BINUS UNIVERSITY INTERNATIONAL BINUS UNIVERSITY

Computer Science Major

Multimedia Stream

Sarjana Komputer Thesis

Semester Even year 2008

Street Skateboarding Theory Simulation:

Character Movement and Environment

Meriyana Citrawati 0800766172

Abstract

The objective of this thesis is to analyze the current learning media of street skateboarding, build a new skateboarding learning media using computer graphic software with 3D technology. To help people to learn skateboarding through a street skateboarding theory simulation, more than one viewing angle for learning skateboarding tricks and slow motion feature to aid users.

The analysis of the current learning media and enthusiasts will be made by interviewing a pro skater and distribute questionnaire to all people both skaters and non skaters. From the questionnaires, pie charts will be used to explain the details of the current learning media and enthusiasts' type. The results of the questionnaire will be used to create the street skateboarding theory simulation. The Waterfall method will be used to make a mock-up of the simulation so that the users could see and try out the simulation.

The result of this thesis is that this Street Skateboarding Theory Simulation will be created as a new learning media to help people, both skater and non skater, in learning skateboarding tricks and also to solve problems of learning skateboard through other media.

To conclude, this Street Skateboarding Theory Simulation is aimed to help people to learn street skateboarding.

Keywords: Skateboarding, Simulation, Computer graphic software, Waterfall method.

ACKNOWLEDGEMENT

First of all, I would like to thank God that I can complete my education in BiNus. Without His blessings, I would never have my health, knowledge, patience, and passion to make this thesis. I would also like to thank my parents for their endless patience, kindness, care, and support through my whole life, without them I would never be what I am now. I am grateful to have my sharing partner, Aditya Krisna, to encourage, support, and be with me through all of the bad and good times together.

My appreciation and gratitude for all the lecturers in Bina Nusantara International who have passed onto me a lot of valuable knowledge and skills in these 4 years of study. Special thanks to Mr. Erwin Adi, my supervisor, for all the guidance, critics, support and kindness that I have received in terms of the ideas and corrections throughout this thesis.

I would like to express gratitude to pro skater Firman Boesly for granting me the interviews and also all the respondents who kindly have spared their time to answer the questionnaires and test my thesis. They were open and cooperative during the process of interviews and testing process giving me very valuable comments and critics which no doubt was crucial for this thesis. Their answers and feedback have definitely helped me a lot.

Last but not least, I will not forget to thank my friends, particularly students of Computer Science batch 2008 for being such great buddies and for all the wonderful times.

TABLE OF CONTENTS

COVER PAGE	I
TITLE PAGE	II
CERTIFICATE OF APPROVAL.	III
STATEMENT OF BOARD OF EX	KAMINER IV
ABSTRACT	V
ACKNOWLEDGEMENT	VII
TABLE OF CONTENTS	IX
LIST OF FIGURES	XVII
CHAPTER 1	ERROR! BOOKMARK NOT DEFINED.
INTRODUCTION	ERROR! BOOKMARK NOT DEFINED.
1.1 BACKGROUND	ERROR! BOOKMARK NOT DEFINED.
1.2 SCOPE	ERROR! BOOKMARK NOT DEFINED.
1.2.1 Assumption	Error! Bookmark not defined.
1.2.2 Constraints	Error! Bookmark not defined.
1.3 AIMS AND BENEFITS	ERROR! BOOKMARK NOT DEFINED.
1.4 STRUCTURES	ERROR! BOOKMARK NOT DEFINED.
CHAPTER 2	ERROR! BOOKMARK NOT DEFINED.

THEORETICAL FOUNDATIONERROR! BOOKMARK NOT DEFINED.

