3D Automotive Modeling

An Insider's Guide to 3D Car Modeling and Design for Games and Film

Andrew Gahan

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To the members of the www.3d-for-games.com/forum and the rest of my friends.

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Foreword

What a decade of advancements in interactive game technology—to think that only 10 to 15 years ago we were pushing the envelope with car models for PC games that could today run glitch-free in many mobile phone games. We're certainly experiencing an exciting era in game development! However, this never-relenting progression in games technology has a double-edged-sword effect.

Sure, we can now achieve spectacular-looking in-game graphics that almost rival 3D movie content, but at exorbitant costs in time, artist resources, and money. The vehicle models that took 1 week to produce 10 years ago now often take 6 or more weeks to produce. One only need look at the seemingly never-ending delays in the release of GT5 to understand how the eye-candy aspect of game design has spiraled to almost out-of-control levels.

We're almost at the plateau where movie content crosses over into game applications. Although they are still vastly different mediums and still require totally different approaches, we are seeing more artists jumping ship and switching between the mediums without too much difficulty.

To me, one of the most rewarding challenges of creating vehicles for real-time applications has been in using the least amount of geometry to achieve the best possible effect . . . optimization and balance being the critical areas of the design with the desired outcome to produce clean, refined meshes that look pleasing in-game. The advent of bump maps and, more important normal maps has helped add fine detail to models instead of using geometry or relying on texture maps to simulate details. Material shaders, specular maps, ambient occlusion, and advances in lighting technology help provide more realistic-looking metals, rubber, plastics, and glass and in many instances have replaced the use of a diffuse texture map altogether.

Modeling aids such as CAD, 3D scanned data, and digitized data can remove much of the guesswork from modeling and help produce very accurate models, although at the expense of removing much of the creative or artistic challenge, and thus making the modeling process a more sterile experience.

As for vehicle artists themselves, what makes them so passionate about wanting to create digital vehicles?

From my own personal experience, it was my love of cars, motorsports, racing games, and art that prompted me to look into 3D modeling apps and teach myself how to model vehicles.

Foreword

I see this same passion in many of the vehicle artists who have worked with me over the years: their love of all things automotive, often combined with a need to express themselves (artistically) initiated their delving into 3D. For many this passion eventually leads to pursuing a career as a 3D artist.

My 3D modeling quest began almost 20 years ago, and, as I've already mentioned, technology has progressed in leaps and bounds since then, as have learning aids, such as online tutorials, Internet forums, videos, and the modeling tools themselves. Finally we have a book that is dedicated to the subject. Whether you are a professional artist or a beginner, I hope you learn from this book and, more important, enjoy the experience.

Chris Wise

Managing Director,

Virtual Mechanix

Introduction

Important Information About this Book

First of all, I'd like to start off with a little bit of important information about this book.

First, this is not a book for complete beginners. If you are new to modeling for games and are looking for simple tutorials to get you up to speed, start off with *3ds Max Modeling for Games* (2008) by Andrew Gahan or the training videos *Max in Minutes* and *Maya in Minutes* from Focal Press.

This will give you all of the basics to get your modeling up to speed. You should also have registered at www.3d-for-games.com/forum. This is a dedicated forum designed to help you through the tutorials of all the books and tutorials I've written, as well as answer any questions you may have about 3D, Games, CGI, or anything else. Just log in and we will be on hand to help you with anything you may need. There are also regular competitions and threads to showcase your work and post your work in progress for help and advice, among a myriad of other topics.

Why This Book Was Written

This book is designed to bring the two important skills of design and modeling together and to feature some of the best designers and modelers in the industry. I have produced this book to showcase how ideas start from nothing, go through a design phase, move on to blueprints, and then finally finish rendered as 3D models. I want to show you exactly how the professionals work, in their words, revealing exactly how they work, how they solve problems, and how they earn a living designing and modeling vehicles for games, films, and the vehicle manufacturers themselves.

Having worked in the games industry for almost 20 years and worked on lots of titles with scores of professional designers and modelers, I knew exactly who to ask to help me with this project.

About the Guest Writers

Let me introduce you to the guest writers and let them tell you a little about themselves in their own words. These guys are at the top of their game and a pleasure to work with. They always amaze me with their talent, skill, and dedication, and it's an honor for them to be part of this project.

Introduction

Brook Middlecott Banham

I was born in Abilene, Texas, and raised in the United Kingdom. My mother is Texan and my father is English. I adopted my father's passion for cars and my mother's artistic talents and started drawing cars at the early age of three. To the horror of my mother, my very first word was "Pontiac."

I got my first degree at Coventry University in transport design in 2000 and since have worked with an international range of clients, including Volkswagen, Microsoft, Hewlett Packard, Puma, BMW, Frog Design, Astro Studios, Hot Wheels, Motorola, and Disney.

Since 2007 my wife and partner in crime, Judith Banham, and I have run our own design studio, Middlecott Design. I am also currently in the first year of a master's degree program in transport design at the College for Creative Studies (CCS) in Detroit, Michigan.

Tim Brown

I've been obsessed with cars for about as long as I can remember and was always drawing cars as a kid, so I didn't have to think too hard about which career path to follow! After studying transport design at the BA level, I obtained a master's degree in vehicle design at the Royal College of Art in London.

I began my career at the celebrated product design agency Seymourpowell, also in London. Here I worked on a diverse portfolio of projects from helicopter interiors, to consumer electronics, to sex toys (yes, really!). Following on from Seymourpowell, I started working as a designer at Ford Motor Company in the southeast of England and am now based in Germany at Ford's European design studio. I have been lucky also to work on many freelance projects over the past decade, as a designer, concept artist, and illustrator in the product, games, and media industries. Clients have included Sony Computer Entertainment Europe, Evolution Studios, and BBC's *Top Gear* magazine. My favorite tool of the trade is Photoshop, in case you hadn't guessed!

Johal Gow

I am the Lead Vehicle Artist at Simbin Development Team with responsibility for design document creation, creating specifications for upcoming games, managing outsourced artwork and artists, creating in-game and front-end artwork and renders, as well as inputting on all game graphics decisions.

I started out playing around with 3D artwork as a hobby at the age of 14. This seemed like a good way to pass the time compared to what I then considered boring schoolwork. Eventually this turned into a passion and I gained a scholarship for the Diploma of Screen at Qantm (specializing in animation) in Brisbane, Australia.

Shortly after finishing my schooling in 2004, I started in the industry with Virtual Mechanix, producing vehicles for the games Project Gotham Racing 3 and 4 (Bizarre Creations/Microsoft).

I then took the opportunity to work for Simbin Development Team on a contractual basis, which lasted two years before taking the plunge and moving from Australia to be in-house with the Swedish company in 2008. With Simbin, I have helped produce RACE (Simbin/Eidos), Caterham Expansion Pack (Simbin/Eidos),

RACE 07 (Simbin), STCC – The Game (Simbin/Atari), GTR Evolution (Simbin/Atari), Race Pro (Simbin/Atari), Volvo – The Game (Simbin), and Race On (Simbin).

In 2010 I am still enjoying a happy relationship working at Simbin Development Team, but often take contractual work to improve my skills and keep up-to-date with all the latest technologies, the latest such game being Blur (Bizarre Creations/Activision).

Tom Painter

After working with 3D for more than 10 years, and with a firm foothold in the advertising, videogames, and VFX industries, I founded Big Man in 2008 in order to develop my own vision of the future of 3D.

Big Man specializes in the production of stylish 3D content. We have produced complex animations, environments, characters, and graphics for a very wide range of purposes. From cartoon, to realism or hyperreality, we are always looking to raise the bar.

Robert Forest

Born in Trinidad and raised in England, I studied design at Coventry University and the Royal College of Art and trained in Germany and Japan at Honda and Toyota. I since worked as contract designer on a number of transport projects before joining Princess Yachts, where I assumed responsibility for the styling and layout of their latest products, including their forthcoming superyacht.

During this time I continued designing vehicles for Sony PlayStation games and writing for *Car Design News*, this love for all things automotive taking me back to Tokyo where I have spent the past three years working in Honda's advanced design studio.

Finding something new is the biggest challenge for a designer, as consumer values are always evolving. My sensitivity to the tastes of clients and customers plus my innate curiosity have led me to designing a wide array of well-received products, and I continue to relish any opportunity to create.

David Griffiths

I have been in the games industry now for over 12 years. I graduated from Blackpool & The Fylde College (part of Lancaster University) with a degree in technical illustration. I started my career in the automotive industry working freelance on site for a company called I.V.M. in Germany. I then moved naturally into games, first starting out with flight simulators.

Some of my notable roles in the games industry have been working as a Lead Artist for Pandemic Studios in Santa Monica, California, when I worked on Star Wars: The Clone Wars. On Clone Wars I was able to add to the Star Wars Universe where I designed the TX-130s Fighter Tank and the G.A.T. vehicles (among many others), which were used in other games, comics, and story books and have even been made into toys, models, and official Lego kits. The Fighter Tank has a very strong fan base, which is cool. Mercenaries was another great game to work on for Pandemic and Lucas Arts, which hit every major console.

Introduction

I have also had the privilege to work on WRC title games like WRC: Rally Evolved on PS2 and on the well-received franchise PS3 games MotorStorm, MotorStorm: Pacific Rift, and the upcoming MotorStorm: Apocalypse.

Paul Cartwright

In the past I have worked in many areas of art and design, wall murals, sign making, fine art, and footwear design to name a few. In 2007, after spending six years in graphic design, I made the move to freelance and set up Zero 9 Studio to offer my illustrative design services.

I am now completely converted to digital art; the main software I use is Photoshop and Painter. I create artwork in whatever style is required for books, comics, and games. More recently I have been working as a contract concept artist in the video games industry, and this is the work I enjoy the most.

Some of my clients include Sony Computer Entertainment Europe, Evolution Studios, RARE, Microsoft, Corel Painter Magazine, Digital Artist Magazine, Insomnia Publications, and Twenty to Six Comics.

About the Author

I'll keep this short and sweet, as I know your primary interest is how to model the vehicles in the gallery. ☺

I started in the games industry in 1992 as a Junior Artist for Digital Image Design. They came to my college and, after seeing my graphic design work, offered me a summer job making games. I jumped at the chance and, without any portfolio or experience at all, started training on my first game. I progressed to Senior Artist developing flight simulators and military training systems until the studio was bought by Infogrammes around 1998. I became Lead Artist when Infogrammes sold the studio to Rage. I then left and became Art Director at a small start-up called Lightning Interactive. I switched again to join my old friends from Digital Image Design at Evolution Studios (Evolution was set up when Infogrammes bought Digital Image Design with Martin Kenwright leaving, taking six people with him). I progressed through the ranks again at Evolution Studios, becoming Art Manager on some of the later World Rally Championship games on PlayStation 2 and then to Producer/Outsource Manager. I'm now a Senior Development Manager at Sony Computer Entertainment Europe and have been hard at work on the MotorStorm series on PlayStation 3 including MotorStorm, MotorStorm: Pacific Rift, and the newly announced MotorStorm: Apocalypse.

