

# 3D Animation ESSENTIALS



SERIOUS SKILLS.

# **3D ANIMATION**

## **ESSENTIALS**

## Andy Beane



Acquisitions Editor: Mariann Barsolo Development Editor: Candace English Technical Editor: Keith Reicher Production Editor: Liz Britten Copy Editor: Sharon Wilkey Editorial Manager: Pete Gaughan Production Manager: Tim Tate

Vice President and Executive Group Publisher: Richard Swadley

Vice President and Publisher: Neil Edde Book Designer: Happenstance Type-O-Rama

Compositor: Craig Johnson, Happenstance Type-O-Rama

Proofreader: Nancy Bell

Indexer: Ted Laux

Project Coordinator, Cover: Katherine Crocker

Cover Designer: Ryan Sneed Cover Image: Andy Beane

Copyright © 2012 by John Wiley & Sons, Inc., Indianapolis, Indiana

Published simultaneously in Canada

ISBN: 978-1-118-14748-1

ISBN: 978-1-118-22579-0 (ebk.) ISBN: 978-1-118-23905-6 (ebk.)

ISBN: 978-1-118-26379-2 (ebk.)

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at http://www.wiley.com/go/permissions.

Limit of Liability/Disclaimer of Warranty: The publisher and the author make no representations or warranties with respect to the accuracy or completeness of the contents of this work and specifically disclaim all warranties, including without limitation warranties of fitness for a particular purpose. No warranty may be created or extended by sales or promotional materials. The advice and strategies contained herein may not be suitable for every situation. This work is sold with the understanding that the publisher is not engaged in rendering legal, accounting, or other professional services. If professional assistance is required, the services of a competent professional person should be sought. Neither the publisher nor the author shall be liable for damages arising herefrom. The fact that an organization or Web site is referred to in this work as a citation and/or a potential source of further information does not mean that the author or the publisher endorses the information the organization or Web site may provide or recommendations it may make. Further, readers should be aware that Internet Web sites listed in this work may have changed or disappeared between when this work was written and when it is read.

For general information on our other products and services or to obtain technical support, please contact our Customer Care Department within the U.S. at (877) 762-2974, outside the U.S. at (317) 572-3993 or fax (317) 572-4002.

Wiley publishes in a variety of print and electronic formats and by print-on-demand. Some material included with standard print versions of this book may not be included in e-books or in print-on-demand. If this book refers to media such as a CD or DVD that is not included in the version you purchased, you may download this material at http://booksupport.wiley.com. For more information about Wiley products, visit www.wiley.com.

Library of Congress Control Number: 2011945005

TRADEMARKS: Wiley, the Wiley logo, and the Sybex logo are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates, in the United States and other countries, and may not be used without written permission. All other trademarks are the property of their respective owners. John Wiley & Sons, Inc. is not associated with any product or vendor mentioned in this book.

#### Dear Reader,

Thank you for choosing *3D Animation Essentials*. This book is part of a family of premium-quality Sybex books, all of which are written by outstanding authors who combine practical experience with a gift for teaching.

Sybex was founded in 1976. More than 30 years later, we're still committed to producing consistently exceptional books. With each of our titles, we're working hard to set a new standard for the industry. From the paper we print on, to the authors we work with, our goal is to bring you the best books available.

I hope you see all that reflected in these pages. I'd be very interested to hear your comments and get your feedback on how we're doing. Feel free to let me know what you think about this or any other Sybex book by sending me an email at nedde@wiley.com. If you think you've found a technical error in this book, please visit http://sybex.custhelp.com. Customer feedback is critical to our efforts at Sybex.

Best regards,

NEIL EDDE

Vice President and Publisher Sybex, an Imprint of Wiley To my wife, Heather, and my boys, Ollie and Max, thank you for all of the patience you have shown me during all of my fretting and for picking up my slack around the house to allow me to complete this project.

### **ACKNOWLEDGMENTS**

This book allowed me to write out in a formal form information I am asked about weekly as a professor at Ball State University—questions such as What kind of jobs are there in 3D animation? and Where will I have to move to, to work in 3D animation? To the prospective students and their parents who have been asking these questions, this book is for you.

