Lori Rothman is a Section Manager for Kraft Foods in the Department of Perceptual and Applied Quantitative Sciences and Innovative Applications, a part of Research and Development. For the past 14 years, Lori has worked in the area of consumer research, conducting both quantitative and qualitative studies for many of the Kraft brands. Lori has a B.S. degree from Cornell University in Nutritional Sciences and an M.S. degree from the University of California, Davis in Food Science. At Davis, Lori researched the language of basic tastes and its transfer to novel tastants with trained panelists. Prior to joining Kraft Foods, Lori worked for Philip Morris (now Altria), researching the sensory impact of flavor degradation in carbonated beverages, for Kellogg's, where she managed the Sensory Evaluation and Shelf Life departments and for Brach's Candies at the inception of its Product Performance group, where she built a state of the art sensory laboratory including shelf life testing chambers and computerized panel evaluation booths. Lori has authored a number of publications in refereed and industry journals and is a frequent speaker at universities and conferences. Lori is a longstanding professional member of the Institute of Food Technologists and its Sensory Evaluation Division as well as ASTM International where she cochairs the Acceptance Preference Task Group. She is an active reviewer for the Journal of Quality and Preference and has authored a chapter on “Just About Right Scales” for the book Consumer Led Food Product Development published in 2007.

Merry Jo Parker has over 25 years experience in applying sensory principles and practices to consumer research. In 2008 she retired as the founder, owner and CEO of Food Perspectives Inc., a guidance research and consumer insights consulting and testing firm. Founded in 1990, Food Perspectives has clients across the United States from Fortune 500 companies to small emerging companies. Food Perspectives works with product guidance and marketing consumer insights professionals offering a variety of research techniques, ranging from fieldwork to complete research services that include test design, interpretation and consulting. Prior to founding Food Perspectives Inc. Ms. Parker was, an independent consultant, a Senior Scientist at General Mills Inc. and Research Scientist at Sandoz Nutrition focusing on product development and consumer research on nutritional, food service and retail food products. Ms. Parker received Bachelors and Masters Degrees in Food Science from the University of Minnesota with an emphasis in sensory science. She has been a member of ASTM since 1999 and serves as the Chairman for the ASTM Subcommittee on Fundamentals of Sensory. In 2007 Ms. Parker co-chaired the 7th Pangborn Sensory Science Symposium. This symposium is considered the most important international scientific gathering for sensory and consumer scientists with over 900 attendees from 54 different countries. She has also been a long standing professional member of the Institute of Food Technologies and IFT's Sensory Evaluation Division.
Just-About-Right (JAR) Scales: Design, Usage, Benefits, and Risks

Lori Rothman and Merry Jo Parker

ASTM Stock Number: MNL63
Preface

When we volunteered for this assignment, we did not know that it would take 10+ years to complete. Or that this document would become Manual 63. Originally conceived as a Standard Guide, the completed document was more than 200 pages in length. Several comments were received during the subcommittee balloting process that the document was too large to be a Standard Guide; thus the idea for a Manual was born. Our goal was to create THE definitive document on Just About Right scales in an easily understood, practical format and we think we have succeeded. Please tell us if you think otherwise.

Lori Rothman
Kraft Foods
801 Waukegan Road
Glenview, IL 60025

Merry Jo Parker
Food Perspectives
2880 Vicksburg Lane North
Plymouth, MN 55447
Dedication

This manual is dedicated to our hardworking colleagues at ASTM E18.04.26.
Acknowledgments

This manual represents the fruits of more than 10 years of labor by a wide range of individuals associated with ASTM International Committee E18. Through the years, E18 committee members helped ‘grow’ the manual, from setting the scope and creating the outline to writing the chapters themselves. Countless versions were edited by the E18.04.26 task group members; each and every editing session made the document more cohesive and compelling. We are particularly grateful to the case study authors, who worked with a common data set to produce the fantastic array of statistical options presented. Many of those authors ventured from their comfort zones, working with novel techniques to showcase them in a format easily read and understood. Task force members evaluated and edited the case studies, making sure that each technique was fairly presented with all its pros and cons. Janya Walsh provided the first draft of the Bibliography. A special ‘thank you’ goes to Bill Raynor of Kimberly Clark for reviewing all the statistical case studies. Tom Carr of Carr Consulting and Greg Stucky of Insights Now also deserve special recognition for their contributions. Richard Popper of P&K provided very helpful specific feedback on the entire document, an invaluable contribution. Scott Orthey of ASTM was our cheerleader extraordinaire, particularly as we became close to publishing. Thanks to the (changing) officers of E18 for their continual support and encouragement and to the publication staff of ASTM International, especially Kathy Dernoga and Monica Siperko. Finally, the editors thank each other for their continued dedication, dogged persistence and friendship. Neither of us could have done it alone.

