CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

Spatial Biases in Perception and Cognition

Our experience of the world is influenced by numerous spatial biases, most of which influence us without our being aware of them. These biases are related to illusions and asymmetries in our perception of space, relationships between space and other qualities, dynamics of moving objects, dynamics of scene configuration, and dynamics related to perception and action. Consideration of these biases provides insight into how we perceive, remember, and navigate space, as well as how we interact with objects and people in space. This volume introduces and reviews numerous spatial biases and provides descriptions and examples of each bias. The contributors discuss historical and current theories for many biases and provide new explanatory theories. Providing a "one-stop shop" for information on such a key aspect of our experience in the world, this volume will interest anyone curious about our understanding of space.

Timothy L. Hubbard is an adjunct faculty member at Arizona State University and Adjunct Doctoral Dissertation Chair at Grand Canyon University, and was previously a full professor at Texas Christian University. He has published 90 papers in peer-reviewed scientific journals, 12 chapters in various academic books, and more than 100 scientific conference presentations. He is a consulting editor for *Attention, Perception, & Psychophysics* and *Journal of Experimental Psychology: Human Perception and Performance*, and an associate editor for *Auditory Perception & Cognition* and *Frontiers in Psychology*. He has published scholarly reviews and empirical findings on several spatial biases and is a fellow of the Association for Psychological Science and of the Psychonomic Society.

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

Spatial Biases in Perception and Cognition

Edited by
Timothy L. Hubbard
Arizona State University and Grand Canyon University

CAMBRIDGE
UNIVERSITY PRESS

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India

79 Anson Road, #06–04/06, Singapore 079906

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781107154988
DOI: 10.1017/9781316651247

© Cambridge University Press 2018

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2018

Printed and bound in Great Britain by Clays Ltd, Elcograf S.p.A.

A catalogue record for this publication is available from the British Library.

Library of Congress Cataloging-in-Publication Data
Names: Hubbard, Timothy L., editor.
Title: Spatial biases in perception and cognition / edited by Timothy L. Hubbard, previously of Texas Christian University.
Description: Cambridge, United Kingdom ; New York, NY : Cambridge University Press, 2018. | Includes bibliographical references.
Identifiers: LCCN 2018008153 | ISBN 9781107154988 (hardback) | ISBN 1107154987 (hardback) | ISBN 9781316607077 (pbk.) | ISBN 1316607070 (pbk.)
Subjects: LCSH: Space perception. | Spatial behavior. | Cognition.
Classification: LCC QP491 .S73 2018 | DDC 152.14/2–dc23
LC record available at https://lccn.loc.gov/2018008153

ISBN 978-1-107-15498-8 Hardback

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

Contents

List of Figures vii
List of Tables x
List of Contributors xi

Introduction: Spatial Biases: What Are They and Why Are They Important? 1
Timothy L. Hubbard

Part I Anisotropies and Illusions

1 **Perceptual Biases in Elementary Geometry** 9
Michael Morgan

2 **Perceptual Anisotropies in Visual Space** 24
Jose Antonio Aznar-Casanova and Leonardo Gomes Bernardino

3 **Situated Influences on Spatial–Numerical Associations** 41
Krzysztof Cipora, Katarzyna Patro, and Hans-Christoph Nuerk

4 **S-R Compatibility with Physical and Representational Locations: The Simon, SMARC, and STEARC Effects** 60
Carlo Umiltà, Mario Bonato, and Elena Rusconi

5 **Unraveling the Paradox of Spatial Pitch** 77
Ophelia Deroy, Irune Fernandez-Prieto, Jordi Navarra, and Charles Spence

6 **Representational Biases in Space and Language** 94
Alexander Kranjec

Part II Dynamics of Objects

7 **Mislocalizations at the Onset Position of Moving Stimuli** 109
Jochen Müsseler and Dirk Kerzel