I've written *3ds Max Modeling for Games* (2008), Focal Press, and I edited *Game Art Complete* (2008), Focal Press. I also founded www.3d-for-games.com and www.3d-for-games.com/forum, which has now grown into an extremely friendly and vibrant 3D community where everyone helps out with any 3D-related issues and showcases their work. Specific help and support are given to anyone who registers and logs in. I've also just completed the *Max in Minutes* and *Maya in Minutes* video tutorials for Focal Press, so be sure to check them out to help you master the software in short, bite-size videos.

If you're interested, here is the list of games I have helped to develop:

Robocop 3 (Amiga)

TFX (PC)

Inferno (PC)

EF2000 (PC)

F22—Air Dominance Fighter (PC)

Total Air War (PC)

Wargasm (PC)

GTC Africa (PS2)

World Rally Championship (PS2)

WRC II Extreme (PS2)

WRC 3 (PS2)

WRC 4 (PS2)

WRC 5—Rally Evolved (PS2)

MotorStorm (PS3)

Pursuit Force 2 (PS2)

MotorStorm: Pacific Rift (PS3)

Pacific Rift DLC (PS3)

MotorStorm Apocalypse (PS3)

OK, enough about me, let's get on to the good stuff....

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Chapter 1

Duster Concept

Brook Banham

Initial Idea

The Duster is a no-nonsense, four-wheel-drive sports hybrid with an off-road pedigree. Brave in its reckless attitude, bold in its rebellious nature, and American as apple pie, the Duster is a country girl's/ boy's dream.

It has a recharging facility from clear solar panels integrated into the glass and roof panels. Safety features, including integrated roll cage with exposed roll bars, play a key role in Duster's legacy of keeping occupants alive.

Figure 1.1 *Duster—another American legend.*

Design

For the design of this car I was strongly inspired by classic American muscle cars like Dodge Chargers, Challengers, and Pontiac Trans Ams.
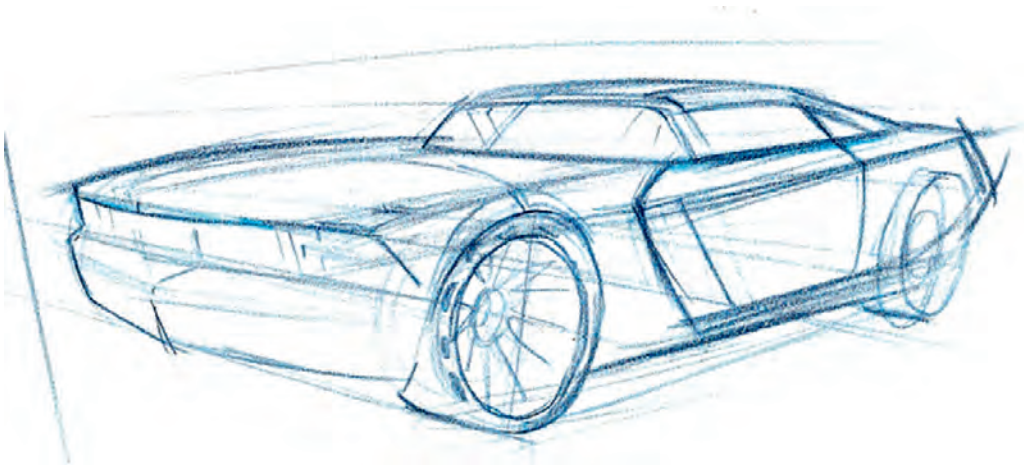
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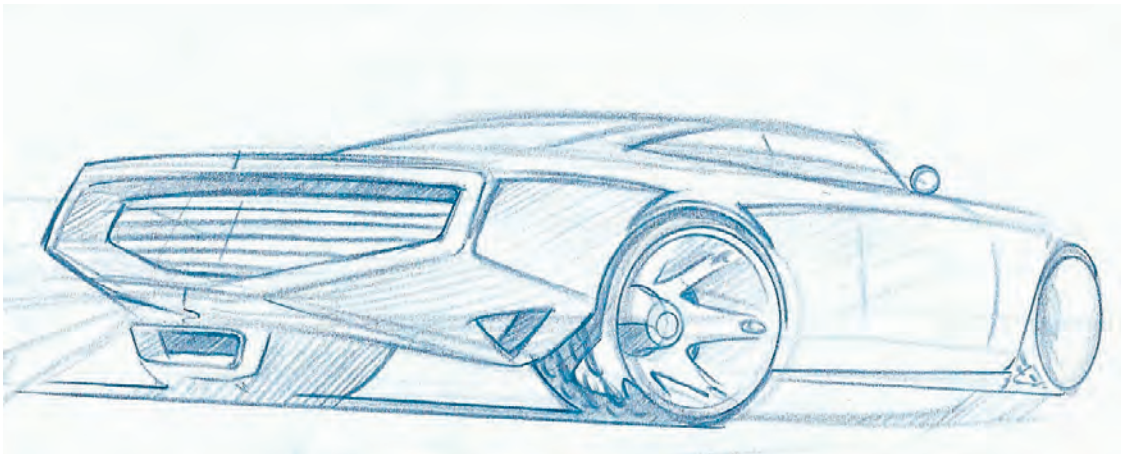
Figure 1.3

I started to get down as many quick ideas as possible, and when there was something I particularly liked, I worked a little more in that direction and continued to produce some very quick ideas.
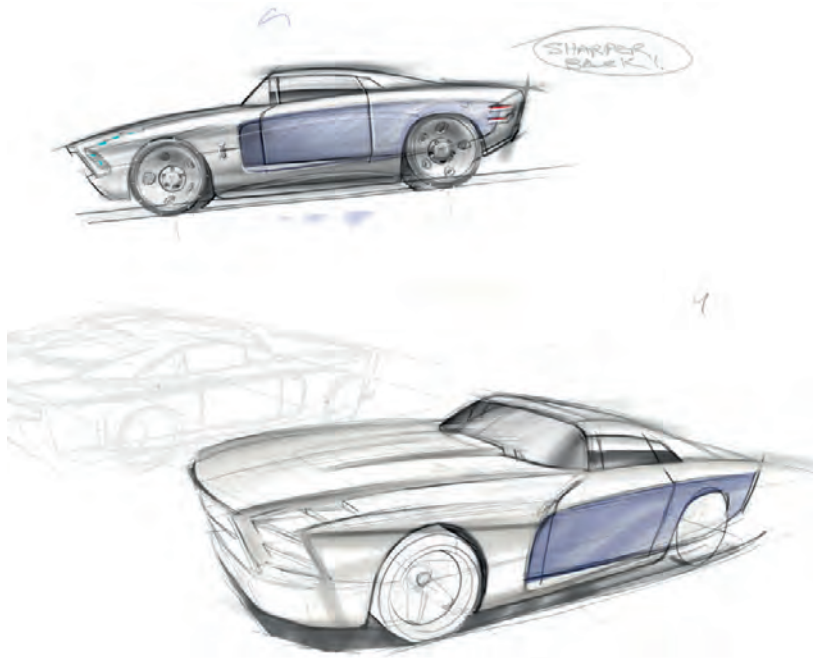
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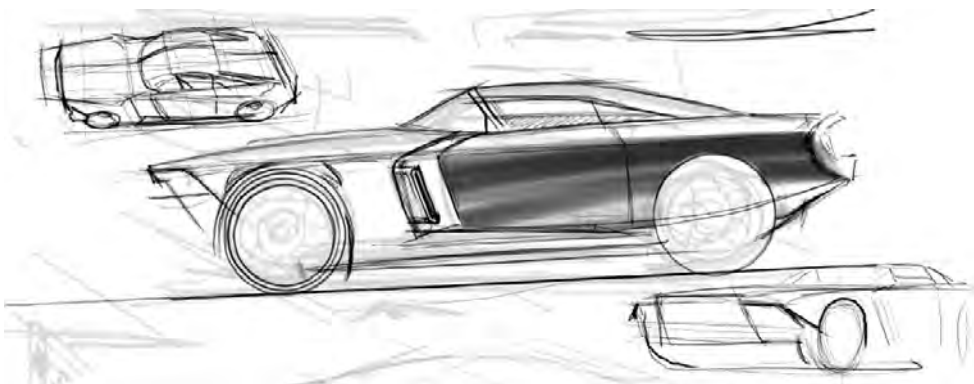
Figure 1.5

