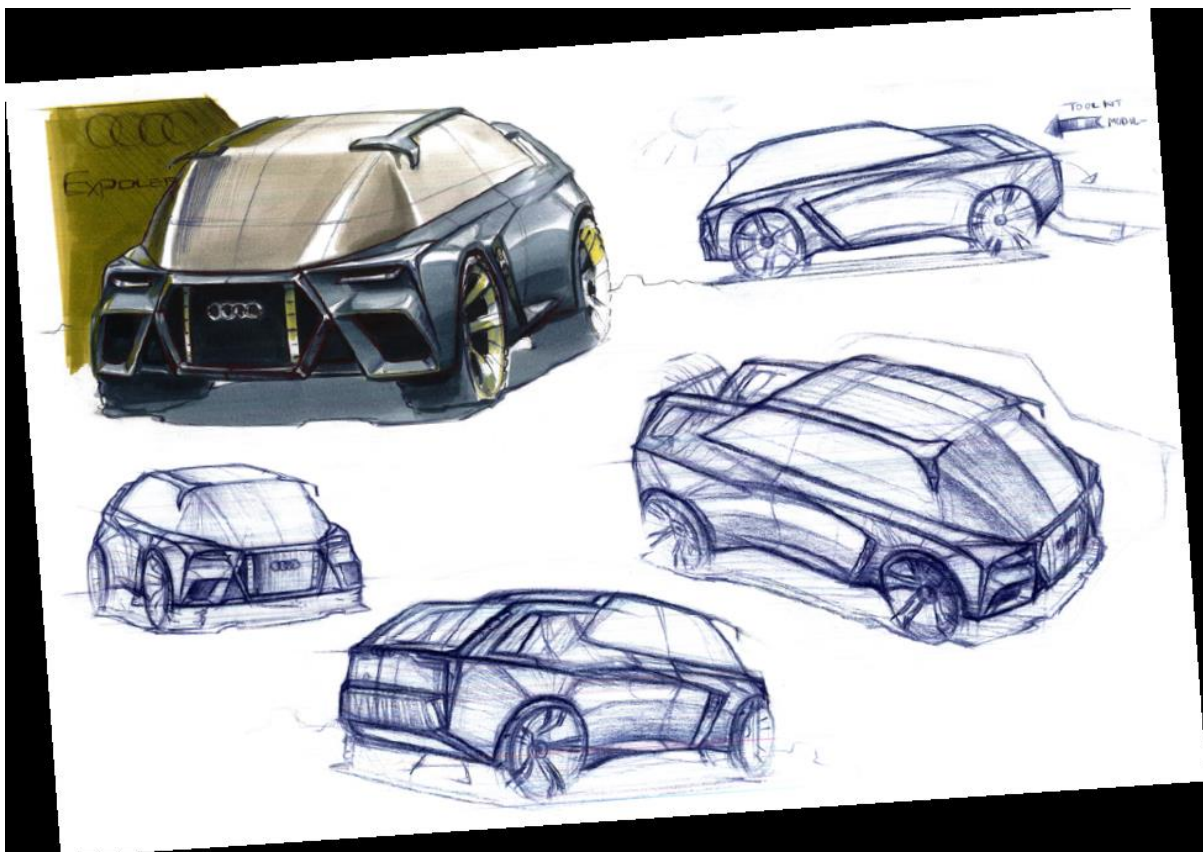


# READY RECKONER

of

## *Automobile and Transportation Design*

### Terms



# The Passenger Car industry 2017



## List of Mobility related Competitions

SLNO	Competition (International and National)	Description, URL	Entry month/date
1	Core77 Design Awards	Since the awards' inception in 2011, the program has welcomed nearly 10,000 entries from professionals and students in over 49 countries around the world. It stands as an annual opportunity to take a look back and celebrate some of the best design of every year. The categories include Vehicles, systems or modes of transportation used to get people or objects from one place to another, for private, public, commercial or industrial purposes. Examples include: planes, trains, automobiles, buses, bikes, boats, mass transit systems, transportation infrastructure, etc. URL : <a href="https://designawards.core77.com/all-categories">https://designawards.core77.com/all-categories</a>	31 Jan 2020 (Early entry)
2	A' Design Award	The A' Vehicle, Mobility and Transportation Design Competition is a freestyle design competition open to both concept stage and realized works designed by professional and young designers, design companies and other business in this industry worldwide. Examples Include Car, Yacht, planes, trains, automobiles, buses, bikes, boats, mass transit systems, etc. URL : <a href="https://competition.adesignaward.com/award-category.php?ID=9">https://competition.adesignaward.com/award-category.php?ID=9</a>	28th Feb 2020(late entry)
3	Michelin Challenge Design	Michelin Challenge Design is an automotive design competition that encourages better mobility solutions through innovation and advanced technology. Every year it has a different theme on the Competition.	1st of March 2020
4	Drone X Challenge 2020	DXC 2020 aims at accelerating the practical deployment of drones/UAVs in key applications focusing on transportation and delivery. DXC 2020 will support innovative commercial applications/solutions that tackle two major challenges: payload capacity and flight endurance. URL : <a href="https://dronexchallenge2020.com/">https://dronexchallenge2020.com/</a>	6-1-2020

5	RVID Train Design	A biannual design competition that focuses on train systems and passenger experience organized by CRRC. URL: <a href="http://www.rvid.org.cn/html/en/index.php">http://www.rvid.org.cn/html/en/index.php</a>	September 2020
6	SIAM - The Automotive Design Challenge	Annual competition in India is organized by The Society of Indian Automobile Manufacturers (SIAM) - A not for profit apex national body representing all major vehicle and vehicular engine manufacturers in India. The contest is organized on the side-lines of Styling & Design Conclave every year. URL : <a href="http://www.siamindia.com/">http://www.siamindia.com/</a>	October to February every year

### List of Popular Automobile Designers

SLNO	Designer Name (International and National)	Brief Professional Career and profile, Firms worked with
1	Walter Maria de Silva	Walter Maria de Silva is an Italian car designer and former head of Volkswagen Group Design, until 2015. Since beginning his car design career in 1972 as trainee car designer for Fiat's Style Centre.
2	Giorgetto Giugiaro	Giorgetto Giugiaro is an Italian automobile designer. He has worked on supercars and popular everyday vehicles. Fiat Special Vehicle Design (1955–1959) Bertone (1959–1965) Ghia (1965–1967) Italdesign Giugiaro (1967–2015) GFG Style (2015–present)
3	Chris Bangle	Christopher Edward Bangle is an American automobile designer. Bangle is known best for his work as Chief of Design for BMW Group, where he was responsible for the BMW, MINI and Rolls-Royce motor cars.
4	Tom Tjaarda	Tom Tjaarda was an automobile designer noted for his work on a broad range of automobiles — estimated at over eighty — from exotic sports cars including the Ferrari 365 California, De Tomaso Pantera.
5	Marcello Gandini	Marcello Gandini is an Italian car designer, known for his work with the automotive design house Gruppo Bertone, including his designs of the Lamborghini Miura, Countach and the Lamborghini Diablo.
6	Karim Habib	Karim Antoine Habib is a Canadian automotive designer of Lebanese descent, currently the head of design for the Korean vehicle manufacturer Kia. He previously worked for the BMW and Infiniti.
7	Jozef Kabaň	Jozef Kabaň is a Slovak automobile designer. He started his career as a designer at Volkswagen. In 2003 he moved to