2.1	SKATEBOARDING	ERROR! BOOKMARK NOT DEFINED.
2	2.1.1 Skateboarding style	Error! Bookmark not defined.
	2.1.1.1 Street skateboarding	Error! Bookmark not defined.
	2.1.1.2 Vertical skateboarding	Error! Bookmark not defined.
2	2.1.2 Skateboard parts	Error! Bookmark not defined.
	2.1.2.1 Deck	Error! Bookmark not defined.
	2.1.2.2 Grip Tape	Error! Bookmark not defined.
	2.1.2.3 Trucks	Error! Bookmark not defined.
	2.1.2.4 Wheels	Error! Bookmark not defined.
	2.1.2.5 Bearings	Error! Bookmark not defined.
2.2	SIMULATION	ERROR! BOOKMARK NOT DEFINED.
2	2.2.1 Live Simulation	Error! Bookmark not defined.
2	2.2.2 Virtual Simulation	Error! Bookmark not defined.
2	2.2.3 Constructive Simulation	Error! Bookmark not defined.
2.3	MODELING	ERROR! BOOKMARK NOT DEFINED.
2	2.3.1 Box Modeling	Error! Bookmark not defined.
2	2.3.2 Character Sheet	Error! Bookmark not defined.
2	2.3.3 Polygon Modeling / Component Modeling	Error! Bookmark not defined.
2	2.3.4 Low-poly	Error! Bookmark not defined.
2.4	TEXTURE MAPPING	ERROR! BOOKMARK NOT DEFINED.
2.5	CHARACTER RIGGING	ERROR! BOOKMARK NOT DEFINED.
2	2.5.1 Bones	Error! Bookmark not defined.
2	2.5.2 Rigging	Error! Bookmark not defined.

2.5.3 SkinningError! Bookmark not define	?d.
2.6 ANIMATION ERROR! BOOKMARK NOT DEFINE	D.
2.7 RENDERING ERROR! BOOKMARK NOT DEFINE	D.
2.8 COMPUTER GRAPHIC ERROR! BOOKMARK NOT DEFINE	D.
2.9 COMPUTER GRAPHICS PROGRAM ERROR! BOOKMARK NOT DEFINE	D.
2.10 WATERFALL SOFTWARE DEVELOPMENT LIFE CYCLE MODEL ERROR! BOOKMAN	₹K
NOT DEFINED.	
HAPTER 3ERROR! BOOKMARK NOT DEFINE	D.
ROBLEM ANALYSISERROR! BOOKMARK NOT DEFINE	D.
3.1 CURRENT SKATEBOARDING LEARNING MEDIA ERROR! BOOKMARK NOT DEFINE	D.
3.2 FUNDAMENTAL RESEARCH ERROR! BOOKMARK NOT DEFINE	D.
3.3 SKATEBOARDING SAFETY EQUIPMENT ERROR! BOOKMARK NOT DEFINE	D.
3.4 SKATEBOARDING STANCES ERROR! BOOKMARK NOT DEFINE	D.
3.5 STREET SKATEBOARDING TRICKS ERROR! BOOKMARK NOT DEFINE	D.
3.5.1 Pushing or Roll in Error! Bookmark not define	?d.
3.5.2 Braking	?d.
3.5.2.1 By foot Error! Bookmark not define	ed.
3.5.2.2 By board	ed.
3.5.3 Carving Error! Bookmark not define	?d.
3.5.4 Switch or Revert Error! Bookmark not define	?d.
3.5.5 KickturnsError! Bookmark not define	?d.
3.5.6 OllieError! Bookmark not define	?d.
3.5.7 Manual Error! Bookmark not define	₽d.

3.5.8	Nollie	Error! Bookmark not defined.
3.5.9	Shove-it	Error! Bookmark not defined.
3.5.10	Pop Shove-it	Error! Bookmark not defined.
3.5.11	Kickflip	Error! Bookmark not defined.
3.5.12	Heelflip	Error! Bookmark not defined.
3.5.13	Noseslide	Error! Bookmark not defined.
3.5.14	50-50 Grind	Error! Bookmark not defined.
3.5.15	5-0 Grind	Error! Bookmark not defined.
3.5.16	Boardslide	Error! Bookmark not defined.
3.6 T	'ARGET USER	ERROR! BOOKMARK NOT DEFINED.
3.7 C	CAMERA ANGLE	ERROR! BOOKMARK NOT DEFINED.
3.8 T	HE CONSIDERED TOOLS TO BE USED	ERROR! BOOKMARK NOT DEFINED.
3.7.1 3	ds max	Error! Bookmark not defined.
3.7.2 N	Лауа	Error! Bookmark not defined.
3.7.3 L	.ightWave	Error! Bookmark not defined.
3.9 T	EXTURE MAPPING	ERROR! BOOKMARK NOT DEFINED.
3.8.1 B	Bump Mapping	Error! Bookmark not defined.
3.8.2 N	Normal Mapping	Error! Bookmark not defined.
3.8.3 L	JVW Mapping and Unwrap UVW	Error! Bookmark not defined.
СНАРТЕ	R 4	ERROR! BOOKMARK NOT DEFINED.
SOLUTIO	N DESIGN	ERROR! BOOKMARK NOT DEFINED.
4.1 CHAR	ACTER MODELING	ERROR! BOOKMARK NOT DEFINED.
4.1.1 M	Modeling the Body	Error! Bookmark not defined.