Part of the inspiration was coming from classic road movies and shows like *The Dukes of Hazzard*, *Smokey and the Bandit*, *Vanishing Point* and *Thelma and Louise*. Imagine it, driving on dirt roads and through the desert.
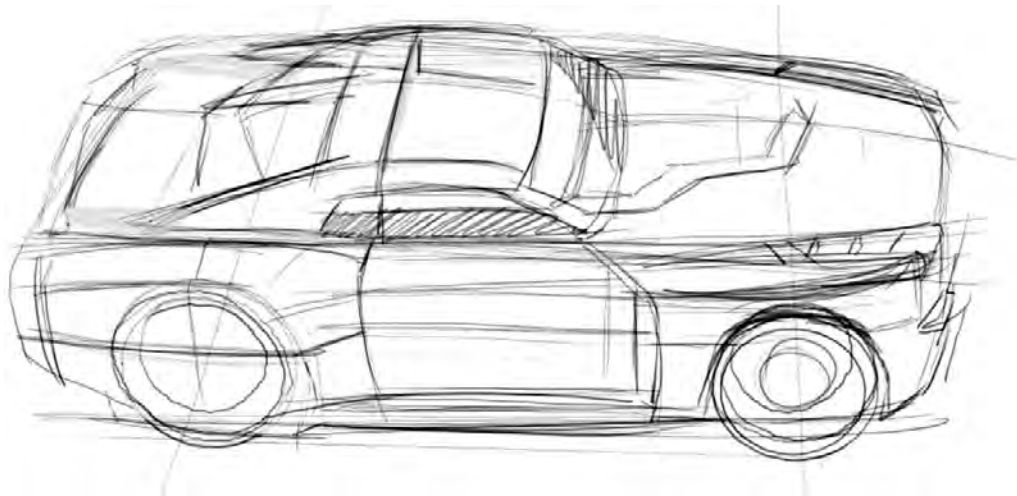
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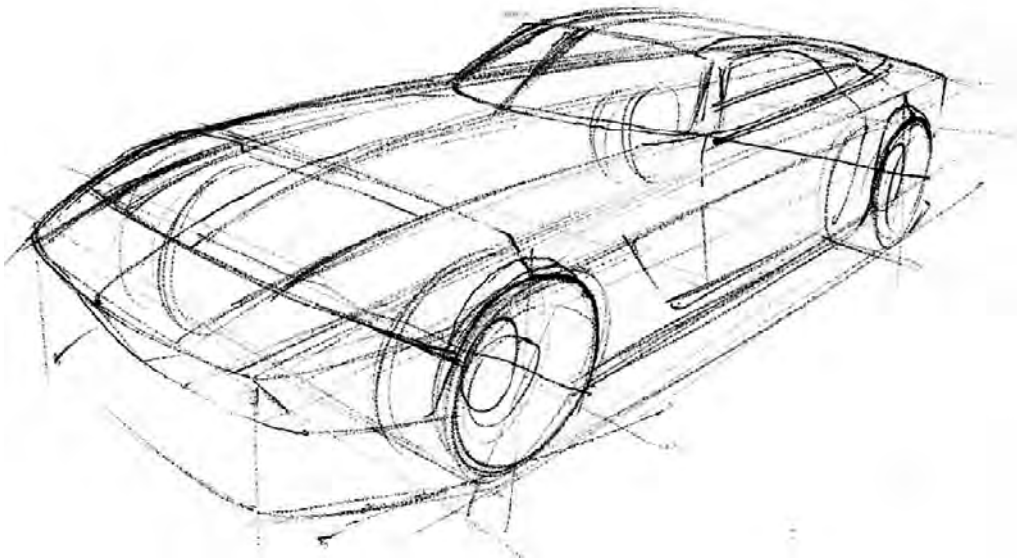
Figure 1.7
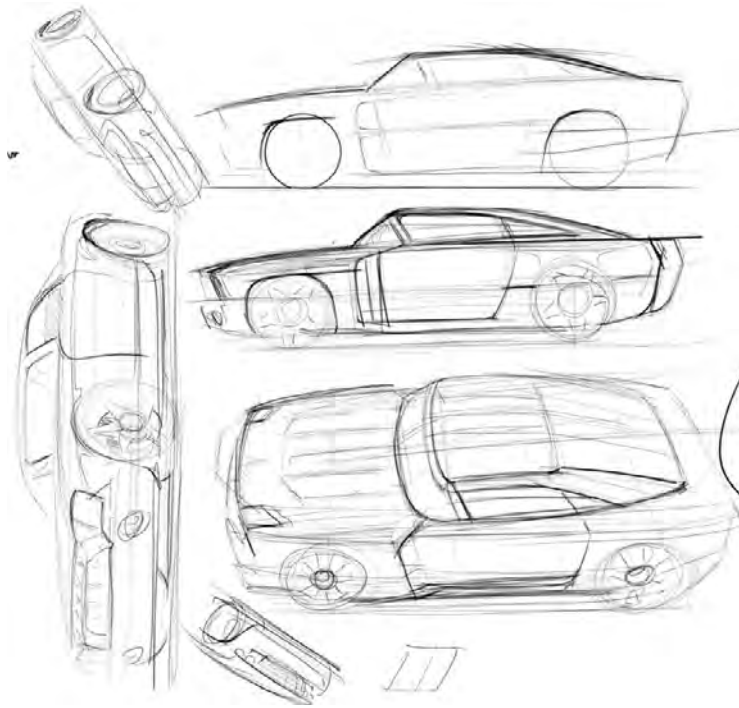
Figure 1.8

For this reason I started to think about details like the roll bars and the front deer guard to add protective qualities to the car, enabling it to drive fast through brush and cacti without getting damaged.
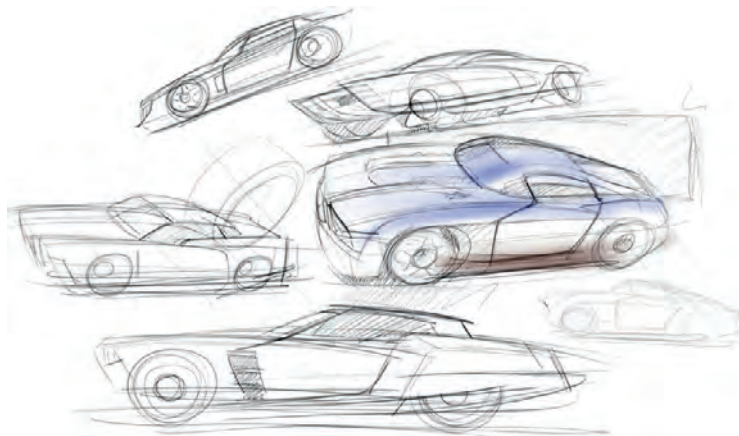
Figure 1.9

This vehicle was also inspired by European rally and Baja car racing, where the cars take a real beating doing jumps and taking knocks.

The Duster is meant to be thrashed and still come out looking okay. This is where much of its styling is coming from, to look rigid and strong, but still sleek and fast.
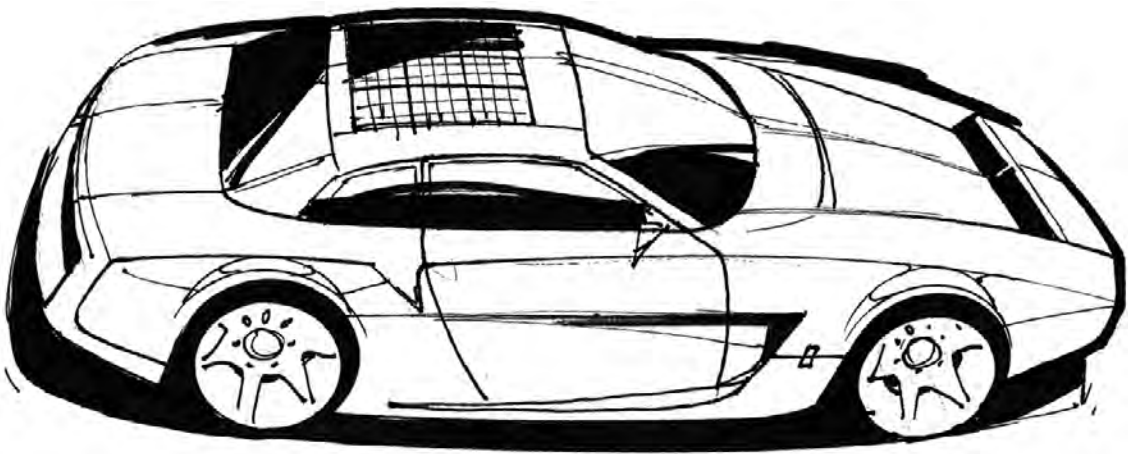
Figure 1.10

Attention is paid to the environment by being hybrid drive—electric and gas. So if it gets stuck in the desert out of petrol/gas, hopefully the windows, which double as solar panels, can help to recharge its batteries and, of course, to reduce the CO_2 emissions.
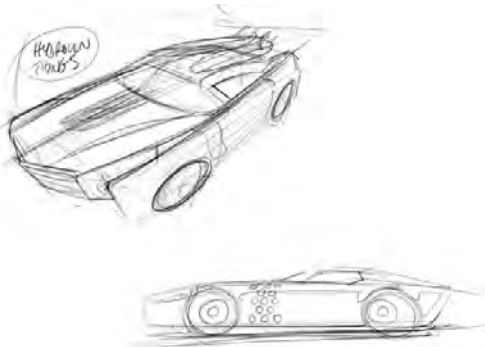
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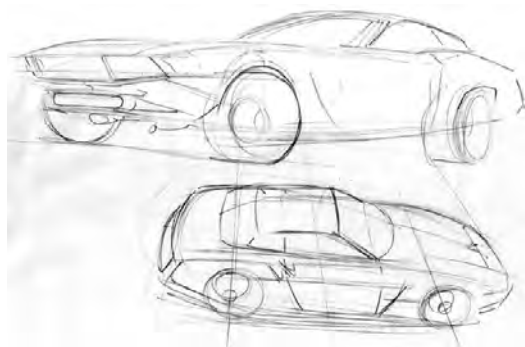
Figure 1.12

The front end has a down force wing incorporated into the bonnet/hood. This is possible due to the reduced size of the engine, allowing room for it.
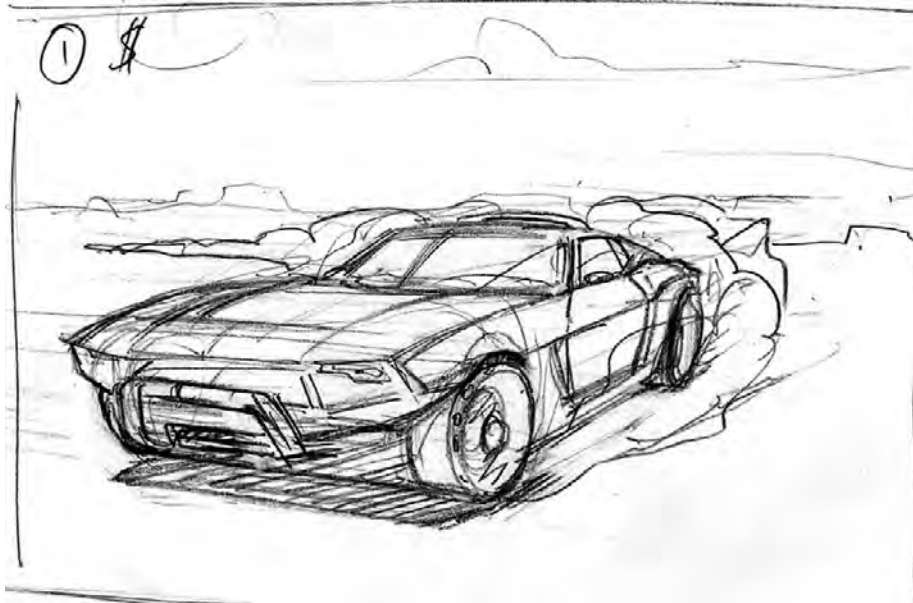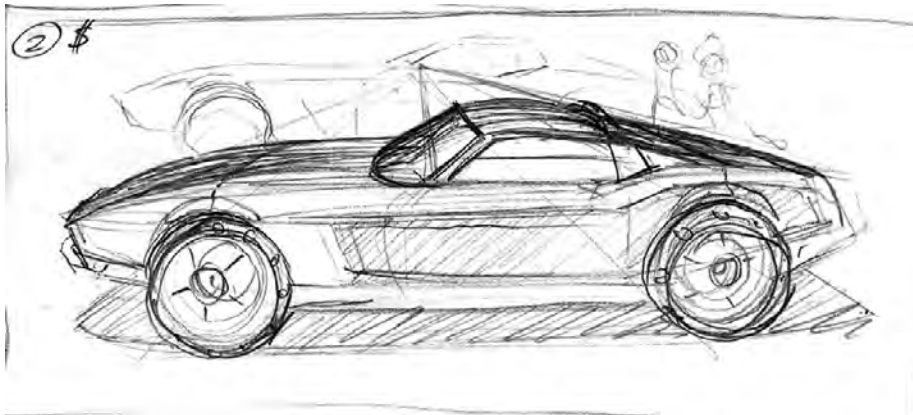

Figure 1.13

Figure 1.14

It has a reduced gas engine size because it also has electric motors in the rear to compensate. Also the front wing theoretically may help it to fly better when hitting a jump, helping it to land squarely back on its wheels.

