to disseminate knowledge that combines academic rigour and practical relevance in this area of crucial importance to the society.

More information about this series at <http://www.springer.com/series/15399>

Sushil Chandra

Aesthetics: Quantification and Deconstruction

A Case Study in Motorcycles

 Springer

Sushil Chandra
Department of Body Engineering
Hero Motocorp Limited
New Delhi
India

ISSN 2509-5986 ISSN 2509-5994 (electronic)
Design Science and Innovation
ISBN 978-981-10-6234-6 ISBN 978-981-10-6235-3 (eBook)
<https://doi.org/10.1007/978-981-10-6235-3>

Library of Congress Control Number: 2017952004

© Springer Nature Singapore Pte Ltd. 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

*I dedicate this book to my
granddaughter Sehr-e-nau (my new dawn).*

Acknowledgements

The germ of this idea of quantifying aesthetics was put in my head by my Ph.D. supervisor. One day, during a casual conversation, he asked me, can we have a computer which scans an object and produces an output which describes the aesthetics of the object. This question set me to the path of two further questions, (1) is there an objective method to describe aesthetics? and (2) Can it be measured or calculated? Looking for an answer to these two questions led to this book. So, Prof. S.K. Atreya, Head of Faculty for Industrial Design at Indian Institute of Technology, Delhi is actually the progenitor of this book and no acknowledgement can start without mentioning him and thanking him.

Going through this book, you will realize that that the backbone of the research is provided by the 3D models and images generated by free-hand sketches. This would not have been possible, if my two friends Mr. Rahul Jain and Mr. Umesh Sharma would not have extended their helping hands and this page gives me an opportunity to express my gratitude. Moreover, this research was not possible without cooperation from the respondents. Though I would love to thank them by name, but the sheer numbers make it impractical. But this does not take away the fact that their contribution demands an acknowledgement of their contribution.

My own horizon on motorcycles has widened after I came in contact with The International Journal of Motorcycle Studies and this widening of my horizons has positively contributed to the scope of this book. I express my gratitude to the editors of this journal Prof. Suzanne Ferris and Prof. Steven Alford from Florida. Continuing with the mention of this journal, I thank the current editor Ms Sheila Malone who, without batting an eyelid, proverbially speaking, allowed me to use the material from my articles published in the journal. Similarly I am thankful to my *alma mater* BITS, Pilani for allowing me to use the data from my Ph.D thesis.

But, most importantly I would like to remind my readers that I am not an academician and writing a book is unusual for a professional engineer. But this happened due to constant goading by two people in my life who did not allow me to rest till this happened—my wife Poonam and my daughter Nimisha. Though this book is an unusual place for thanking them but I cannot resist the temptation.

Contents

| | | |
|----------|---|----|
| 1 | Introduction: Motorcycle and the Semantics of Design | 1 |
| 1.1 | Semantics of Design | 3 |
| 1.2 | Motorcycle and Aesthetics | 5 |
| | References. | 7 |
| 2 | Motorcycle and Its Aesthetics: A Glimpse in History | 9 |
| 2.1 | 1869 to First World War: The Birth-Pangs | 10 |
| 2.2 | Between the Wars: The Baby Steps | 15 |
| 2.3 | The Metamorphosis (1945–60) | 17 |
| 2.4 | 1960–1984: Decline of the Empire | 19 |
| 2.5 | Post 1984: Return of the East | 20 |
| 2.6 | The Indian Story | 22 |
| 2.7 | Summary | 25 |
| 3 | Challenges for Product Planners | 27 |
| 3.1 | DNA Strategy | 28 |
| 3.2 | Architecture Strategy | 33 |
| 3.3 | Platform Strategy | 34 |
| 3.4 | Product Family Strategy | 34 |
| 3.5 | Semantic Strategy | 34 |
| 3.6 | Product Planning Tools | 35 |
| 3.7 | The Tensions | 36 |
| 4 | Challenges for Styling Designers | 39 |
| 4.1 | The Process | 39 |
| 4.2 | The Tensions | 42 |
| 5 | The Science of Emotions | 45 |
| 5.1 | Emotion Perspectives | 46 |
| 5.2 | Summary | 55 |
| | References. | 56 |