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- Audi as an exterior design assistant. In 2007 he advanced to the position of Chief of Exterior Design at Audi.
- 8 Ian Callum Ian Callum CBE FRSE is a British car designer who has worked for Ford, TWR, Aston Martin, and in 1999 became the Director of Design for Jaguar Cars, which then merged into Jaguar Land Rover in 2013, a position he held until mid-2019. His younger brother Moray Callum is Vice President, Design, Ford Motor Company.
- 9 Adrian van Hooydonk Adrian van Hooydonk, is a Dutch automobile designer and BMW Group's Design Director and best known for several modern BMW concept cars and production vehicles. He is based in Munich,
- 10 Peter horbury Peter D. Horbury is a British car designer who is Vice President, Design of Volvo. He is widely known for his design work for Volvo and has worked in a variety of roles in the automotive industry, including as Executive Design Director, Americas for Ford between 2004 and 2009.
- 11 John Mays J Mays is an American industrial designer who served as Group Vice President of Global. He was responsible for a number of concept car designs, including the Ford Fairlane, Shelby GR-1 and "427", Jaguar F-Type.
- 12 Ralph Giles Ralph Victor Gilles is a Haitian-Canadian-American automobile designer and executive. Gilles was the President and CEO of Chrysler's SRT brand and Senior Vice President of Design at Chrysler before being promoted to Head of Design for Fiat Chrysler Automobiles in April 2015.

## List of Terms – Acronyms and Description

- |   |                               |   |
|---|-------------------------------|---|
| 1 | <b>1:1 model</b>              | All the details of the new model are hand-crafted to produce a deceptively real-looking model. All the characteristic features of the new car become apparent. Optical measuring tools and milling machines are applied to produce the first full-scale prototype.  |
| 2 | <b>1:4 clay models</b>        | Not everything can be simulated to perfection on a computer. The clay models of every variant of a new automobile are thus produced alongside virtual models in the subsequent course of the development process. Only then are the designers able to judge whether their designs also produce the desired effect in three dimensions.      |
| 3 | <b>A-Line</b>                 | If you traced a vehicle's silhouette from front to rear, you'd have the A-line, or main profile. This line often defines the entire character of a car, and a few millimetres here and there can mean the difference between sleek or dull.   |
| 4 | <b>Active safety features</b> | Refers to features that interact with, or are controlled by, the driver. For example, brakes, anti-lock braking system, manual seat belts, and traction control.  |
| 5 | <b>Aftermarket parts</b>      | Auto parts made by companies other than the original equipment manufacturer (OEM) and which are used for replacing or repairing autos. Aftermarket parts are generally less expensive than OEM parts. It's often alleged that such parts are inferior in quality compared to OEM parts.   |
| 6 | <b>Air bag</b>                | It describes a gas-inflated cushion that deploys at the time of impact and is designed to protect a person's upper body from making direct contact with a vehicle's interior components such as the steering column or dashboard; rear-seat as well as side air bags are also becoming options.   |
| 7 | <b>Air filtration system</b>  | System that cleans smog, pollen, exhaust, smoke and odours out of the air. Cleans both interior circulated air and that coming from the outside.  |
| 8 | <b>Alias</b>                  | Autodesk Alias (formerly known as Alias StudioTools) is a family of Computer-aided industrial design (CAID) software predominantly used in Automotive Design and Industrial Design for generating Class A surfaces using Bézier surface and NURBS modelling method. The product is sold specifically as CAID rather than CAD, and its tools |

		and abilities are oriented more towards the "styling" aspect of design - that is to say, the product's housing and outer appearance.
9	<b>Animation</b>	A visualization comprised of moving images, usually created from 3D CAD, which allows a 'movie' of the design without needing physical samples. The quality of an animation can vary dramatically depending upon the application.
10	<b>Anthropometrics</b>	Study of measurements of humans. Used to inform ergonomics.
11	<b>Anti-lock brake system (ABS)</b>	A braking system that is designed to preserve the driver's ability to steer a car during an emergency braking situation, unlike conventional brakes which lock and steering control is lost.
12	<b>Assembly</b>	A collection of components that are related and have interconnections. Parts joined together form an assembly. Maybe physical, also within CAD.
13	<b>Automatic safety features</b>	Refers to features that are not under a driver's control; rather they act in response to programmed circumstances. For example, air bags and automatic seat harnesses.
14	<b>Automatic transmission</b>	A transmission where the gears are shifted automatically by the vehicle and controlled by a torque converter. The torque converter replaces the clutch. It connects and disconnects the engine from the drive wheels while selecting the proper gears for the speed of the car. These transmissions come in three, four and five speeds. The more gears involved, the smoother the acceleration. With four- and five-speed transmissions, the highest gear is for overdrive. Overdrive reduces the revolutions per minute (RPM) and provides better gas mileage while on the highway.
15	<b>Automobile Styling</b>	In automotive styling, creativity, productivity and the ability to rapidly iterate different design concepts are critical for success. There are tools for concept design, reverse engineering and high-end rendering that gives the power and freedom to push a designers creativity. For exterior and interior Class A surfaces, designers work with manipulation and surface alignment tools while giving full control and real-time analysis of surface quality.
16	<b>Automotive Accessory Design</b>	Design of accessories of a vehicle which involve styling and also knowledge of industrial design and manufacturing knowhow in an automobile manufacturing setup.

17	<b>Backend</b>	The later phases of a design program, closer to manufacturing. Within some organizations some of these activities are identified as engineering.
18	<b>Backfire/backfiring</b>	When fuel that hasn't been burned seeps into the exhaust system and is ignited, causing a small explosion.
19	<b>Bauhaus</b>	A defining style in design, art and architecture which arose in response to expressionism at the beginning of the 20th century. Walter Gropius founded the Staatliche's Bauhaus as a school of art in Weimar in 1919. The succinct character of Bauhaus and the manner in which it strips everything down to the essentials are also manifested in car design principles and represent a pole of the design philosophy.
20	<b>Beltline</b>	The horizontal line that divides the sheet metal from the glass in a vehicle. Just as a higher or lower beltline on a human body drastically alters a person's look, the height of a vehicle's beltline can make it look sporty and menacing or welcoming and airy.
21	<b>Bill of materials (BOM)</b>	A table containing a list of the components and the quantity of each required to produce an assembly. A costed BOM includes pricing information. An indented BOM indicates how different components and sub-assemblies relate to one another and the order in which they are assembled.
22	<b>Block</b>	Short for engine block; see the definition of crankcase.
23	<b>Brief</b>	Instructions and requests provided to design team prior to the commencement of a project. The format can vary and may range from informal & verbal, to comprehensive document.
24	<b>CAD</b>	Computer-aided design is software used to assist with design and documentation.
25	<b>Cam</b>	Part of the mechanism that opens and closes the valves.
26	<b>Car body configurations</b>	The configuration of a car body is typically determined by the layout of the engine, passenger and luggage volumes, which can be shared or separately articulated. A key design feature are the car's roof supporting pillars, described from front to rear of the car as A-pillar, B-pillar, C-pillar or D-Pillar. Common car body configurations are one-box (e.g., a van, minivan, MPV), two-box (e.g., a hatchback) and three-box (e.g., a sedan) designs.