Concept

Once I was happy with the basic front and side sketches, I set about rendering the vehicle to make sure I was happy with the overall design.

I then produced some design sheets to hopefully answer some of the questions that the 3D modeler might have. Quite often these ¾ views are enough for the modeler, depending on the polygon count of the vehicle, but to make the build a whole lot easier, I set about producing the design sheets and then a set of blueprints.
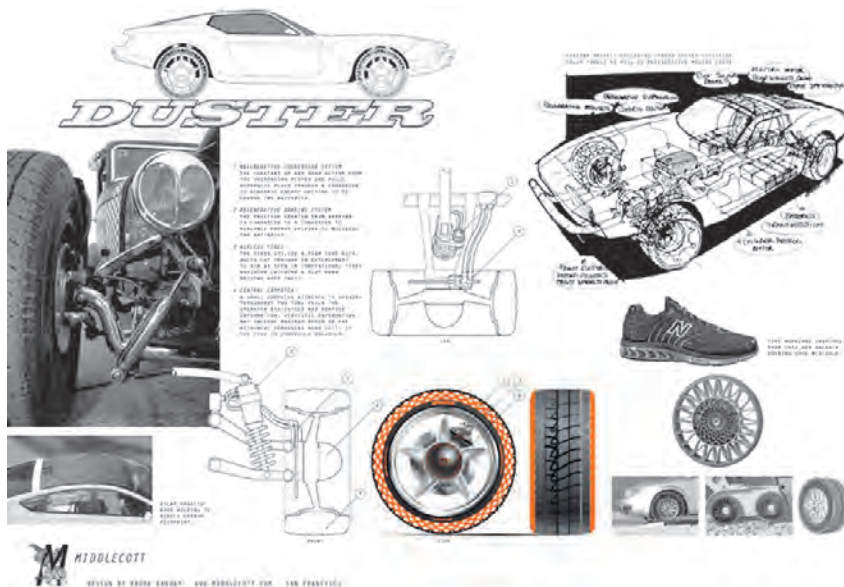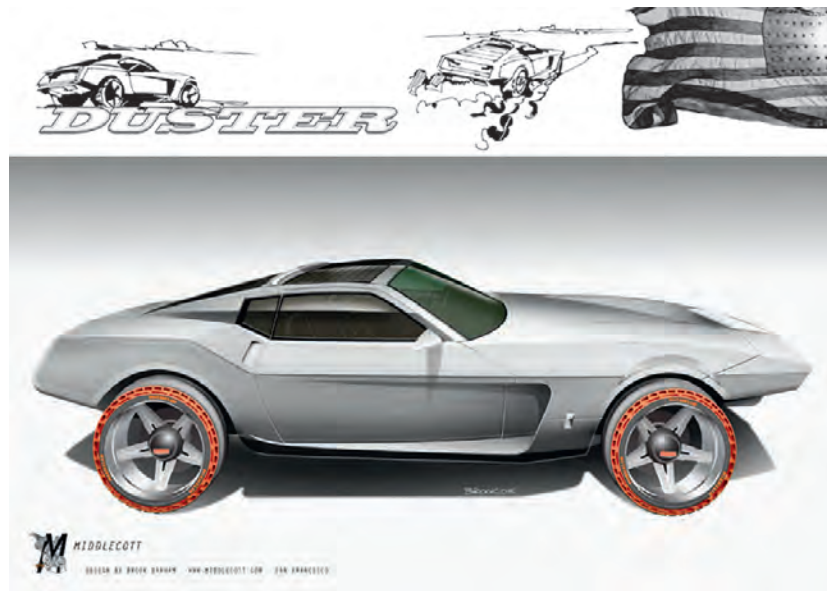

Figure 1.16

Figure 1.17

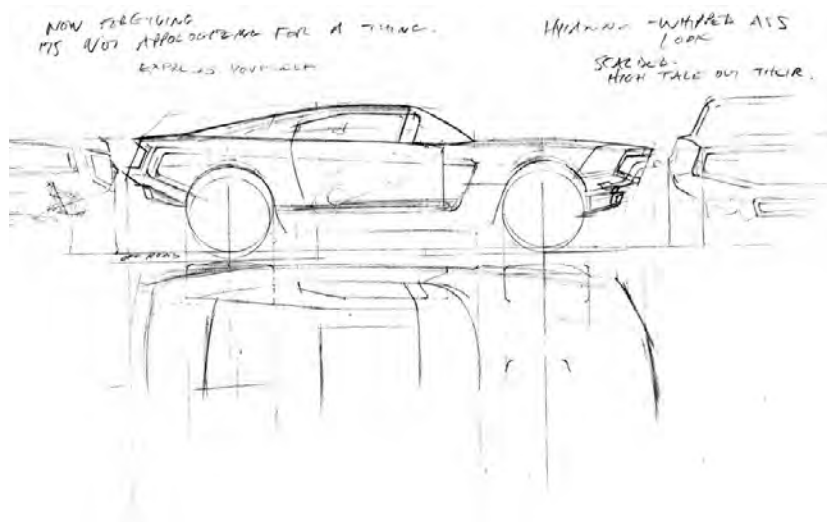I first produced the orthographic projections for the modeler as a sketch.

Figure 1.18

Then as a finished sheet.

TUBULAR BUMPER
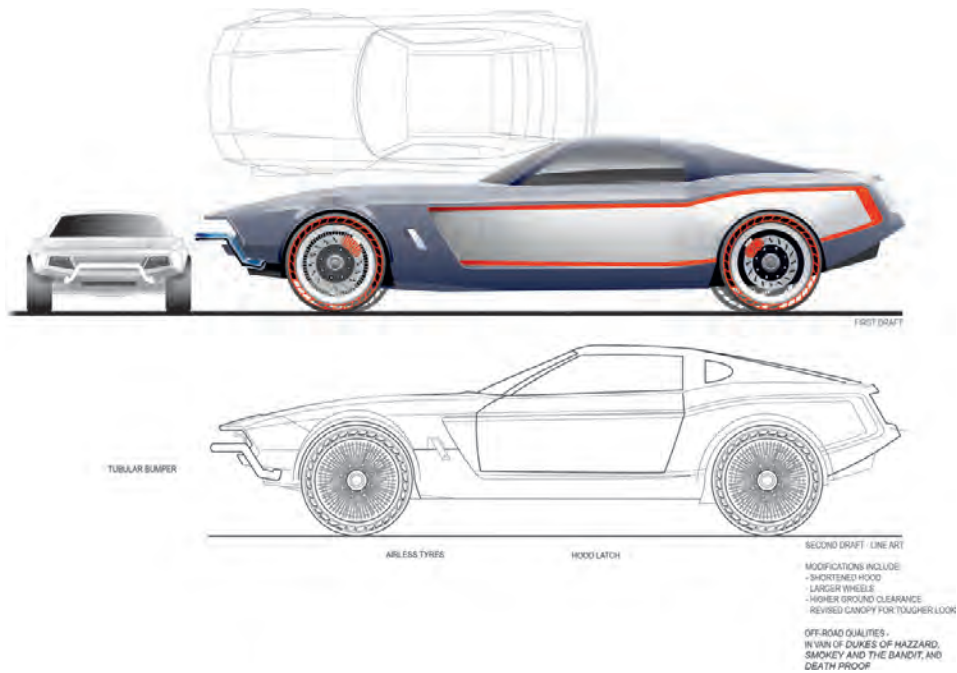
AIRLESS TYRES   HOOD LATCH

FIRST DRAFT

SECOND DRAFT - LINE ART

MODIFICATIONS INCLUDE:
- SHORTENED HOOD
- LARGER WHEELS
- HIGHER GROUND CLEARANCE
  REVISED CANOPY FOR TOUGHER LOOK

OFF-ROAD QUALITIES -
IN VAIN OF DUKES OF HAZZARD,
SMOKEY AND THE BANDIT, AND
DEATH PROOF

Figure 1.19

That completed the design.

Thanks for reading through this Duster tutorial. I hope you found it interesting and I hope it gave you a bit of insight into how I design vehicles.

Thanks

Brook Banham

www.Middlecott.com

Chapter 2

Modeling the DUSTER in 3ds Max

Andrew Gahan

Welcome to the first modeling tutorial of the book. Hopefully you'll have already been through Chapter 1 with Brook Banham and are familiar with the Duster concept. If not, flick back to Chapter 1 and have a look.

I'd like to stress the fact that this is not just a tutorial and that this is not just a book. Let me explain.

I'd like you to think of this book as an invitation to an exclusive community. Think of this community as a group of friends, amateurs, and professionals who are all ready to help you out on your 3D journey.

With this in mind I decided to host this chapter on the website and the forum that supports this book. So, to find the tutorial, you'll need to log onto www.3d-for-games.com and follow the 3D Automotive Modeling link and download the chapter.

While you're online, register on the forum www.3d-for-games.com/forum and introduce yourself. There are a lot of really friendly and helpful people on hand to answer your questions and help you with your work, as well as regular competitions and a place for you to show off your work and also see what other people are doing.

This forum is unlike most others as it is extremely friendly, supportive, and run by a close-knit group of regular people, just like you.