8 **Influences on Representational Momentum** 121
Timothy L. Hubbard

9 **The Flash-Lag Effect** 139
Timothy L. Hubbard

10 **Perceptual and Motor Biases in Reference to Gravity** 156
Myrka Zago

11 **Auditory Biases in Visual Motion Perception** 167
Wataru Teramoto, Souta Hidaka, and Yoichi Sugita

12 **Adaptive Biases in Visual and Auditory Looming Perception** 180
John G. Neuhoff

Part III Dynamics in Scenes

13 **Expanding Space: Does Imagination Affect Boundary Extension for Visual Scenes?** 193
Helene Intraub and Kristin M. Gagnier

14 **Spatial Contraries and Mirrors** 209
Ivana Bianchi and Ugo Savardi

15 **Aesthetics and Preferences in Spatial and Scene Composition** 222
Timothy L. Hubbard

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

16 **Spatial Biases in Thought and Judgment: Reference Theory** 241
Barbara Tversky

17 **Categorical Influences on Spatial Bias** 249
Nora S. Newcombe

Part IV Perception and Action

18 **Spatial Bias after Brain Damage: The Case of Visual Neglect** 263
Pom Charras, Juan Lupianez, and Paolo Bartolomeo

19 **Natural Regularities and Coupled Predictive Perceptual and Cognitive Biases: Why We Evolved to Systematically Experience Spatial Illusions** 276
Michael K. McBeath

20 **Two "Inhibitions of Return" Bias Orienting Differently** 295
Raymond M. Klein and Ralph S. Redden

21 **Spatial Biases from Action** 307
Jessica K. Witt

22 **Spatial Biases in Navigation and Wayfinding** 324
Jan M. Wiener and Tobias Meilinger

23 **Grounding Social Cognition in Space** 336
Caterina Suitner and Thomas W. Schubert

24 **Forms of Bias in Cognitive Science: Moving beyond Perception, Action, and Cognition** 350
J. Scott Jordan, Vincent Cialdella, Daniel S. Schloesser, and Jiuyang Bai

References 366

Index 473

The plate section can be found between pp 260 and 261

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

Figures

1.1 Various configurations investigated by Müller-Lyer, from his 1889 paper 'Optische Urteilstauschigen' 17
1.2 The Fraser twisted cord. Each vertical line is composed of Gabor wavelets, phase-shifted as they go up the page. The vertical lines do not look parallel, although the separation between them looks constant. Evidently, acuity for parallelism does not depend upon distance acuity. 18
1.3 Configurations used by Morgan and Dillenburger (2016) to test the orientation-repulsion effect reported by Blakemore et al. (1970). The task (2AFC) was to decide whether the upper two lines in the configuration on the left were more or less parallel than those on the right. In Experiment 3.4 the task was to decide in which of the two figures the line and the dot were more collinear. For further explanation, see the text. 21
2.1 (a) Three-dimensional spatial configuration defined by orthogonal axes (X, Y, and Z), with VS represented as an implicit frustum. (b) Spatial planes starting from the egocentric frame of reference. 25
2.2 The Shepard illusion (a), in which the boards of the tables are perceived as being different despite being identical, and the two more common arrangements of the horizontal-vertical illusion (HVI), in L-shape (b) and inverted T-shape (c) 29
2.3 Depth interpretation and HVI 31
3.1 Overview of relationships between numbers and space 43
3.2 Overview of proposed types of situated influences on the SNARC effect 45
4.1 Examples of compatibility effects when stimuli and responses share a spatial dimension 70
5.1 (A) Results of Chiou and Rich's (2012, Exp. 1) crossmodal cuing study. (B–C) Results of Chiou and Rich's (2012, Exp. 4) study of the effects of endogenous attentional orienting and crossmodal correspondence on the magnitude of spatial cuing effects observed in the vertical dimension. 82
5.2 Fernández-Prieto and Navarra's (2017) experimental procedure showing the sequence and timing of events in a trial 83
5.3 Results of Sadaghiani et al.'s (2009) neuroimaging study looking at the neural substrates of crossmodal effects of auditory stimulation on visual motion perception 86
6.1 To test hypotheses regarding processing biases across hemispheres and information types, the tasks were residualized against each other in order to establish orthogonal measures for particular representational formats (Amorapanth et al., 2010) 98
6.2 Results from six matching (Probe-Target) tasks in Kranjec, Ianni, and Chatterjee (2013) 100
6.3 Examples of four kinds of "different" trials in Kranjec, Lupyan, and Chatterjee (2014), Exps. 1–3 102
6.4 Results from Kranjec et al. (2014) 103
7.1 Four localization errors with moving stimuli 110
7.2 Simplified assumptions (a) of lateral inhibition with stationary stimuli, (b) cumulative lateral inhibition with moving stimuli with regard to Geer and Schmidt (2006), and