<b>27</b>	<b>Car types</b>	The basic types of automobiles marketed to the general public. See the definitions for convertibles, coupes, hatchbacks, minivans, pickups, sedans, sport, sport utility vehicles, station wagons.
<b>28</b>	<b>Carburettor</b>	The fuel system component that supplies the proper mixture of fuel and air to the engine. This part of the engine also adjusts the air and fuel mixture within an engine to meet different operating conditions (e.g., heat or altitude).
<b>29</b>	<b>Catalytic converter</b>	A part of an exhaust system that reduces harmful emissions caused by the engine. This device became a standard feature in 1975 as an anti-pollution measure.
<b>30</b>	<b>Character Line</b>	The creases running horizontally along the side of the vehicle that give it a visual definition. "We have a line," says Klaus Bischoff, Volkswagen Head of Design, "that runs through the entire car and brings the volume of the Arteon even closer to the ground. This line starts in the radiator grille at the front and runs cleanly over the side profile and into the tail lights."
<b>31</b>	<b>Chassis</b>	Once this was simply defined as the frame of the car which provided the strength of the vehicle, and to which the body, engine, drive line components and suspension were attached. Now, few vehicles other than trucks have separate frames, and the chassis structure is incorporated into the body components in what is known as a shell or unit body construction.
<b>32</b>	<b>CMF</b>	Colour, material, finish.
<b>33</b>	<b>CNC</b>	Computer-numerically-controlled. Refers to various machinery used to produce prototypes, tools and components.
<b>34</b>	<b>Colour &amp; trim</b>	Area of interior design. In addition to exterior paint finishes, the main focus here is on colours and appointments (e.g. trim) for the interior. For the surface finishing, the colour & trim designers choose materials and colours from hundreds of fabric, leather, wood and metal samples. The effects of the materials' touch and feel and the employed colours are configured and defined in realistic conditions in 1:1 interior mock-ups.
<b>35</b>	<b>Colour &amp; trim/control and user interface concepts</b>	Materials and colours are chosen for the interior. The trim lines for the future automobile are defined from hundreds of fabric and leather samples and colours. All control and display elements and telematics interfaces are designed and coordinated to produce a fully integrated interior with a seamless appearance.

<b>36</b>	<b>Commercialization</b>	Commercialization is the process or cycle of introducing a new product or production method into the market. Many technologies begin in the laboratory and are not practical for commercial use in their infancy.
<b>37</b>	<b>Component</b>	Part. Single, discrete element within an assembly.
<b>38</b>	<b>Concept design</b>	Early-stage design, not all aspects are resolved, however overall intent or direction should be apparent.
<b>39</b>	<b>Contract Manufacturer (CM)</b>	The external company that produces parts or products to order.
<b>40</b>	<b>Control Drawing</b>	2D representation of a design, used to assist production. Often used in conjunction with 3D CAD data, a control drawing can provide information such as dimensions, tolerances and notes that may not be readily obtained from 3D data alone. Also called 2D drawing, engineering drawing or technical drawings. Similar to architectural 'plan'
<b>41</b>	<b>Convertible</b>	Describes any car with a top that can be lowered or removed. Such tops may be moved either manually or automatically and, typically, are made of canvas with a plastic rear window.
<b>42</b>	<b>Corporate design</b>	The visual appearance of a company and its brands, also as part of the corporate identity (CI). CD covers the entire scope of corporate communications, from the logo through stationery to internet sites, appearances at events and fairs, architecture, clothing, etc.
<b>43</b>	<b>Coupe</b>	A four-door passenger car with a separate trunk which is similar to a sedan but, instead of full-sized, the rear doors are cut (or in French, coupe) in order to allow a more stylish body.
<b>44</b>	<b>Crankcase</b>	Engines consist of three major elements: the cylinders in which the pistons move; the cylinder head where the fuel/air combination enters, where combustion occurs, and where the burned gasses are vented off; and the crankcase which houses the crankshaft and usually the oil supply. The crankcase is usually the major (largest) part of the engine and is also referred to as the (engine) block.
<b>45</b>	<b>Crease</b>	Design feature. A recess which serves to define the character of surfaces.
<b>46</b>	<b>Crumple zones</b>	The areas of the vehicle outside of the passenger compartment that are designed to absorb the impact during a collision.
<b>47</b>	<b>Cylinder</b>	A chamber within an engine that contains a piston and valves. A fuel and air mixture in the cylinder is

- compressed by the piston and then ignited. This controlled explosion moves the piston, creating the basic force of the engine (power).
- 48 Dashboard** The panel located just beneath a vehicle's windshield where the various gauges, indicators, sound system and steering column are mounted. Note: the dash board was first installed in the front of carriages so that the dirt, mud, stones and other objects kicked up from the road would be dashed against the bottom of the board rather than upon the riders.
- 49 Data control model** In order to evaluate the class A data in a real-life scenario and to define the form in more precise terms, they are precision-cut on a data control model. The data are subsequently revised to take into account any modifications which prove to be necessary on aesthetic and technical grounds. In terms of surface quality, the resultant model essentially constitutes the first production vehicle and serves as the basis for series production.
- 50 Design freeze** The final phase of the free design process, in which all the design specifications are finalised and technically feasible. The design process is “frozen” in this state and approved for the preparation of series production.
- 51 Design Process** The process of development from the initial idea to final approval of the finished model covers a period of years in which the design team jointly creates the final vehicle step by step. The team slowly transforms various, initially competing design studies into the next generation of a vehicle. The design process is an integral part of the development process. The designers collaborate closely with research, development and production areas, coordinating and fine-tuning vehicle dimensions, material concepts and production processes, also ensuring producibility in the process.
- 52 Design Thinking** An approach to problem-solving based upon the methodology used by designers, but (usually) applied to other disciplines, such as business and education.
- 53 Detail** An upscale term for cleaning a vehicle, usually in reference to a very thorough cleaning of either the interior or exterior that results in a "like new" condition and is generally done by specialists.
- 54 Detail design** Determining and accurately documenting all the aspects of the design, largely related to the performance and manufacture of the part.