OK, once you've logged onto the website and downloaded the chapter, here's what we'll be building: the Duster—another American legend.
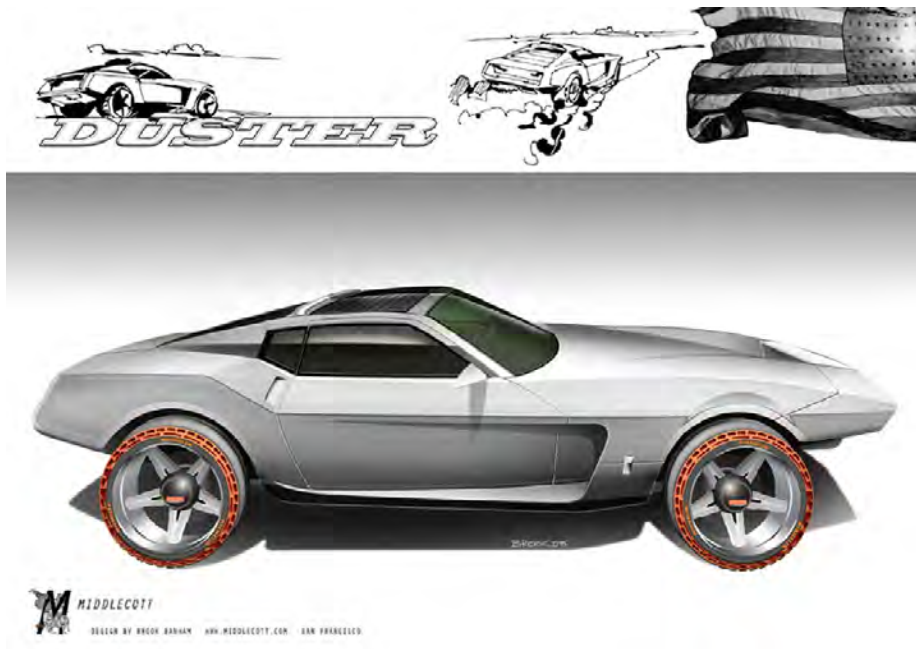
Figure 2.1

This build will be what I would call a mid-poly car or game-res car. It will be weighing in at around 15,000 triangles, but don't worry, we'll be adding them a few at a time and step by step.

If you have any problems at any point, I have provided a save file for each step of the process, so if you don't quite understand what I'm explaining, have a look at the save file for that image and I'm sure it will be clear. The adage "A picture is worth a thousand words" is usually true on a project like this.

This will be a static car. By that, I mean that it will not be rigged and the suspension will not need to be built accurately in order to move. It won't need to have a driver, and it will be modeled with a very simple interior behind darkened glass. Once you've completed the model, feel free to go to work on improving it by building an interior or cutting in some openings so that you can see inside the engine bay or open the doors.

Are you ready to get started?

Great, just log onto www.3d-for-games.com and follow the 3D Automotive Modeling link and download the chapter.

And I look forward to talking to you online. Bye for now!

Chapter 3

Chicago-Styled Hot Rod Concept

Brook Banham

The "Gangster Car" was a project for a contest to design a car specifically for the city of Chicago for Local-Motors (www.local-motors.com). Instead of a commercially producible car design, my entry was done more as a fun spin-off from the competition brief.

The intention was to create a nearly comical approach to the design of this car with respect to Chicago's heritage of gangsters from the 1930s, like Al Capone. Hence the styling is obviously retro, harking back to vintage cars of the time with modern touches and some outrageous features like a Gatling gun in the nose.

Figure 3.1 *The Chicago-Styled Hot Rod concept front ¾ view.*

Figure 3.2 *The Chicago Styled Hot Rod concept rear ¾ view.*

The summary was:

- Five-seater sports sedan
- Front engine layout
- Rear wheel drive
- 4 + 2 door sedan. Suicide side doors layout, perfect for drive-by shootings.

The overall design of the Gangster Car is a throwback to Prohibition-era car shapes. It could be looked upon as a modern-day hot rod like the Model A hot rods.

The front end of the car was inspired by the Fairchild A-10 Thunderbolt II, or "Warthog" as it was affectionately known by the pilots and crews of the United States Air Force attack squadrons who flew and maintained it. I also took inspiration from handguns and I also included a sight integrated on the front grille.

The supercharger was designed around the GAU-8 Avenger, which is the heavy automatic cannon that serves as the aircraft's primary armament. The front suspension was designed with the idea of wings in mind.

The front windshield is raked horizontally to help deflect incoming bullets from the front, if the vehicle were in pursuit of a rival's car.

The graphics on the side of the car were inspired from the Chicago Bulls basketball team. The elliptical windows on the side offer added protection for the occupants in the rear, whereby they can shoot out of the thin windows without being too exposed to return fire.
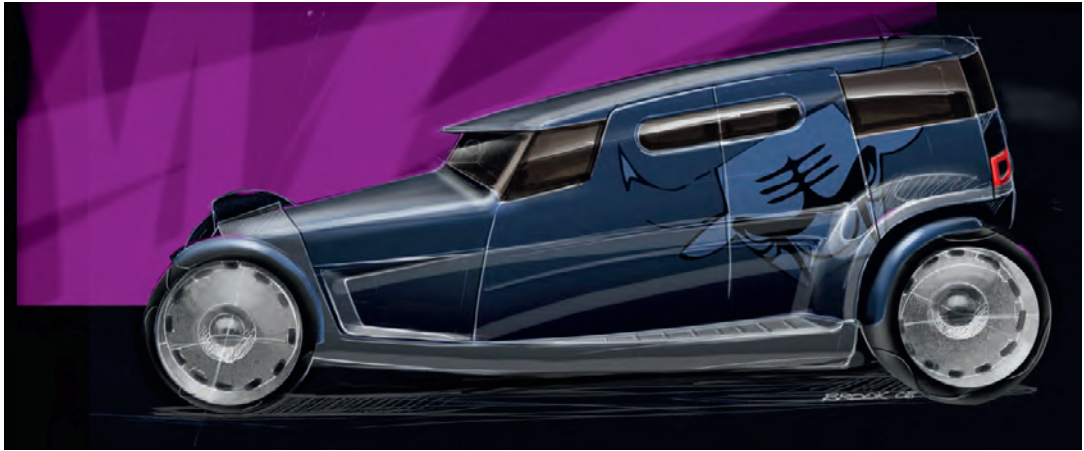
Figure 3.3 *The Chicago-Styled Hot Rod concept side view.*

The Design Process

This was a fairly quick design, which took at most maybe two or three days to complete. These weren't full work days, so I fast-tracked the design process.

As you can see, I did just a few thumbnail sketches to get a flavor of what I wanted to achieve.
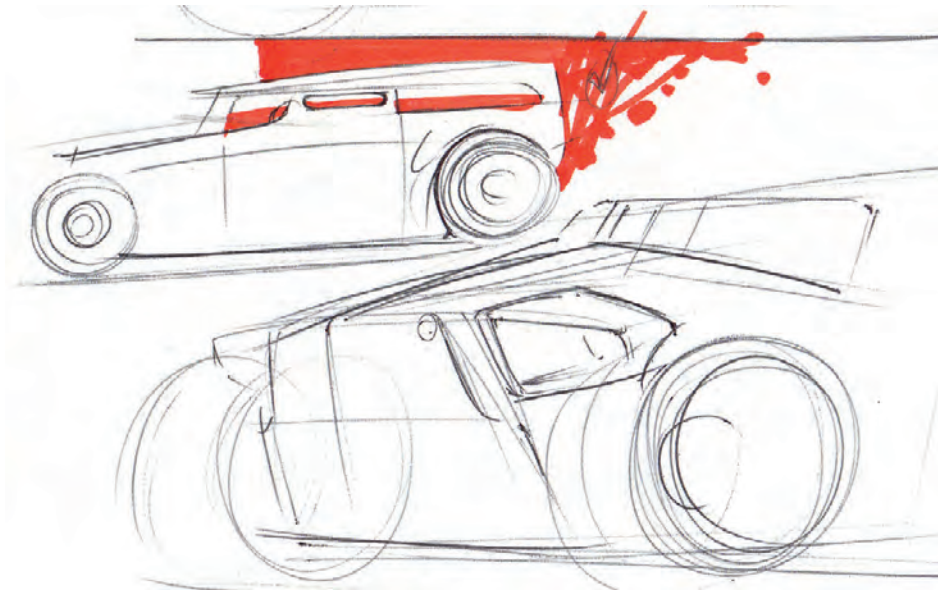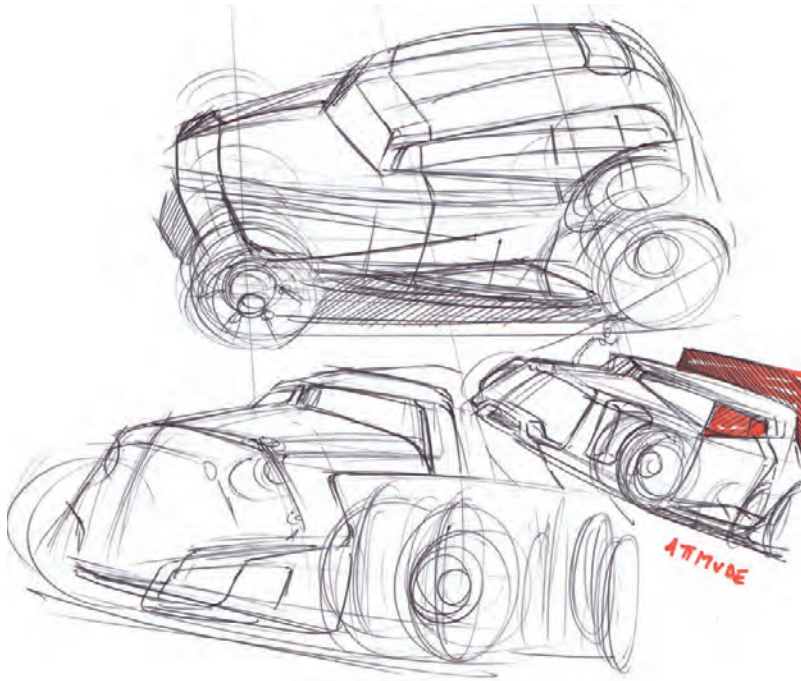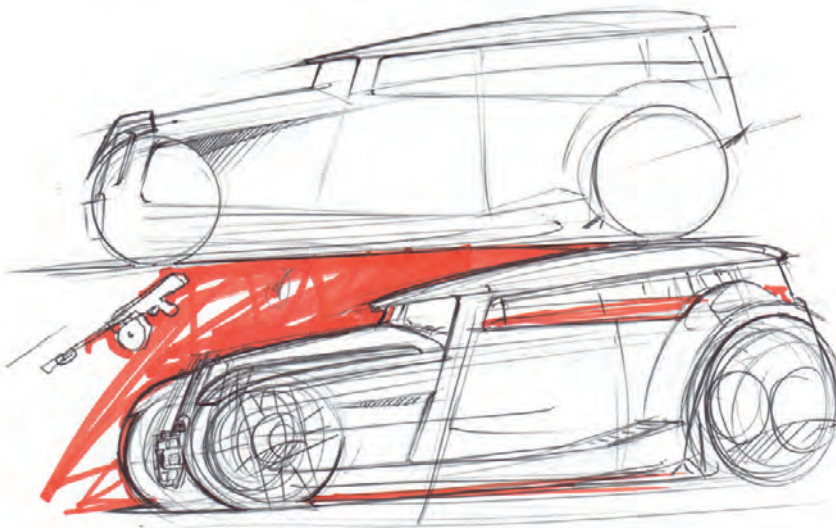