I would first like to thank my fantastic wife for supporting me during the writing of this book. Also I would like to thank Mariann Barsolo for giving me the chance to write this book and for helping me through the whole process. Thanks to Candace English, my development editor, for helping me make this book understandable and worth reading. Thank you to my technical editor, Keith Reicher, for helping me keep it real and correct. I would like to thank Larry Richman for giving me a recommendation that started this whole endeavor and for giving me my start in the education world. I would also like to thank the entire Sybex production team for making this book look great. I would like to thank everyone who helped me by talking about his book and creating images for me to use. They look good.

## **ABOUT THE AUTHOR**

Andy Beane is an animation artist who has been teaching and working in the field since 2002. He currently oversees the animation major at Ball State University in Indiana and previously taught animation at the Art Institute of California–Orange County. His production experience includes a children's television show pilot with Xzault Studio, "Coming Undone" music video, and Barnyard from Paramount Pictures. He wrote curriculum for the Autodesk Animation Academy 2010 and is also a board member of the MG Collective, an Indiana-based motion graphics and animation community group. He has an MFA in computer animation from the Academy of Art University in San Francisco.

# CONTENTS AT A GLANCE

	Introduction	xiii
CHAPTER 1	3D Animation Overview	1
CHAPTER 2	Getting to Know the Production Pipeline	21
CHAPTER 3	Understanding Digital Imaging and Video	55
CHAPTER 4	Exploring Animation, Story, and Pre-visualization	83
CHAPTER 5	Understanding Modeling and Texturing	135
CHAPTER 6	Rigging and Animation	177
CHAPTER 7	Understanding Visual Effects, Lighting, and Rendering	213
CHAPTER 8	Hardware and Software Tools of the Trade	249
CHAPTER 9	Industry Trends	275
APPENDIX A	Answers to Review Questions	291
APPENDIX B	Gaining Insight into 3D Animation Education	299
APPENDIX C	Learning from Industry Pros	313
	Index	327

# **CONTENTS**

	Introduction	xiii
CHAPTER 1	3D Animation Overview	1
	Defining 3D Animation	1
	Exploring the 3D Animation Industry	2
	Entertainment	2
	Scientific	4
	Other	
	The History of 3D Animation	
	Early Computers	10
	1960s: The Dawn of Computer Animation	11
	1970s: The Building Blocks of 3D Animation	12
	1980s: The Foundations of Modern Computing	14
	1990s: 3D Animation Achieves Commercial Success	
	2000s: The Refining of 3D Animation	
	The Essentials and Beyond	
CHAPTER 2	Getting to Know the Production Pipeline	21
	Understanding the Production Pipeline's Components	21
	Working in 3D Animation Preproduction	
	Idea/Story	25
	Script/Screenplay	27
	Storyboard	28
	Animatic/Pre-visualization	
	Design	30
	Working in 3D Animation Production	33
	Layout	
	Research and Development	36
	Modeling	37
	Texturing	39
	Rigging/Setup	40
	Animation	41
	3D Visual Effects	41
	Lighting/Rendering	42

	Working in 3D Animation Postproduction	43
	Compositing	44
	2D Visual Effects/Motion Graphics	44
	Color Correction	44
	Final Output	45
	Using Production Tools	45
	Production Bible	46
	Folder Management and Naming Conventions	52
	The Essentials and Beyond	52
CHAPTER 3	Understanding Digital Imaging and Video	55
	Understanding Digital Imaging	55
	Pixels	
	Raster Graphics vs. Vector Graphics	
	Anti-Aliasing.	
	Basic Graphic-File Formats	
	Channels	
	Color Depth or Bit Depth	
	Color Calibration	
	Understanding Digital Video	
	Resolution, Device Aspect Ratio, and Pixel Aspect Ratio	
	Safe Areas	
	Interlaced and Progressive Scanning	
	Compression.	
	Frame Rate and Timecode	
	Digital Image Capture	
	The Essentials and Beyond	
CHAPTER 4	Exploring Animation, Story, and Pre-visualization	83
	Using Principles of Fine Art and Traditional Animation	83
	Modeling	84
	Texturing/Lighting	87
	Character Animation	93
	VFX	104
	Building a Good Story	105
	Story Arc	105
	Character, Goal, and Conflict	106
	The Hero's Journey	110
	Other Storytelling Principles	112