		Depending upon organizational structure this work may be carried out by engineers.
55	<b>Dimension</b>	Distance or measurement.
56	<b>Disc brake</b>	A brake that works by a calliper squeezing two friction pads against a disc that is attached to a car's wheel. This braking system is becoming dominant over the older, less efficient drum brake.
57	<b>Drawing</b>	Usually refers to a precise black and white 'line' image often generated in CAD within a recognized format, used for communicating technical aspects of a design. See also control drawing.
58	<b>Drawing/rendering</b>	The design process always begins with an idea, which gives rise to a drawing. On a sketch pad or a computer screen, ideas which previously only existed in the designer's head become visible. The best and most promising sketches are chosen from the initial diverse offering.
59	<b>Drive shaft</b>	A long metallic tube that connects the transmission and the rear axle.
60	<b>Drum brake</b>	A brake that works by curved brake "shoes" pressing against the inside of a iron drum that is attached to the wheel.
61	<b>E.E.</b>	Electrical (or electronic) engineering.
62	<b>Eco-design</b>	Design with significant consideration to the environment also called green design.
63	<b>Electronic transmission</b>	A computer-controlled automatic transmission, which has four forward gears and one reverse gear. One does not have to manually shift the gears.
64	<b>Engine</b>	A powerplant that uses the force of exploding fuel (typically gas, diesel fuel, alcohol or propane) to create a rotating action to drive the car's wheels. The engine is usually made of pistons linked to a crankshaft to create this rotating motion, or may involve a Wankel rotary engine, which uses a rotating piston.
65	<b>Engine displacement</b>	The total displacement of an engine that is usually expressed in either litres or cubic inches. This is the total volume within an engine devoted to the combustion that produces power.
66	<b>Equipment models</b>	All materials and colours are presented on an intricate 1:1 interior model in standard production geometry, enabling an all-embracing assessment of the interior with regard to geometry and surfaces.
67	<b>Ergonomics</b>	Application of principles that consider the effective, safe and comfortable use of a design by humans. An example would be the design of a

		handle based on anthropometric data and with subsequent usability testing.
<b>68</b>	<b>Estate back</b>	A station wagon, also called an estate car, estate or wagon, is a car body style which has a two-box design, a large cargo area and a rear tailgate that is hinged to open for access to the cargo area. The body style is similar to a hatchback car, but station wagons are longer and are more likely to have the roof-line extended to the rear of the vehicle body (resulting in a vertical rear surface to the car) to provide ample space for luggage and small cargo.
<b>69</b>	<b>Exploded view</b>	Visual representation of an assembly, showing some or all of the components separated to illustrate the parts and their relationships to one another.
<b>70</b>	<b>Fastback</b>	A fastback is an automotive styling feature which is defined by the rear of the car having a single slope from the roof to the rear bumper. Some models (such as the Ford Mustang) have been specifically marketed as a fastback, often to differentiate the model from other body styles (e.g. coupe models) in the same model range.
<b>71</b>	<b>FEA</b>	Finite-element analysis: a computer-based engineering tool for assessing structural aspects of a mechanical design.
<b>72</b>	<b>Feasibility Study</b>	A feasibility study is an evaluation and analysis of the potential of a proposed project, based on extensive investigation and research to support the process of decision making.
<b>73</b>	<b>Final model</b>	The exterior and interior and their respective features are combined by hand to produce a deceptively real-looking final model. All the characteristic features of the new car become apparent. The exterior form of the future Mercedes-Benz model becomes tangible for all associated disciplines.
<b>74</b>	<b>Finish</b>	Surface treatment of component. Maybe functional and/or cosmetic, examples include polishing, painting and anodizing.
<b>75</b>	<b>Flitzer</b>	The German term for the side badge on Volkswagens where the front door line meets the fender.
<b>76</b>	<b>Form</b>	The three-dimensional equivalent of Shape.
<b>77</b>	<b>Form study</b>	Type of prototype used to assess the external form of the design, usually full size, often in a single colour or with minimal cosmetic finishes. The 'clays' used in automotive design are an example.
<b>78</b>	<b>Four-wheel drive</b>	When the engine supplies power to all four wheels for the purpose of greater tire traction. The option

		may be full-time, but there is usually an option to switch from two-wheel to four-wheel drive.
<b>79</b>	<b>Front end</b>	Preliminary stages of the design process, typically where overall configuration and desired appearance are established.
<b>80</b>	<b>Front wheel drive</b>	When the engine supplies power only to the front wheels of a vehicle. This option is usually restricted to smaller vehicles.
<b>81</b>	<b>Fuel injection</b>	Fuel injection is an electronic system that increases performance and fuel economy because it monitors engine conditions and provides the correct air/fuel mixture based on the engine's demand. Fuel injection injects the fuel directly into the cylinder head enabling more precise control over the quantity used. Eliminates the need for a carburettor and the complex, imprecise tuning that goes with it.
<b>82</b>	<b>Gear</b>	Circular, metal, tooth-edged parts that engage with other such parts in order to transfer/transmit engine power.
<b>83</b>	<b>General Assembly (GA)</b>	A drawing or CAD model illustrating all the components of a finished product and their relationship to one another. May incorporate a bill of materials (BOM).
<b>84</b>	<b>Gray market</b>	Refers to cars that are bought in a foreign market and shipped to another market to avoid import inspections. This market is used for getting cars at discount prices, but typically buyers have problems getting the cars serviced by dealers, particularly warranty work.
<b>85</b>	<b>Greenhouse / Day Light Opening (DLO)</b>	The shape and total area of the glass around a passenger compartment in a vehicle. Owners generally favor open, airy greenhouses, but too much glass can make for awkward exterior design. Sports cars often have the smallest DLOs that emphasize performance at the expense of visibility. The best designs offer a balance between extremes.
<b>86</b>	<b>Hatchback</b>	A two- or four-door car with either a coupe or sedan styling but with a door (sometimes referred to as a third or fifth door) in its back instead of a trunk. The backseats in hatchbacks generally fold down for extra cargo space.
<b>87</b>	<b>Horsepower</b>	One of several measures of engine power. In this instance, an engine's ability to move a vehicle. The higher the horsepower of the vehicle, the more mass it can move; in other words, it's more powerful.

<b>88</b>	<b>Human Factors</b>	A phrase largely interchangeable with 'ergonomics', human factors relates to consideration of human users in the design of a product and environment. Some people make a distinction that ergonomics more specifically relates to the physical association between people and products.
<b>89</b>	<b>Hydraulic brakes</b>	Brakes that use pressurized fluid instead of a cable. When the brake pedal is pressed, hydraulic fluid forces the pistons to put pressure on the brake pads which rub against the brake disc and cause enough friction to stop the vehicle.
<b>90</b>	<b>Hydraulic fluid</b>	A fluid that is under pressure in a system. In cars, hydraulic fluid systems replaced wire and rod systems to perform steering and braking more reliably and efficiently.
<b>91</b>	<b>IDEA</b>	International Design Excellence Award. Presented by IDSA.
<b>92</b>	<b>Ideation</b>	Idea generation, typically early in a project and in a relatively loose/abstract form. Brainstorming is an ideation technique.
<b>93</b>	<b>IDSA</b>	Industrial Designers Society of America
<b>94</b>	<b>Ignition system</b>	The electrical system that produces a spark to ignite the fuel/air mixture in a gasoline engine.
<b>95</b>	<b>Illustrator</b>	Computer software often used for 2D design work. Also used extensively by graphic designers.
<b>96</b>	<b>Industrial Design (ID)</b>	A term for the profession, as in the design of industrially-produced goods. ID is generally interchangeable with product design, though industrial design (or ID) is more often used by people 'in the know'. When a distinction is made, it is generally that whilst there is a lot of overlap, industrial design is more focused toward the earlier stages of the design process.
<b>97</b>	<b>Intellectual property (IP)</b>	Characteristics of a design the owner may wish to protect from unauthorized use. Strategies include trade secrets and formal, legal IP protection such as utility patents & design registration.
<b>98</b>	<b>Interface</b>	Elements of a product via which a user receives and inputs information. On a smartphone this may be as simple as a touchscreen and a few buttons. On a motorcycle it is far more involving, with both hands and both feet operating controls, along with visual display of information.
<b>99</b>	<b>Interior clay model</b>	The development of the design is best revealed to the designer on the 1:1 clay model, which is created from the inside out, as it were. All the details are modelled until an aesthetically accomplished sense of space is achieved. Several