Figure 3.4

Figure 3.5
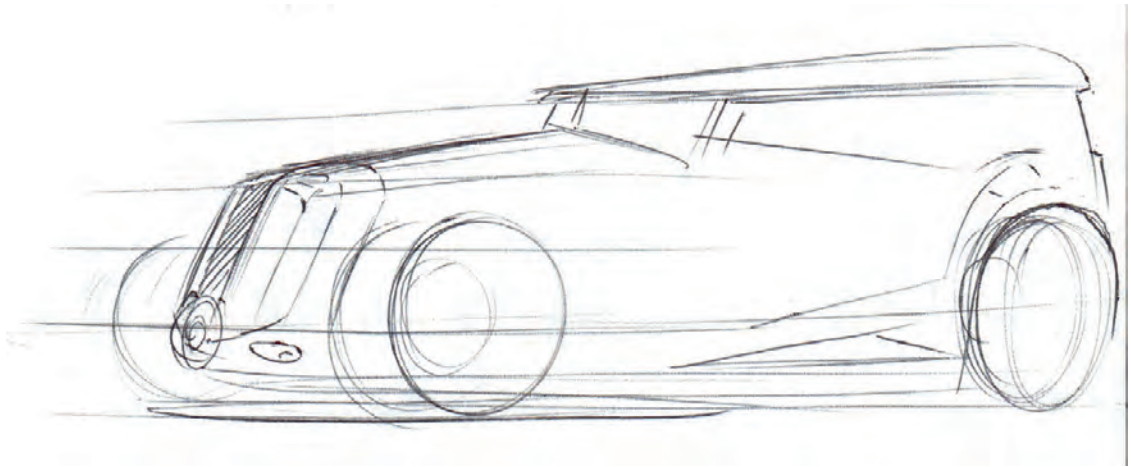

Figure 3.6

Figure 3.7
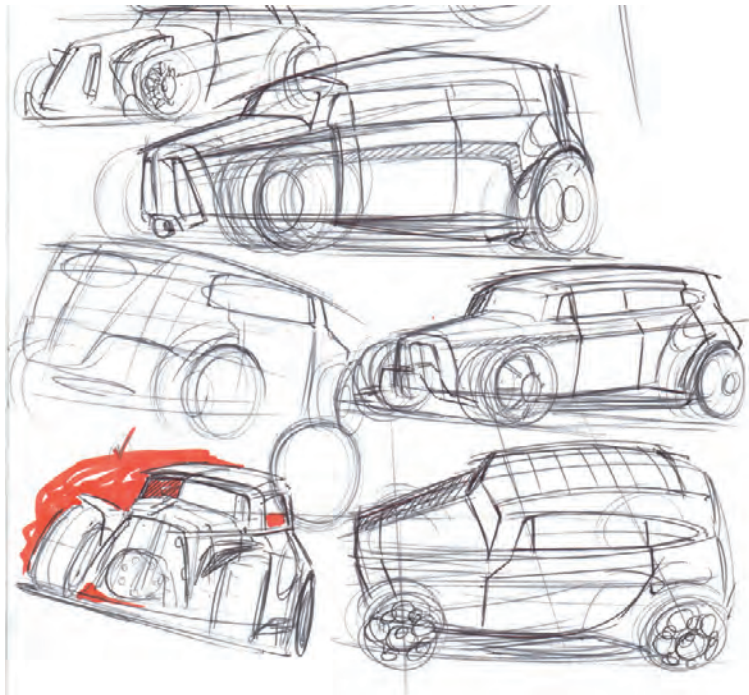
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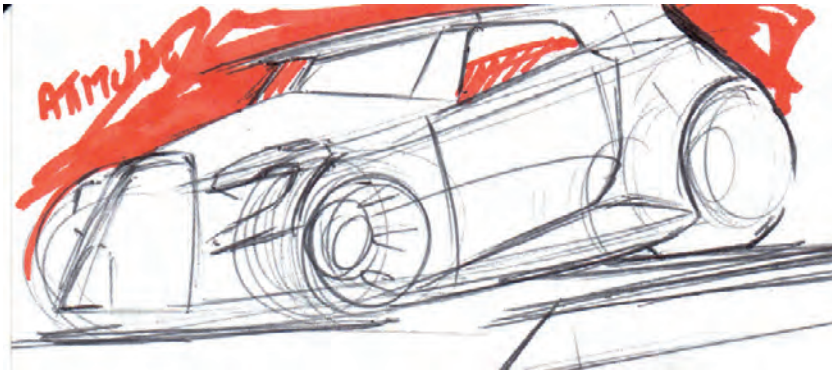
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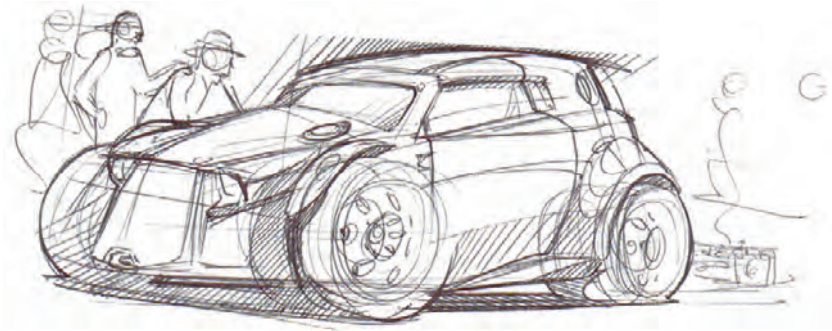
Figure 3.10
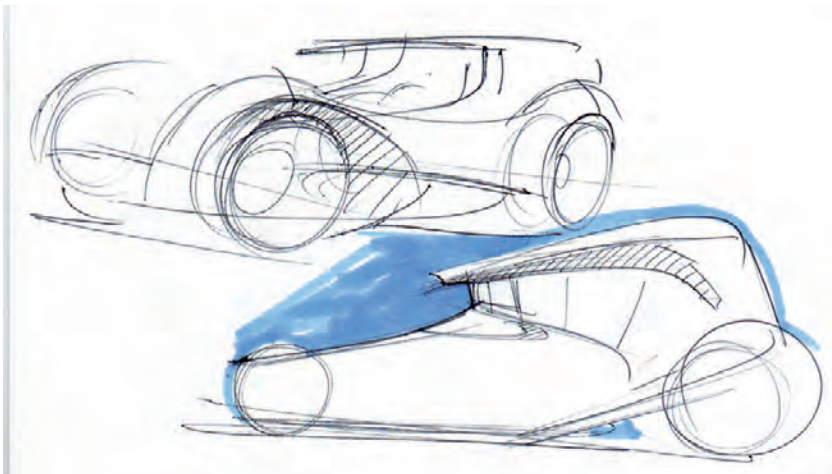
Figure 3.11

For this design I avoided a lengthy exploration process, as I already had an idea of what I wanted to produce from the beginning.

Figure 3.12 *The raw, untouched double page sketch from the sketchbook.*

I was thinking retro shapes and silhouettes with a modern twist. The sketches were done with Bic® ball–point pen medium. I like to use only Bic brand ballpoint pens because they hardly ever leak, have a great tactile feel while sketching, and are less oily, so less smearing occurs.

I am using a coarse spiralbound sketchbook measuring 18 cm × 26 cm. The paper is recycled with a fibrous look, which looks good when it is scanned and coloration is added afterward. It gives the sketch an added layer of texture, especially when shading and color are added on top.

For these sketch pages I actually photograph the pages instead of scanning them. I normally do this for work done in sketchbooks for two reasons:

1. Laziness. It is much faster to stand over the pages and take a snap of each page than to use a scanner.
2. A scanner casts weird shadows when scanning something uneven like a spiralbound sketchbook. I find I get much better results when I use our Leica camera with the flash turned on.

While I sketch, sometimes my mind wanders a little and other seemingly unrelated vehicles may appear on the page. I find that sometimes I need a slight departure from the job at hand and treat this as a kind of break. Besides, many times, elements from those "unrelated" vehicles appear later on in the designs of the vehicles.

As this sketchbook is sometimes awkward to draw on in certain areas due to the thick spiral binding, I must rotate the sketchbook around to find my most comfortable sketching position. That is why each sketch is in a different orientation to the other.

After getting the images onto my computer I load them into the desired software, which in this case is Alias Sketchbook Pro 2010. I use this program for quick and dirty sketches. If I want to do something tighter I would use Photoshop. So for this stage I simply block in the dark areas with flat color as a base from which to add light and shade.
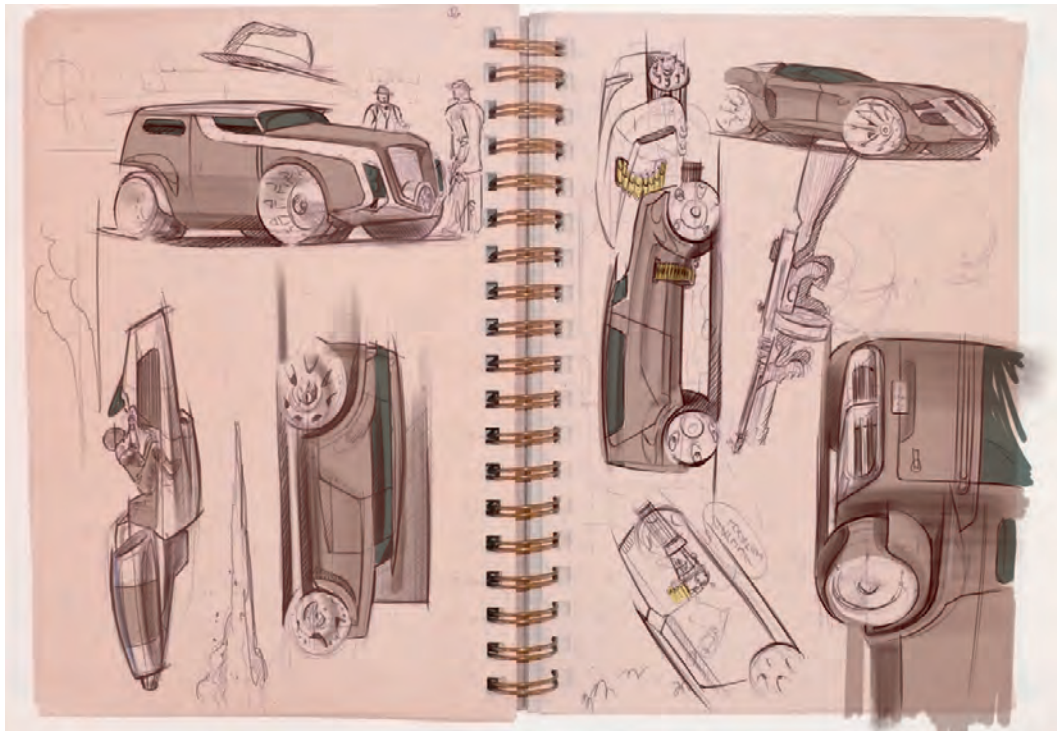
Figure 3.13