Lori Rothman
Kraft Foods
801 Waukegan Road
Glenview, IL 60025

Merry Jo Parker
Food Perspectives
2880 Vicksburg Lane North
Plymouth, MN 55447
# TABLE OF CONTENTS

## Preface

## Dedication

## Acknowledgments

Structure and Use of Just-About-Right Scales 1

## APPENDIXES

A. Graphical Data Display 14

B. Graphical Scaling 16

C. Percent Difference from Norm and Percent Difference from Just Right 18

D. The Mean 23

E. Mean Direction and Mean Absolute Deviation 25

F. Mean versus Scale Mid-Point 27

G. Methods for Determining Whether JAR Distributions are Similar Among Products (Chi-Square, Cochran-Mantel-Haenszel (CMH), Stuart-Maxwell, McNemar) 29

H. A Proportional Odds/Hazards Approach to JAR Data 38

I. Student's $t$-Test—Analysis of Variance of Two Samples 42

J. Analysis of Variance (ANOVA) 44

K. Thurstonian Ideal Point Modeling 46

L. Penalty Analysis or Mean Drop Analysis 50

M. Using Grand Mean versus JAR Mean to Create Penalties in Penalty Analysis 54

N. A Regression-Based Approach for Testing Significance of JAR Variable Penalties 57

O. Bootstrapping Penalty Analysis 63

P. Opportunity Analysis 67

Q. PRIMO Analysis 71

R. Chi-Square 75

S. Biplots, Correspondence Analysis, and Principal Components Analysis 82

T. Correlation 86

U. Regression 88

V. Preference Mapping from JAR Data Using Tree-Based Regressions 90

W. Application of JAR Data to Preference Mapping Using Dummy Variables 94

X. Collecting Intensity and Hedonic Information Separately 102

Y. Designed Experiments 104

Z. Ideal Scaling 106

Bibliography 110
Lori Rothman is a Section Manager for Kraft Foods in the Department of Perceptual and Applied Quantitative Sciences and Innovative Applications, a part of Research and Development. For the past 14 years, Lori has worked in the area of consumer research, conducting both quantitative and qualitative studies for many of the Kraft brands. Lori has a B.S. degree from Cornell University in Nutritional Sciences and an M.S. degree from the University of California, Davis in Food Science. At Davis, Lori researched the language of basic tastes and its transfer to novel tastants with trained panelists. Prior to joining Kraft Foods, Lori worked for Philip Morris (now Altria), researching the sensory impact of flavor degradation in carbonated beverages, for Kellogg’s, where she managed the Sensory Evaluation and Shelf Life departments and for Brach’s Candies at the inception of its Product Performance group, where she built a state of the art sensory laboratory including shelf life testing chambers and computerized panel evaluation booths. Lori has authored a number of publications in refereed and industry journals and is a frequent speaker at universities and conferences. Lori is a longstanding professional member of the Institute of Food Technologists and its Sensory Evaluation Division as well as ASTM International where she co-chairs the Acceptance Preference Task Group. She is an active reviewer for the Journal of Quality and Preference and has authored a chapter on “Just About Right Scales” for the book Consumer Led Food Product Development published in 2007.

Merry Jo Parker has over 25 years experience in applying sensory principles and practices to consumer research. In 2008 she retired as the founder, owner and CEO of Food Perspectives Inc., a guidance research and consumer insights consulting and testing firm. Founded in 1990, Food Perspectives has clients across the United States from Fortune 500 companies to small emerging companies. Food Perspectives works with product guidance and marketing consumer insights professionals offering a variety of research techniques, ranging from fieldwork to complete research services that include test design, interpretation and consulting.

Prior to founding Food Perspectives Inc. Ms. Parker was, an independent consultant, a Senior Scientist at General Mills Inc. and Research Scientist at Sandoz Nutrition focusing on product development and consumer research on nutritional, food service and retail food products.

Ms. Parker received Bachelors and Masters Degrees in Food Science from the University of Minnesota with an emphasis in sensory science. She has been a member of ASTM since 1999 and serves as the Chairman for the ASTM Subcommittee on Fundamentals of Sensory. In 2007 Ms. Parker co-chaired the 7th Pangborn Sensory Science Symposium. This symposium is considered the most important international scientific gathering for sensory and consumer scientists with over 900 attendees from 54 different countries. She has also been a long standing professional member of the Institute of Food Technologies and IFT’s Sensory Evaluation Division.