andsError! Bookmark not defined.	4.1.2 Modeling the Arms
etError! Bookmark not defined.	4.1.3 Modeling the Legs of
Error! Bookmark not defined.	4.1.4 Modeling Head
G ERROR! BOOKMARK NOT DEFINED.	4.2 CHARACTER TEXTURE M
Error! Bookmark not defined.	4.2.1 Head Texture Mapp
Error! Bookmark not defined.	4.2.2 Body Texture Mapp
Error! Bookmark not defined.	4.2.3 Multi/Sub-Object M
ERROR! BOOKMARK NOT DEFINED.	4.3 CHARACTER RIGGING
TEXTURE MAPPING. ERROR! BOOKMARK NOT DEFINED.	4.4 Environment Modelin
Error! Bookmark not defined.	4.4.1 Skateboard
Error! Bookmark not defined.	4.4.1.1 Deck
Error! Bookmark not defined.	4.4.1.2 Trucks
Error! Bookmark not defined.	4.4.1.2.1 The hanger
Error! Bookmark not defined.	4.4.1.2.2 The axle
Error! Bookmark not defined.	4.4.1.2.3 The base pla
Error! Bookmark not defined.	4.4.1.2.4 The kingpin
Error! Bookmark not defined.	_
Error! Bookmark not defined.	4.4.1.3 Bearings
Error! Bookmark not defined.	
Error! Bookmark not defined.	4.4.2 Ground
Error! Bookmark not defined.	4.4.3 Fountain
Error! Bookmark not defined.	4.4.4 Rails
Error! Bookmark not defined.	4.4.5 Traffic Cone
ERROR! BOOKMARK NOT DEFINED.	4.5 CYCLIC ANIMATION
ERROR! ROOKMARK NOT DEFINED	4 6 ΑΝΙΜΑΤΙΟΝ

4.6.1 Manual trick animation
4.6.2 Nollie trick animation Error! Bookmark not defined.
4.6.3 Shove it trick animation Error! Bookmark not defined.
4.6.4 Pop shove it trick animation Error! Bookmark not defined.
4.6.5 Heel flip trick animation Error! Bookmark not defined.
4.6.6 Nose slides trick animation Error! Bookmark not defined.
4.6.7 50-50 grind trick animation Error! Bookmark not defined.
4.6.8 5-0 grind trick animation Error! Bookmark not defined.
4.6.9 Board slide trick animation
4.7 RENDERING ERROR! BOOKMARK NOT DEFINED.
4.7.1 Lighting Error! Bookmark not defined.
4.7.2 CameraError! Bookmark not defined.
4.8 SOUND
4.8 SOUND
4.9 Final Delivery Error! Bookmark not defined.
4.9 FINAL DELIVERY

5.4.4 Question 16 Error! Bookmark not defined.		
5.4.5 Question 17 Error! Bookmark not defined.		
5.4.6 Question 19 Error! Bookmark not defined.		
5.4.7 Question 20 Error! Bookmark not defined.		
5.4.8 Question 21 Error! Bookmark not defined.		
CHAPTER 6ERROR! BOOKMARK NOT DEFINED.		
EVALUATION ERROR! BOOKMARK NOT DEFINED.		
6.1 SELF EVALUATION ERROR! BOOKMARK NOT DEFINED.		
6.1.1 Modeling Error! Bookmark not defined.		
6.1.2 Texturing Error! Bookmark not defined.		
6.1.3 Lighting Error! Bookmark not defined.		
6.1.4 Animation		
6.1.5 Video Output Quality		
6.1.6 Environment		
6.2 RESPONDENTS EVALUATION ERROR! BOOKMARK NOT DEFINED.		
CHAPTER 7ERROR! BOOKMARK NOT DEFINED.		
CONCLUSION AND RECOMMENDATIONERROR! BOOKMARK NOT		
DEFINED.		
REFERENCEERROR! BOOKMARK NOT DEFINED.		
CURRICULUM VITAEERROR! BOOKMARK NOT DEFINED.		
APPENDIX AERROR! BOOKMARK NOT DEFINED.		