I start to add darker tones of shade as well as a few color pops using mainly an airbrush tool.
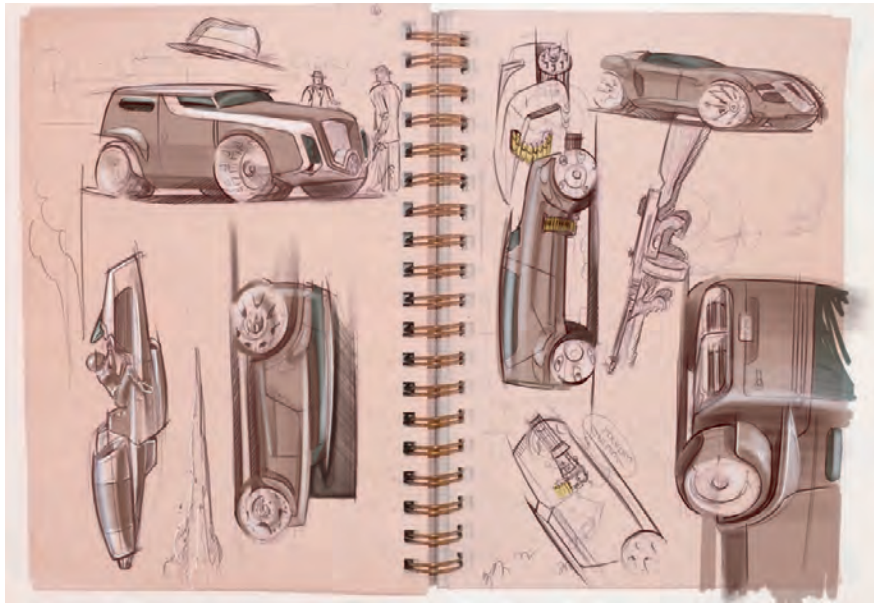
Figure 3.14

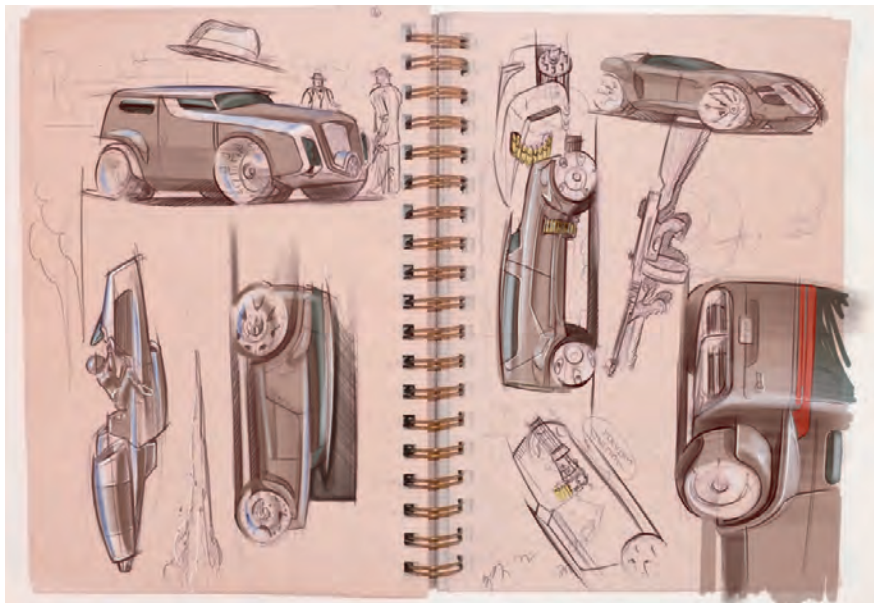At this stage I add white reflections, once again with mainly the airbrush tool.

Figure 3.15

Here I'm adding a few more color pops, like red in the taillights and some blue sky reflections. With a white pencil tool I start to add sharp and more detailed reflections. Each part of these processes I do in a separate layer. This is so one can edit more easily the elements later on.
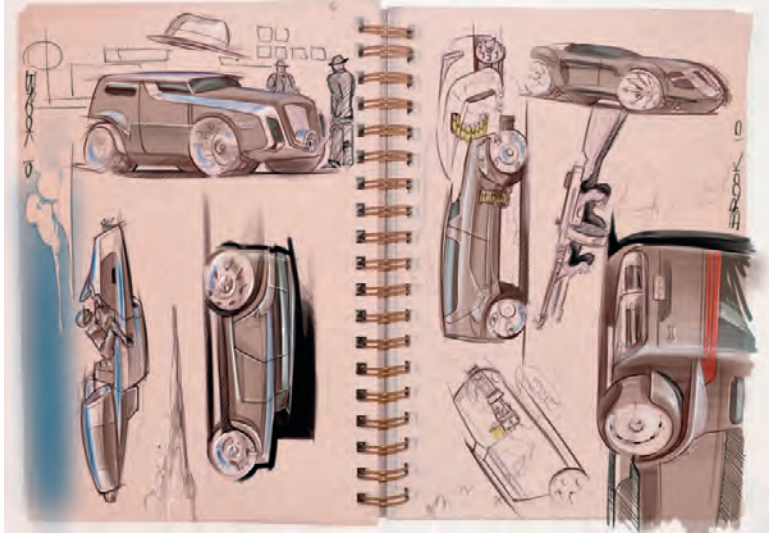

Figure 3.16

On a separate layer I add details with black and white pencil tools, working in details like shut line definition, sky and backgrounds and ultimately my signature.

Figure 3.17
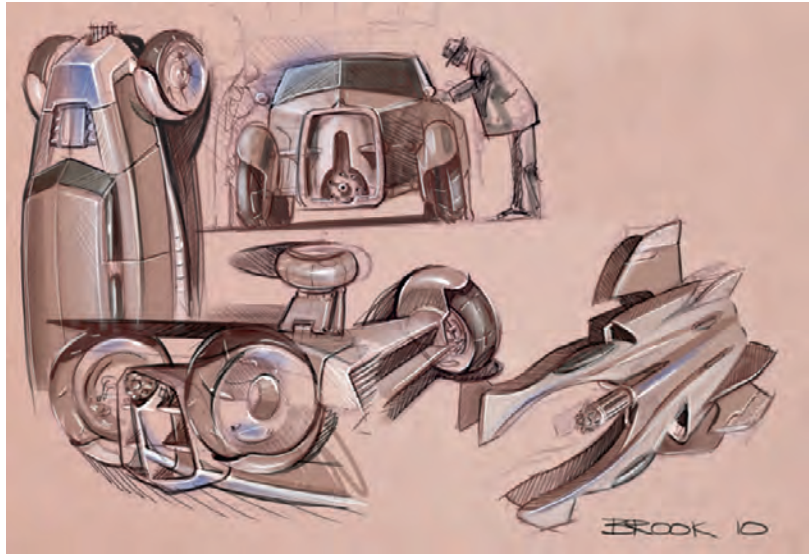
Figure 3.18

This shows a final tidy up, extracting the pages from the sketchbook. I do this in Photoshop by cropping out the spiral binding as well as tidying up and deleting messy areas.
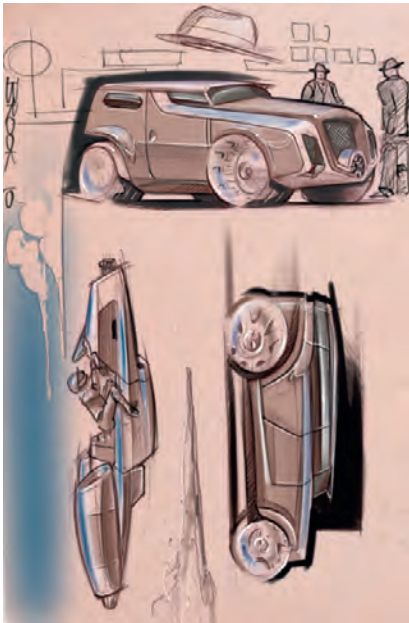
Figure 3.19
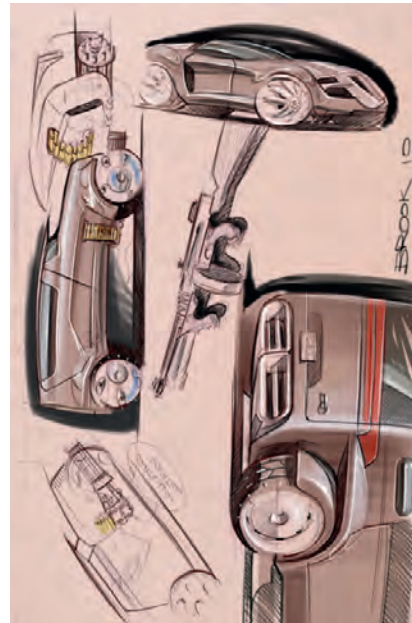
Figure 3.20

To illustrate the process in a little more detail, here's another step-by-step walkthrough focusing on one of the pages.