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

(c) metacontrast and visual focal attention with regard to Kirschfeld and Kammer (1999, fig. 6) 112
7.3 Trial contexts and findings of Müsseler and Kerzel (2004, Exp. 1) 117
8.1 An illustration of a typical methodology and results for an experiment assessing representational momentum 122
9.1 Illustrations of common stimulus displays in studies of the flash-lag effect 140
10.1 Systematic errors in the SVV when participants lie in a roll-tilted posture (60°, 105°, and 150°, from A to C, respectively) 157
10.2 Intersection points, for all targets, between the ball surface and the tip of the handheld rod 164
10.3 Distributions of positional errors in the occluded trials for each ball acceleration 165
11.1 Schematic illustration of spatiotemporal positions of audiovisual stimuli in Freeman and Driver (2008) 169
11.2 Example of the visual display and the presentation sequence used in Teramoto, Hidaka, Gyoba, and Suzuki (2010) 170
11.3 Schematic illustration of the sound-induced visual motion illusion (Hidaka et al., 2009) 173
11.4 Schematic illustration of perceptual associative learning effects between auditory and visual stimuli reported in Teramoto, Hidaka, and Sugita (2010) 177
13.1 The figure shows a stimulus view and a drawing made by a participant demonstrating boundary extension 195
13.2 The figure shows boundary scores in the explicit imagination experiment conducted by the authors (panel A); the sound effects experiment (Gagnier, 2010; Section 3 experiments) (panels B.1 and B.2); and the discourse experiment (Gagnier, 2010; Section 2 experiments) (panel C) 203
14.1 Basic spatial oppositions 211
14.2 Diagrams showing reflections in mirrors set in different positions 213
14.3 Some false beliefs concerning naive optics; all are represented using aerial views 215
14.4 Diagrams showing the relationship between the orientation of a material object or movement and that of its reflection in terms of two vector components 216
15.1 Illustrations of the Gestalt principles of perceptual grouping including proximity, similarity, good continuation, closure, common fate, symmetry, parallelism, uniform connectedness, common region, and synchrony 234
17.1 Idealized pattern of bias found in experiments on memory for the location of dots in a circle 250
17.2 Model of the Category Adjustment Model (CAM) 251
17.3 Experimental procedure in Kranjec, Lupyan, and Chatterjee (2014) 257
18.1 The four configurations used in Charras et al. (2010) 269
18.2 The eight configurations used in the study by Charras, Lupianez, Migliaccio, Toba, Pradat-Diehl, Duret, and Bartolomeo (2012) 271
18.3 The mean percentage and SDs of horizontal underestimation and horizontal overestimation as a function of Configuration for Healthy controls and Neglect patients 272
19.1 Invariant properties in a Gibsonian flow field 278
19.2 Illusion of the rising fastball and the stop-and-drop sinkerball 279