<b>100</b>	<b>Interior mock-up</b>	alternative interiors are modelled as a rule, in order to decide which concept is to be pursued. A 1:1 scale model to represent the interior of an automobile. These mock-ups model the geometries and surface finishes inside the vehicle. Mock-ups serve to examine the ergonomics of the driver's area and to assess and select colour & trim variants, for example.
<b>101</b>	<b>Interior sketches</b>	The first step in the interior design process also involves producing drawings and renderings. The various equipment packages or lines are created here – the interior in which the future driver is to feel at home.
<b>102</b>	<b>Joint line/Shut line</b>	Any place on a vehicle where two body panels meet. Joint lines are rarely the centrepiece of a vehicle's design, but they can add or detract greatly from the overall impression.
<b>103</b>	<b>Math Model</b>	Alias surface model.
<b>104</b>	<b>Manual transmission</b>	A mechanism in the drive train with gears to vary the power and torque delivered to the driven wheels. It consists of a lever that the driver operates in conjunction with the clutch to change from one gear to another.
<b>105</b>	<b>ME</b>	Mechanical engineering.
<b>106</b>	<b>Minivan</b>	Similar to sport utility vehicles in that minivans are also a type of truck. These vehicles have taken the place of station wagons as the city transport vehicle of choice. They have a higher road clearance so their visibility is greater than cars and they have much more cargo space. However, their higher centre of gravity makes them less manoeuvrable.
<b>107</b>	<b>Model (including CAD)</b>	Representation of a design. May refer to a physical item or a representation within computer software e.g. CAD model
<b>108</b>	<b>Model approval</b>	Each design process concludes with approval of the model by the Board of Management. Following this approval, the new Mercedes-Benz is released for production.
<b>109</b>	<b>Model selection</b>	The most promising options are chosen from numerous variants and modelled on a scale of 1:1.
<b>110</b>	<b>Moodboard</b>	Collection of images gathered at the outset of a project to help clarify and communicate aspects of the aesthetic of the yet-undesigned product. Interchangeable with theme board. This work aid and presentation tool consists of a collage of photographs, drawings and concise captions. Mood boards help to inspire creative processes by visualising ideas and conveying atmosphere.



<b>111</b>	<b>Mould (or mold)</b>	Tool used to create plastic parts. Typically made of metal.
<b>112</b>	<b>Muffler</b>	A part of the exhaust system that eliminates noise.
<b>113</b>	<b>Native</b>	The file type used by a given software program during normal use (creating & saving files) Example ‘.docx’ for MS Word. Native files are often not used to transfer design data, as translation formats such as STEP offer tamper resistance, revision control and do not have the interdependence that is common with CAD data.
<b>114</b>	<b>New Product Introduction (NPI)</b>	New product introduction is the complete process of bringing a new product to market.
<b>115</b>	<b>Normally aspirated</b>	An engine that intakes air or "breathes" without the assistance of a supercharger or turbocharger.
<b>116</b>	<b>Off-Tool Sample (OTS)</b>	Initial sample created using production tooling. Used to check design and ‘tune’ tooling prior to making production quantities. Common to have at least 2 generations of OTS (OTS1, OTS2, etc.) as first OTS will often not have cosmetic finishes applied to tool.
<b>117</b>	<b>Oil pump</b>	An engine-driven pump that delivers oil, under pressure, to the engine's moving parts.
<b>118</b>	<b>Oil ring</b>	The lowermost piston ring that scrapes off excess oil from the cylinder walls and returns it to the oil pan via vents in the ring and piston.
<b>119</b>	<b>One-box design</b>	A one-box design, also called a monospace, mono-box or mono volume configuration - approximates in shape a single volume comprising engine, cabin and cargo areas, in part by locating the base of a vehicle's A-pillars further forward. One-box designs include light commercial vehicles, minivans, MPVs and mini MPVs.
<b>120</b>	<b>Organic</b>	Describes form. Soft, irregular shapes, as occur in nature.
<b>121</b>	<b>Original Design Manufacturer (ODM)</b>	Company that designs and produces goods to be sold by other brands. The design may be initiated by the ODM or may be to meet a specification provided by a brand.
<b>122</b>	<b>Original Equipment Manufacturer (OEM)</b>	Contract manufacturer that produces complete, finished products. Manufactures products for other brands, (to the design and specification of those brands) which the brand then distributes. Common business model, with many brands outsourcing some or all of their production (to OEMs).
<b>123</b>	<b>Original equipment manufacturer (OEM) parts</b>	Auto parts made by the company which builds the car or supplies the parts to the original car builder; but it is marketed to auto repair shops (instead of being used in new auto assembly).

<b>124</b>	<b>Overdrive</b>	A small auxiliary gearbox that provides an additional gear ratio. It causes the drive shaft to turn faster than the engine crankshaft or "overdrive" it. It is engaged manually when under way and reduces fuel consumption.
<b>125</b>	<b>Overhang</b>	As seen from the side, the part of the car that extends ahead and behind of the wheel arches. Classic American cars commonly had a foot or two of Sheetmetal and frame sticking out in front and back. In the modern era, smaller overhangs have become the more preferred style (and provide more assured handling, as more of the vehicle's weight lies within the wheelbase.)
<b>126</b>	<b>Oversteer</b>	Rear-end fishtailing. Occurs when a car (usually with rear-end drive) is turned too quickly and the rear tires lose traction. The car slides instead of rotates.
<b>127</b>	<b>Package</b>	The essential basis for every design is the so-called "package" - the sum total of all geometrical specifications. On the basis of this package, the sketches are developed such that proportions, dimensions and lines produce a coherent whole.
<b>128</b>	<b>Part</b>	A single element. Some products, such as a paperclip, consist of a single part. Often a product is an assembly of multiple parts.
<b>129</b>	<b>Passive safety features</b>	Those features incorporated into the structural design of the car. Features that the driver cannot control. For example, crumple zones, bumpers, side intrusion beams and roll-over bars.
<b>130</b>	<b>PCB</b>	A printed circuit board (PCB) mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate. PCBs can be single sided (one copper layer), double sided (two copper layers) or multi-layer.
<b>131</b>	<b>Percentile (as in '5th percentile')</b>	Term used within ergonomics to indicate a portion of the population with regard to a particular trait. Using height for example, of a sample population 50th percentile is the mid point, 5th percentile would be the shortest 5% of people within the sample group, 95th percentile the tallest 5%.
<b>132</b>	<b>Phase</b>	A period within a design program that is identified as having a particular focus of activity and/or outcome. A project may have a user-research phase, a concept phase, etc. This term is commonly used in the US, the word 'stage' is largely interchangeable.