PRE-DEVELOPMENT QUESTIONNAIRESERROR! BOOKMARK NOT
DEFINED.
APPENDIX BERROR! BOOKMARK NOT DEFINED.
AFTER- DEVELOPMENT QUESTIONNAIRESERROR! BOOKMARK NOT
DEFINED.
APPENDIX CERROR! BOOKMARK NOT DEFINED.
PRE-DEVELOPMENT QUESTIONNAIRES RESULTS ERROR! BOOKMARK
NOT DEFINED.
APPENDIX DERROR! BOOKMARK NOT DEFINED.
AFTER-DEVELOPMENT QUESTIONNAIRES RESULTS ERROR! BOOKMARK
NOT DEFINED.

LIST OF FIGURES

Figure 1 Street skateboarding [3]	Error! Bookmark not defined.
Figure 2 Vertical skateboarding [4].	Error! Bookmark not defined.
Figure 3 Skateboard parts [5]	Error! Bookmark not defined.
Figure 4 Skateboard deck [6]	Error! Bookmark not defined.
Figure 5 Grip tape [7].	Error! Bookmark not defined.
Figure 6 Skateboard trucks [6]	Error! Bookmark not defined.
Figure 7 Elements of skateboard trucks [8]	Error! Bookmark not defined.
Figure 8 Skateboard wheel [6]	Error! Bookmark not defined.
Figure 9 Skateboard bearings [9].	Error! Bookmark not defined.
Figure 10 Skateboard bearings elements [10]	Error! Bookmark not defined.
Figure 11 A vertex, face, polygon, and an edge [12]	Error! Bookmark not defined.
Figure 12 An example of a character sheet [13]	Error! Bookmark not defined.
Figure 13 An example of polygon modeling [14]	Error! Bookmark not defined.
Figure 14 An example of low-poly model [12]	Error! Bookmark not defined.
Figure 15 An example of character rigging [12]	Error! Bookmark not defined.

Figure 16 An example of bones [12]. Error! Bookmark not defined.

Figure 17 An example of a character completely skinned [12]. Error! Bookmark not defined.

Figure 18 An example of character animation [12]. Error! Bookmark not defined.

Figure 19 The track view windows in 3ds Max [12]. Error! Bookmark not defined.

Figure 20 The classic waterfall development model [16]..... Error! Bookmark not defined.

Figure 21 Pie chart for "How do you learn skateboarding?"......Error! Bookmark not defined.

Figure 29 Kickturns. (Skater: Stanley Ariyanto)...... Error! Bookmark not defined.

Figure 30 Ollie. (Skater: Krisna Aditya)	Error! Bookmark not defined.
Figure 31 Manual. (Skater: Stanley Ariyanto)	Error! Bookmark not defined.
Figure 32 Nollie. (Skater: Stanley Ariyanto)	Error! Bookmark not defined.
Figure 33 Shove-it. (Skater: Krisna Aditya)	Error! Bookmark not defined.
Figure 34 Pop Shove-it. (Skater: Krisna Aditya)	Error! Bookmark not defined.
Figure 35 Skateboard parts. (Skater: Krisna Aditya)	Error! Bookmark not defined.
Figure 36 Heelfip. (Skater: Hajime Nakano)	Error! Bookmark not defined.
Figure 37 Noseslide. (Skater: Krisna Aditya)	Error! Bookmark not defined.
Figure 38 50-50 grind. (Skater: Stanley Ariyanto)	Error! Bookmark not defined.
Figure 39 5-0 grind. (skater: Stanley Ariyanto)	Error! Bookmark not defined.
Figure 40 Boardslide. (skater: Stanley Ariyanto)	Error! Bookmark not defined.
Figure 41 Pie chart for "How can you categorize yourse	elf as a skater?" Error!
Bookmark not defined.	
Figure 42 Pie chart for "What is the best character view	v for learning a trick in
skateboarding from a simulation video?"	Error! Bookmark not defined.
Figure 43a A sphere without bump map applied [20]	Error! Bookmark not defined.

Figure 43b A sphere with bump map applied which gives the appearance of a bumpy texture resembling that of an orange [21]. Error! Bookmark not defined. Figure 44 Simple steps in applying UVW mapping to the model [22]. Error! Bookmark not defined. Figure 45 An image on how the model will be roughly [23].......Error! Bookmark not defined. Figure 46 Rough body shape from front, side, and perspective view... Error! Bookmark not defined. Figure 47 Complete modeling for body along with t-shirt...... Error! Bookmark not defined. Figure 48 Complete modeling for body along with t-shirt and hands. . Error! Bookmark not defined. Figure 49 Complete modeling for body along with t-shirt, hands, and legs..... Error! Bookmark not defined. Figure 50a The final shoe modeling. Error! Bookmark not defined. Figure 50b Complete modeling for body along with clothes and shoes on...... Error!