| | | |
|-----------|---|-----|
| 6 | Deconstructing Emotions into Design Factors | 59 |
| 6.1 | Context | 60 |
| 6.2 | Color | 61 |
| 6.3 | Form | 64 |
| 6.4 | Unity | 64 |
| 6.5 | Dynamism | 66 |
| 6.6 | Graphics | 67 |
| | References | 68 |
| 7 | The Methodology | 69 |
| 7.1 | The Approach | 69 |
| 7.2 | Mathematical Modeling | 75 |
| 7.3 | Verification and Loop Closure | 78 |
| | Appendix 1: Weightage Calculation for Context Sub-factors | 80 |
| | Appendix 2: SGDI Calculation for Context Sub-factor Front Facia | 80 |
| | References | 81 |
| 8 | The Context of Emotions | 83 |
| 8.1 | Type: Cruiser, Sports, and Standard (Fig. 8.2) | 86 |
| 8.2 | Construction | 91 |
| 8.3 | Front Facia | 93 |
| 8.4 | Wheels | 93 |
| | Appendix 1: Emotion Scores for Motorcycle Types | 98 |
| | Appendix 2: Emotion Scores for Wheels | 99 |
| | Appendix 3: Emotion Scores for Front Facia | 101 |
| | References | 102 |
| 9 | The Shape of a Motorcycle | 103 |
| 9.1 | Fuel Tank | 104 |
| 9.2 | Side Cover | 112 |
| 9.3 | Seat | 116 |
| 9.4 | Visor | 119 |
| 9.5 | Summary | 122 |
| | Appendix 1: Fuel Tank Shapes and their Emotion Scores | 124 |
| | Appendix 2: Side Cover Shapes and their Emotion Scores | 130 |
| | Appendix 3: Seat Shapes and their Emotion Scores | 132 |
| | Appendix 4: Visor Shapes and their Emotion Scores | 133 |
| 10 | Color and Texture | 135 |
| 10.1 | Mono-Colors | 138 |
| 10.2 | Combinations in a Single Primary Color | 139 |
| 10.3 | Combinations of Different Primary Colors | 141 |
| 10.4 | Combination of Primary Colors, White, Black and Gray | 145 |
| 10.5 | Texture | 149 |
| | Appendix 1: Emotion Scores for Color Combinations | 152 |
| | Appendix 2: Emotion Scores for Color and Texture Combinations | 154 |

- 11 Unity and Dynamism: The Interplay** 157
 - 11.1 Unity 158
 - 11.2 Dynamism 162
 - 11.3 Unity and Dynamism 173
 - References. 177

- 12 Graphics: To Be or Not to Be** 179
 - 12.1 Graphics 180
 - 12.2 Typography 184
 - Appendix 1: Graphics Combinations. 189
 - Appendix 2: Emotion Scores for Graphics Combinations 190
 - Appendix 3: Emotion Scores for Typography Combinations. 192
 - Reference 194

- 13 A Case Study** 195
 - 13.1 Calculation of Evaluation Scores 198
 - 13.2 Comparison and Iterations 198
 - Appendix 1: Calculation of Evaluation Scores 203
 - Appendix 2: Sample Calculation of Emotion Scores. 205
 - Appendix 3: Sample Calculation of Emotion Scores for Texture 206
 - Appendix 4: Weighted Emotion Scores for Texture 218

- 14 Design and the Role of Cultures** 219
 - 14.1 Migration 221
 - 14.2 Gender 222
 - 14.3 Lyricism 230
 - 14.4 Accounting for Culture. 232

About the Author

Sushil Chandra is an R&D engineer working with Hero Motocorp, the world's largest motorcycle manufacturer. He was part of the design team for "Splendor", the world's best-selling motorcycle, and was chiefly responsible for the design of Hero Motocorp products, which included both studio and engineering aspects. He currently heads the body engineering function group, which vertically integrates all activities from conceptualization to mass production and focuses on the interplay of social, political, and philosophical aspects with the world of engineering design. Literature, especially ancient and modern poetry, happens to be one of his loves. This confluence of engineering and art drew him to the field of automobile aesthetics, which he found intriguing and exciting at the same time, leading him to complete a Ph.D. in the engineering of aesthetics. He has published several papers on the semantic aspects of motorcycle design.