<b>133</b>	<b>Pickup</b>	This type of vehicle is a truck. It consists of a closed cab and an open bed. It is popular with the general public because the open bed maximizes the ability to haul cargo.
<b>134</b>	<b>Pilot Run</b>	An initial small production run produced as a check prior to commencing full-scale production. The pilot run provides an opportunity to further refine assembly process or identify any remaining issues with the design or manufactured parts, thereby saving time & money in the transition to full production.
<b>135</b>	<b>Piston</b>	A cylindrically-shaped metal piece (like a plug) that is moved back and forth in a cylinder by pressure from an explosion, or the introduction of liquid or air. In an engine, an explosion in a cylinder head pushes a piston that in turn moves a crank shaft and turns the car's wheels. In a hydraulic system, like brakes, when the brake pedal is depressed, liquid is pushed against a piston that presses a pad against a rotor attached to the wheel, slowing the car.
<b>136</b>	<b>Power train</b>	All of the items needed to "power" a car's wheels, including the engine, transmission, axles, clutch (manual transmission) or torque converter (automatic transmission) and drive shaft.
<b>137</b>	<b>Power Wall</b>	The projection screen on which the designers are able to view and analyse their designs or data models on a scale of 1:1 from various perspectives and in various settings.
<b>138</b>	<b>Pro/E</b>	Brand of CAD software, subsequently named 'Wildfire', and now 'Creo' (the family of products still widely referred to as Pro/E). Well-established platform for mechanical CAD with large user base.
<b>139</b>	<b>Program</b>	A body of design work for a single organisation, typically involving multiple projects. Alternatively a piece of computer software, increasingly called apps or applications.
<b>140</b>	<b>Project</b>	A specific, defined design task. In this context often a product. May also be more narrowly defined, such as a piece of stand-alone research or a conceptual exploration used to gather knowledge without necessarily being intended for production.
<b>141</b>	<b>Proposal</b>	Stated approach to a design project. This is a response to a brief.
<b>142</b>	<b>Prototype</b>	A model made during the design process to assess aspects of the design prior to manufacture. Usually physical, but may take other forms, including on-screen or even Post-it notes.

<b>143</b>	<b>Quality Assurance</b>	Quality assurance (QA) attempts to improve and stabilize production (and associated processes) to avoid, or at least minimize, issues which lead to a product's defects.
<b>144</b>	<b>Quality Control</b>	Quality control (QC) is a process in which the quality of all factors involved in production is reviewed. It emphasizes testing of products to uncover defects and reporting to those who make the decision to allow or deny product release.
<b>145</b>	<b>Quality Management Systems</b>	A quality management system (QMS) is a collection of business processes focused on achieving quality objectives to meet customer requirements. It is expressed as the organizational structure, policies, procedures, processes and resources needed to achieve the desired standard of quality.
<b>146</b>	<b>Rack and pinion steering</b>	Steering system technology that allows for more responsive handling and is found mostly in newer cars. The steering shaft has a small gear at its bottom. It meshes with a toothed bar connected to the steering linkage that controls the two front wheels.
<b>147</b>	<b>Radiator</b>	The device through which air passes to cool a single system in a car. Normally, it is used to cool engine coolant. Conversely, it can cool engine oil. In the case of a turbocharged car, a radiator cools the air being forced into the engine and is called an intercooler.
<b>148</b>	<b>Rake</b>	The angle of the windshield as seen from the side of the car. The Volkswagen Beetle was a good example of a vehicle with almost no windshield rake. Modern vehicles have more rake for lower wind noise and better aerodynamics, although glare can be an issue at too great an angle.
<b>149</b>	<b>Rapid prototyping</b>	Generic term for various production processes whereby sample components and prototypes are produced particularly quickly by reference to CAD data. Methods applied here include stereolithography and 3D printing.
<b>150</b>	<b>Rapid Prototyping (RP)</b>	Various technologies for producing a prototype directly from 3D CAD data which produce a result far more quickly (typically within a couple of days) than traditional model-making.
<b>151</b>	<b>Rear axle assembly(Differential)</b>	The drive shaft, gears and rear axle system that facilitates the changes in power and direction to the rear wheels. Also known as the differential. The term also applies to a front axle assembly (found in rear-engine vehicles).

<b>152</b>	<b>Rear wheel drive</b>	When the engine supplies power only to the rear wheels of a vehicle. This option used to be the standard and still is best used with heavier vehicles.
<b>153</b>	<b>Redline</b>	The maximum number of rpms at which a given vehicle may be safely operated. This number is indicated by a red line on a tachometer.
<b>154</b>	<b>Rendering</b>	A graphic representation which is produced from a sketch, a model or CAD data with the aid of computer technology or directly by electronic means. An image of a proposed design which may be generated by various means including marker pens on paper, 2D software, or 3D CAD visualisation software. The detail provided in a rendering can range from quite abstract and suggestive to photorealistic. In layman's terms, an 'artist's impression'. I have no idea why the term rendering is used.
<b>155</b>	<b>Research</b>	May be undertaken at different times in a project, for different reasons. Common types are user research, competitor research, and research into materials and process.
<b>156</b>	<b>Rhinoceros (Rhino)</b>	Brand of CAD software, tends to be used for free-form modelling and visualisation.
<b>157</b>	<b>Rpm</b>	Means revolutions per minute; it is a measurement of engine speed that refers to the number of times a crank shaft rotates.
<b>158</b>	<b>Sample</b>	Item demonstrating one or more characteristics of a design. Can differ from a prototype in that a sample may represent a material or process, without necessarily being in the form of the design in progress.
<b>159</b>	<b>Scale</b>	A ratio of size to allow documentation of designs that are too large or small to be documented effectively at true size. For example a chair may be drawn at 1:5 scale (one fifth of full size). A scale may also refer to a ruler with graduations to easily measure scaled drawings, but this is more common in architecture.
<b>160</b>	<b>Schematic</b>	A structural or procedural diagram, especially of an electrical or mechanical system.
<b>161</b>	<b>Sedan</b>	A four-door passenger car that is equipped with a separate trunk; usually appears "boxy" because the rear doors are full-sized.
<b>162</b>	<b>Series production data</b>	In the last stage of the process, the final design model which has been approved by the management board is described in 3D data, the so-called "class A data". All the tools required to manufacture the vehicle can subsequently be