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

19.3 The linear optical trajectory (LOT) interception control strategy: an example of the invariant property of maintaining angular constancy 280
19.4 Misjudging the destination of a pop-up 281
19.5 The natural regularity of object symmetry 283
19.6 The natural regularity of top salience 285
19.7 The natural regularity of axis-aligned motion 287
19.8 The natural regularity of neoteny in head shape as a cue of age 290
20.1 A figure illustrating the flow of information between cognitive modules from perceptual, input-related processing to motoric, output-related processing 298
20.2 Diagnostics for determining whether an effect is early (input) or late (decision/output) in processing 299
20.3 (A) Results from the target-type diagnostic as employed in Taylor's dissertation (Taylor & Klein, 2000). (B) Results from the speed–accuracy diagnostic as employed in Ivanoff's dissertation (Ivanoff & Klein, 2001, 2006). 300
20.4 Patterns of findings when the two diagnostics illustrated in Figure 20.2 are applied to our studies and to the literature 302
21.1 A participant performing the visual matching task to estimate hill slant 309
21.2 Targets presented up a hill appear farther away than when presented on flat ground 310
21.3 Bird's-eye view of visual matching task used to assess perceived distance to objects beyond arm's reach but within reach when using a tool 312
21.4 Softball players selected the circle that matched the size of the softball prior to filling out a survey on recent batting performance 313
21.5 Triangle adjustment task used as an indirect measure of perceived distance 319
22.1 Example of a movement pattern generated by a Lévy process 327
22.2 Two sample search trajectories 329
22.3 Schematic drawing of a navigation task and two alternative solutions 333

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

Tables

3.1 Overview of situational influences on the SNARC effect 46
22.1 Overview of route choice strategies described in this chapter 326

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

Contributors

Jose Antonio Aznar-Casanova
University of Barcelona, Spain

Jiuyang Bai
Illinois State University, USA

Paolo Bartolomeo
Inserm U1127 and Sorbonne Université, Paris, France

Leonardo Gomes Bernardino
Universidade Federal de Uberlandia, Brazil

Ivana Bianchi
University of Macerata, Italy

Mario Bonato
University of Padua, Italy

Pom Charras
University Paul Valery Monpellier, France

Vincent Cialdella
Illinois State University, USA

Krzysztof Cipora
University of Tübingen, Germany

Ophelia Deroy
University of London, UK

Irune Fernandez-Prieto
Hospital Sant Joan de Deu, Barcelona, Spain

Kristin M. Gagnier
Johns Hopkins University, USA

Souta Hidaka
Rikkyo University, Japan

Timothy L. Hubbard
Arizona State University and Grand Canyon University, USA

Helene Intraub
University of Delaware, USA

J. Scott Jordan
Illinois State University, USA

Dirk Kerzel
University of Geneva, Switzerland

Raymond M. Klein
Dalhousie University, Canada

Alexander Kranjec
Duquesne University, USA

Juan Lupianez
University of Granada, Spain

Michael K. McBeath
Arizona State University, USA

Tobias Meilinger
Max Planck Institute for Biological Cybernetics, Tübingen, Germany

Michael Morgan
City University of London, UK

Jochen Müsseler
RWTH Aachen University, Germany

Jordi Navarra
Hospital Sant Joan de Deu, Barcelona, Spain

John G. Neuhoff
College of Wooster, USA

Nora S. Newcombe
Temple University, USA

Hans-Christoph Nuerk
University of Tübingen, Germany

Katarzyna Patro
Ulm University, Germany

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-107-15498-8 — Spatial Biases in Perception and Cognition
Edited by Timothy L. Hubbard
Frontmatter
More Information

Ralph S. Redden
Dalhousie University, Canada

Elena Rusconi
University of Trento, Italy

Ugo Savardi
University of Verona, Italy

Thomas W. Schubert
University of Oslo, Norway

Daniel S. Schloesser
Illinois State University, USA

Charles Spence
University of Oxford, UK

Yoichi Sugita
Waseda University, Japan

Caterina Suitner
University of Padua, Italy

Wataru Teramoto
Kumamoto University, Japan

Barbara Tversky
Columbia University, USA

Carlo Umiltà
University of Padua, Italy

Jan M. Wiener
Bournemouth University, UK

Jessica K. Witt
Colorado State University, USA

Myrka Zago
IRCCS Santa Lucia Foundation, Rome, Italy

© in this web service Cambridge University Press www.cambridge.org