Figure 51 An edge loop to make the eye socket. Error! Bookmark not defined.

Bookmark not defined.

Figure 52 Complete head modeling Error! Bookmark not defined.
Figure 53 The edit UVW's from head model Error! Bookmark not defined.
Figure 54 The complete UVW texture map for the head modelError! Bookmark not
defined.
Figure 55 The edit UVW's from the body and shoes modelError! Bookmark not
defined.
Figure 56 The complete UVW texture map for the body. Error! Bookmark not defined.
Figure 57 The complete bump map for the bodyError! Bookmark not defined.
Figure 58 Multi/Sub-Object Window with 2 id set number Error! Bookmark not
defined.
Figure 59 The complete textured character modeling Error! Bookmark not defined.
Figure 60 The biped character model Error! Bookmark not defined.
Figure 61 The character model mesh after applying physiqueError! Bookmark not
defined.
Figure 62 The envelope for the left thigh Error! Bookmark not defined.
Figure 63 The envelope for the head Error! Bookmark not defined.
Figure 64 The skateboard model Error! Bookmark not defined.

Figure 65 The deck model.	Error! Bookmark not defined.
Figure 66 The texture for the deck	Error! Bookmark not defined.
Figure 67 The textured deck.	Error! Bookmark not defined.
Figure 68 The hanger model.	Error! Bookmark not defined.
Figure 69 Hanger's texture.	Error! Bookmark not defined.
Figure 70 The textured hanger.	Error! Bookmark not defined.
Figure 71 The axle model.	Error! Bookmark not defined.
Figure 72 The textured axle.	Error! Bookmark not defined.
Figure 73 The base plate model	Error! Bookmark not defined.
Figure 74 The textured base plate model	Error! Bookmark not defined.
Figure 75 The textured kingpin and kingpin nut model.	. Error! Bookmark not defined.
Figure 76 The textured bushing model	Error! Bookmark not defined.
Figure 77 The bearings elements models	Error! Bookmark not defined.
Figure 78 The textured bearings.	Error! Bookmark not defined.
Figure 79 The rectangle forms into a wheel.	Error! Bookmark not defined.
Figure 80 The wheel model.	Error! Bookmark not defined.

Figure 81 The textured wheel model	Error! Bookmark not defined.
Figure 82 The rendered street model.	Error! Bookmark not defined.
Figure 83 The road texture and pavement texture. (left	to right)Error! Bookmark not
defined.	
Figure 84 The rendered flooring covered ground model	. Error! Bookmark not defined.
Figure 85a The center fountain model	Error! Bookmark not defined.
Figure 85b The pool model	Error! Bookmark not defined.
Figure 86 The rendered complete fountain model	Error! Bookmark not defined.
Figure 87 The rendered rail model	Error! Bookmark not defined.
Figure 88 The traffic cone model	Error! Bookmark not defined.
Figure 89 The textured traffic cone model	Error! Bookmark not defined.
Figure 90 Typical foot action [24].	Error! Bookmark not defined.
Figure 91 Wrongly skinned for the thigh biped object	Error! Bookmark not defined.
Figure 92 Some skater respondents.	Error! Bookmark not defined.
Figure 93 Pie chart for "Quality of still pictures"	Error! Bookmark not defined.
Figure 94Pie chart for "Quality of animations"	Error! Bookmark not defined.
Figure 95 Pie chart for "Do the video angles useful?"	Error! Bookmark not defined.

Figure 96Pie chart for "Does the slow motion feature useful?"Error! Bookmark not
defined.
Figure 97Pie chart for "Can you observer the tricks movement clearly?" Error!
Bookmark not defined.
Figure 98Pie chart for "Do you skate or have you?" Error! Bookmark not defined.
Figure 99Pie chart for "Do you think that you (or skaters) can learn skateboarding using
this simulation?" Error! Bookmark not defined.
Figure 100 Pie chart for "Do you think this simulation s more helpful for you to learn
skateboarding rather than watching skate videos?" Error! Bookmark not defined.