<b>163</b>	<b>Shoulder</b>	produced by reference to these data. Great importance is attached here to precisely designed joints, harmonious surfaces and ideal mirror lines. The side curve of a vehicle body, typically above the wheels. Many vehicles lack shoulders entirely, as the roof and sides meet in one continuous line. On the VW Arteon, its shoulders create one of its most distinctive features around the rear fender and hatch.
<b>164</b>	<b>Side impact beams</b>	(Also called side intrusion impact beams.) These are steel beams located on the inside of vehicle doors. They are a passive safety feature meant to protect riders from side impact collisions.
<b>165</b>	<b>Sketch</b>	An image that is quick to generate and does not contain complete detail. Also used as an adjective, e.g. sketch model.
<b>166</b>	<b>SolidWorks</b>	Brand of CAD software. Widely used platform for mechanical CAD.
<b>167</b>	<b>Spark plug gap</b>	The space between the centre and side electrodes of a spark plug across which the spark must jump to ignite the air-fuel mixture in the combustion chamber.
<b>168</b>	<b>Spline data</b>	The spline of a vehicle is the mathematically perfect geometric representation of the visible interior and exterior surfaces, taking into account all technical and aesthetic design requirements. The spline data are approved by Design and forwarded via the Development units to the toolmaker's shop.
<b>169</b>	<b>Sport utility vehicle-SUV</b>	Basically a jeep with four doors. They ride much higher off the road than sedans, which gives drivers higher visibility and the ability to operate on rougher (including unpaved) roads. They usually have plenty of cargo room.
<b>170</b>	<b>Sports car</b>	Is generally a two-seat car which, compared to a sedan, rides lower to the ground, moves faster, has higher horsepower and stiffer suspension. May also be a convertible.
<b>171</b>	<b>Stabilizer bar</b>	A metal bar, usually in a rough U-shape, which links wheels on opposite sides of the car. It tends to keep the wheel motion similar for each side, thus it reduces the roll or sway of a car. As a result, it is frequently called a roll bar or sway bar. Almost always installed on the front suspension, but many touring or performance cars use rear stabilizer bars also.
<b>172</b>	<b>Station wagon (Also known as wagon.)</b>	These vehicles have the same "boxy" style as sedans and have four doors, but instead of a trunk,

		the back of the car is extended to provide a cargo area.
<b>173</b>	<b>STEP file</b>	Computer file format for cross-platform transfer of 3D CAD data.
<b>174</b>	<b>Stereolithography</b>	A rapid prototyping method whereby high-precision plastic components are produced directly from the CAD data. Working with a liquid, light-sensitive plastic (photopolymer) the solid areas of the component are exposed to light from a laser beam, causing them to set.
<b>175</b>	<b>Stitched facing</b>	Leather or artificial leather covering for the dashboard or other interior components, consisting of various pieces which are stitched together by hand.
<b>176</b>	<b>Struts</b>	A metal bar or rod that provides the suspension system with structural strength.
<b>177</b>	<b>Styling Freeze</b>	Point in time after which no further changes to the appearance are intended. This may be implicit and not formally identified.
<b>178</b>	<b>Sub assembly</b>	An assembly that forms part of a larger assembly. For example the display of a smartphone.
<b>179</b>	<b>Supplier</b>	A company that provides goods or services relating to the item being designed, typically prototype or production components. For design the term is largely interchangeable with 'supplier' (though this may be debated by a procurement specialist!). Supplier is more commonly used in Australia and the UK.
<b>180</b>	<b>Suspension</b>	The components on which the vehicle rides, including shock absorbers and struts, which make the ride comfortable. Stiffer suspension gives you a better feel for the road and allows better handling and more predictable cornering. The downside to a stiff suspension is a harsh or bumpy ride.
<b>181</b>	<b>System Architect</b>	System(s) architects define the architecture of a complex system in order to fulfil the technical requirements. Such design includes a breakdown of the system in components, how these components interact together, and generally what technologies they employ.
<b>182</b>	<b>System Architecture Plan</b>	It is the conceptual model that defines the structure, behaviour, and more views of a system.[1] An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviours of the system.
<b>183</b>	<b>Tachometer</b>	A gauge in the dashboard that shows the engine speed in rpms.

<b>184</b>	<b>Thermal Management</b>	Heat generated by electronic devices and circuitry must be dissipated to improve reliability and prevent premature failure.[1] Techniques for heat dissipation can include heatsinks and fans for air cooling, and other forms of computer cooling such as liquid cooling.
<b>185</b>	<b>Thermal Simulation</b>	Thermal simulation calculates the theoretical temperature and heat transfer within and between components in your design and its environment. This is an important consideration of design, as many products and material have temperature dependent properties. Product safety is also a consideration—if a product or component gets too hot, you may have to design a guard over it.
<b>186</b>	<b>Three-box design</b>	Three-box design is a broad automotive styling term describing a coupé, sedan, notchback or hatchback where—when viewed in profile—principal volumes are articulated into three separate compartments or boxes: engine, passenger and cargo.
<b>187</b>	<b>Tolerance</b>	Dimensional variation that can occur between nominally ‘identical’ components during manufacture. Tolerance may refer to a dimensioning approach to define this, or the variation observed in parts.
<b>188</b>	<b>Tool, tooling</b>	Catch-all phrase for dedicated elements of manufacturing equipment used for the mass production of components. Tooling is a general term which includes moulds used for injection-moulded plastic parts and dies used for cast metal parts. Investment in tooling often represents a major capital expense and time component of new product development programs.
<b>189</b>	<b>Torque</b>	The maximum amount of force produced at a specific speed.
<b>190</b>	<b>Torque converter</b>	The torque converter converts hydraulic pressure within the transmission to mechanical torque which drives the drive shafts and ultimately, the wheels.
<b>191</b>	<b>Track</b>	The width between the wheels. Narrower cars have better aerodynamics, but wider vehicles look more premium. Much of the design of the Arteon emphasizes its width, from the flowing horizontal brightwork in the grille to the taillights and seamless, one-piece hatch.
<b>192</b>	<b>Traction</b>	Sticking to the ground or getting a grip on the road. If you don't have traction when you are driving, your wheels are just spinning. Your tires