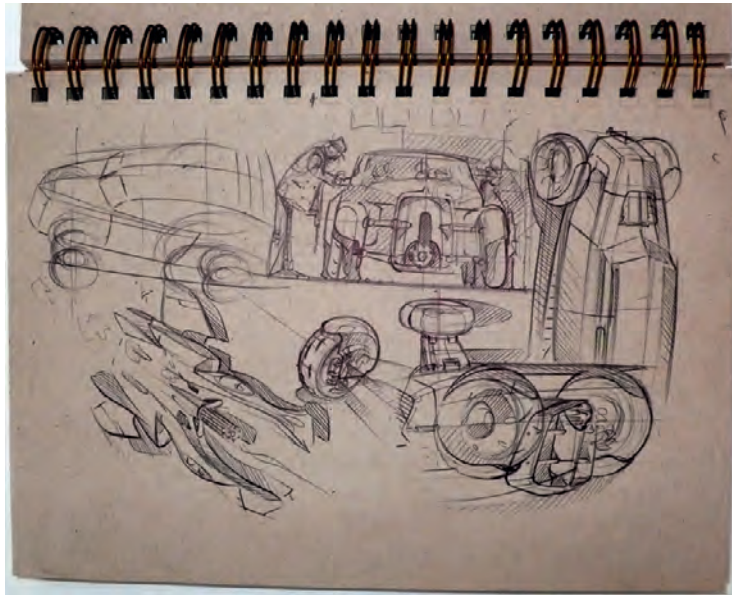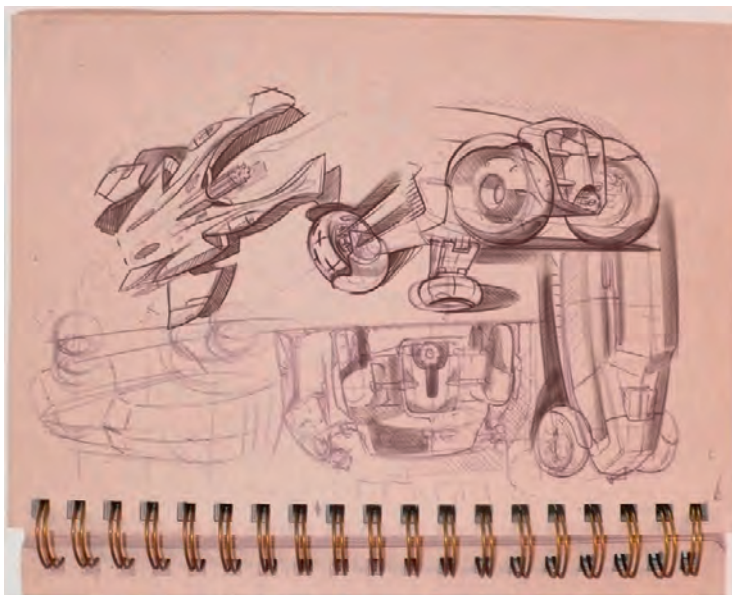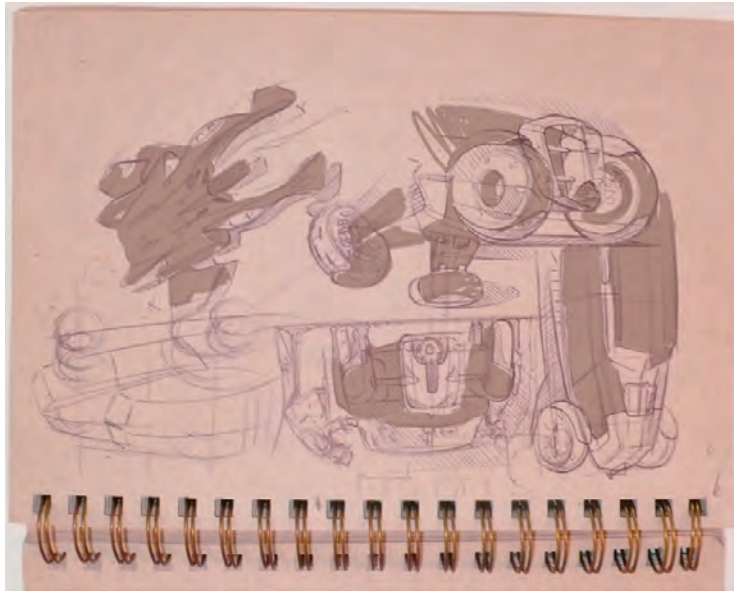**Figure 3.21** *The raw sketchbook image.*

Figure 3.22

Figure 3.23

I start to add base color from which later on I can overlay reflections and shade. I am using Sketchbook Pro 2010 and using black with the paintbrush tool on a layer turned down to 50%.
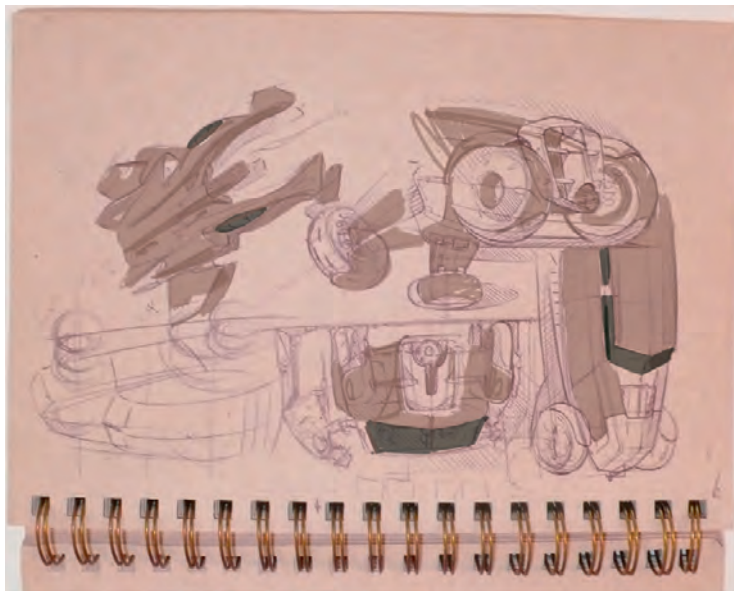

Figure 3.24

I add a base window color on a new layer turned down to 50%.

Figure 3.25

Figure 3.26

I start to add more black on another layer for tires, intakes, shadows, and generally darker areas.
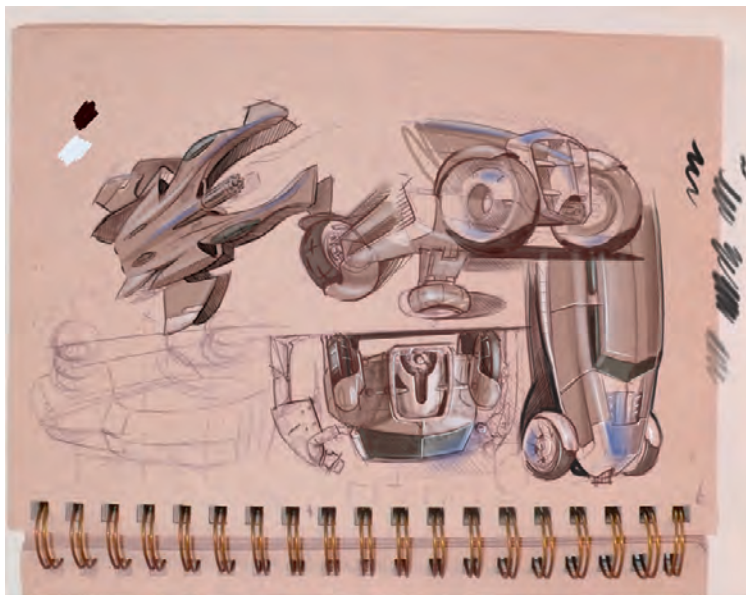

Figure 3.27

I start adding whites and sky tones. I am using white pencils for sharp reflections and an airbrush for larger surface areas.
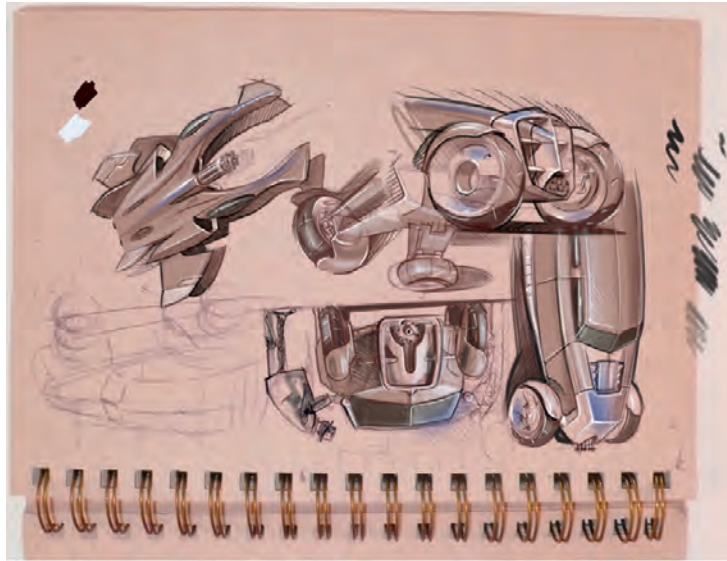

Figure 3.28

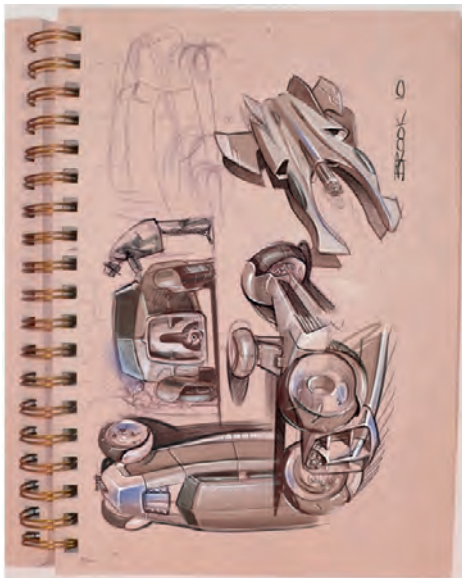I start to go into more details with light and shade, and then once I'm almost at the last stage, I add my signature.

Figure 3.29

Figure 3.30

After I produced the initial sketches I went straight into Rhino 3d to do a quick sketch model.

I then used the basic 3D form of the sketch model as an underlay and took it into Photoshop to produce a quick render.
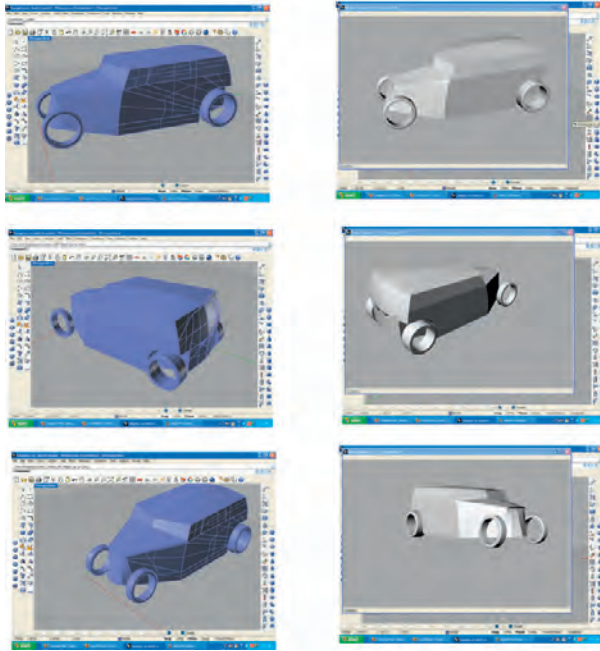

Figure 3.31

Once I was happy with the shape, I experimented with the paintwork and the style of the graphics on the side of the vehicle.

Figure 3.32