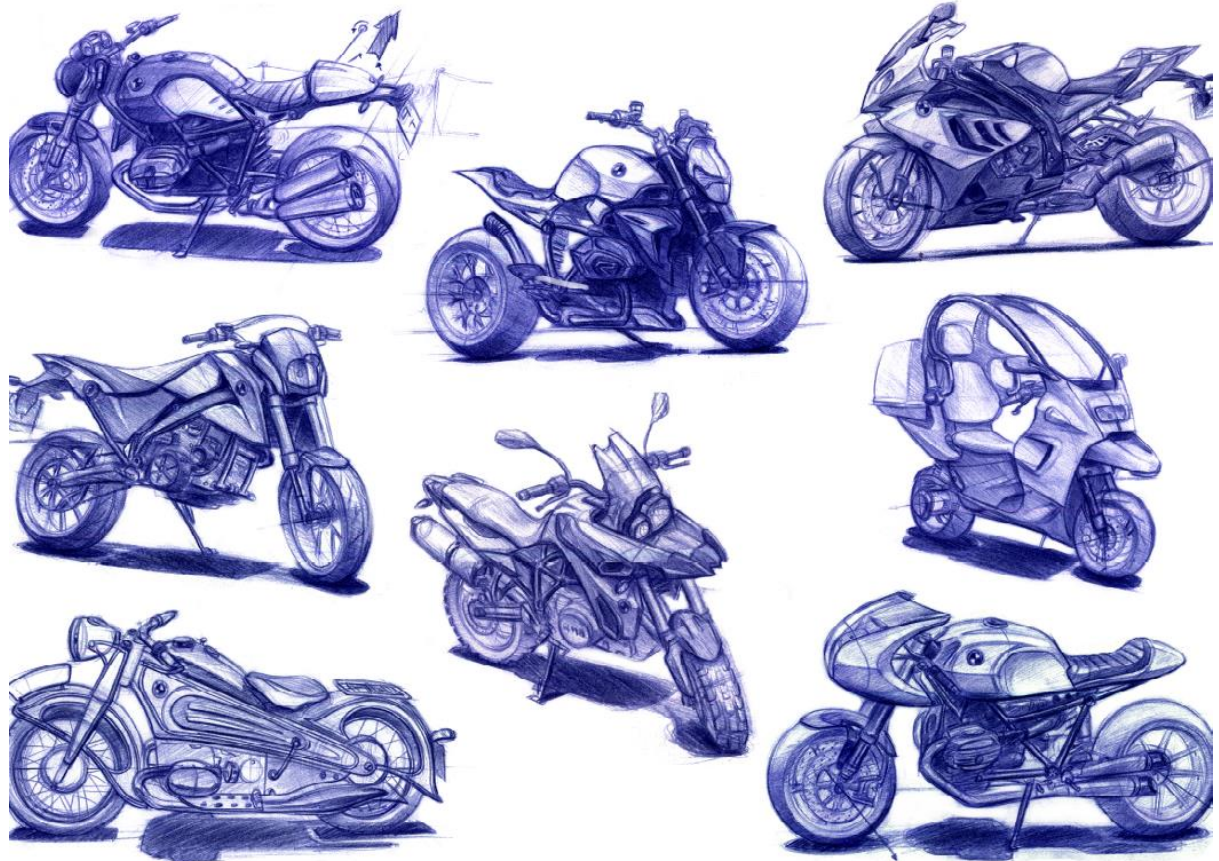
		won't be transferring the car's power to the road and you won't get the full benefit of the work the engine is doing. If you completely lose traction (like on water) you won't be able to steer the car in the direction you want it to go.
<b>193</b>	<b>Transaxle</b>	Generally found in front wheel drive vehicles. A housing of both the transmission and the differential since there is no need for a driveshaft.
<b>194</b>	<b>Transmission</b>	A mechanism that includes the gears, linking the power produced by the engine to the drive wheels.
<b>195</b>	<b>Tumblehome</b>	A nautical term that describes the inward angle of the greenhouse. Pickups, vans and many SUVs have zero to little tumblehome to optimize interior space (and because looking "blocky" can be a virtue.) Just the right amount of tumblehome can be the difference between an attractive design and a competent, but boring, one.
<b>196</b>	<b>Turbocharger</b>	An air compressor that provides more air to an engine than it could normally draw. The added air supply increases engine power.
<b>197</b>	<b>Two-box design</b>	Two-box designs articulate a volume for engine and a volume that combines passenger and cargo volumes, e.g., station wagons or (three or five-door) hatchbacks and minivans
<b>198</b>	<b>UI design (user interface design)</b>	Design field focusing on the interaction between man and machine, that is, control panels and interfaces.
<b>199</b>	<b>Understeer</b>	Front-end ploughing or diving. Also called nose-diving due to weight shifting to the front of a vehicle during a quick or emergency turn, when the tires plough (push) instead of rotate. This is a tendency in vehicles with front-end drive.
<b>200</b>	<b>Unibody construction</b>	A process for building cars in which sheet metal body parts are pressurized to form the body and chassis as a single piece, as opposed to attaching body parts to a frame.
<b>201</b>	<b>User</b>	The person or people who will use the design. A product may have multiple users, for example 'users' of a piece of medical equipment may include the patient, the doctor, and technical staff.
<b>202</b>	<b>UX design (user experience design)</b>	A specialised area of design dedicated to fashioning an overall user experience. UI design is a sub-area of UX design.
<b>203</b>	<b>Valve</b>	A device that can measure or prevent the flow of a liquid or gas. Most internal combustion engines use intake and exhaust valves to control the fuel air mixture into the cylinders and to exhaust burned gases. Some engines have three, four or

		even more valves per cylinder to increase total valve area for increased flow, efficiency and performance.
<b>204</b>	<b>Vendor</b>	A company that provides goods or services relating to the item being designed, typically prototype or production components. For design the term is largely interchangeable with 'supplier' (though this may be debated by a procurement specialist!). Vendor is more commonly used in the US.
<b>205</b>	<b>VIN (Vehicle Identification Number)</b>	A series of 17 numbers and letters that are stamped on a metal plate which is then attached to a dashboard. The VIN identifies the make, manufacturer, model, year and place of manufacture for each car.
<b>206</b>	<b>Virtual model</b>	In order to assess the actual three-dimensional effect, selected designs are produced as authentic detailed 1:4 clay models and as virtual data models. These virtual models are visualised using the Power Wall – a huge multimedia projection screen on which the designers can view and analyse their designs from various perspectives. The car can be envisioned in the correct size and features such as geometry, colour and texture can be altered at a click. While both clay models and data models have their own respective advantages, to this day the virtual world is no substitute for real models produced to scale.
<b>207</b>	<b>Virtual reality</b>	"Virtual reality" refers to an all-embracing computer-generated simulation of reality, which is usually brought tangibly to life by means of special data eyeglasses. The Mercedes-Benz design team uses this technology to visualise diverse concepts relating to all aspects of the car development and design process and to bring these concepts to life in interactive form.
<b>208</b>	<b>Wedge</b>	The horizontal angle at which a car sits when viewed from the side. Minivans have zero wedge; drag racers have extreme wedge. The VW Arteon adds to its overall sport-inspired design with a slight wedge body that rises along its entire length.
<b>209</b>	<b>Wheel arch Gap</b>	The space between the wheel and the body. It's a particular obsession for many auto fans, with a whole enthusiast community devoted to "slammed" cars that have no gap at all. Trucks and off-road SUVs require more gap, but even in those types of vehicles designers work to ensure the body still provides an aesthetically pleasing space. With the R-Line's optional 20-inch wheels, the

**210 Wheelbase**

stance of the VW Arteon carries only a modest gap.

The distance from the centre line of the front wheels to the centre line of the rear wheels. Wheelbase length is a major factor in road stability.



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**Thank You**

