

Independent Inquiry

Philosophical Design Thinking

Design Movements

There are nine main design movements that are still used today. The first is the “Arts and Crafts Movement (1880–1920)”. The Arts and Crafts Movement had an emphasis on hand crafted quality and used mostly natural materials. The second design movement is Bauhaus (1919–1933). The core idea of Bauhaus was that form follows function which means that the design should prioritise functionality and simplicity. This approach combined art and industrial design. The third design movement is modernism. Modernism focused on simplicity and rejected decorative design elements because the aim was to create a universal design language. It set the foundation for contemporary minimalism. The fourth design movement is Art Deco (1920s–1940s). Art deco followed a design style using luxury and glamour. It used patterns, rich colours and lavish materials. The fifth design movement is Swiss/International Style (1950s). This design style followed clarity and readability. It had a focus on typography laid out in a clear manner. It has heavily influenced graphic design & digital media and it has set the standard for clean, functional design. The sixth design movement is Mid Century Modern (1945–1969). The mid century modern design movement was all about minimalism and integration with nature. It was an affordable and functional design, mostly with iconic furniture and home design pieces that remain popular today. The seventh design movement is Postmodernism (1970s–1990s). There was a certain element of playfulness to this design style and it rejected the rigidity of modernism. It had an experimental approach to design thinking. The eighth design movement is Sustainable/Eco Design (1990s–Present). The core idea of this design style is to prioritise the environment and sustainability. In this design style you should conserve resources and be socially responsible in design. This design movement influences materials, processes, and product life cycles across all design fields. The ninth, and final, main design movement is Human Centred Design (2000s–Present). The focus on this design style is to focus on the user’s needs and experiences. Perhaps the ergonomics and convenience of a product or service. Understanding user behaviour and emotional impact is key to the functionality of a product or service.

The design style I have chosen

The design style I have chosen consists of a blend of two types of design movements. I have taken Swiss/International Style (1950s) and Human Centred Design (2000s–Present). The reason I have decided to take Swiss/International Style (1950s) is because it is clean and easy to understand. I know the Swiss/International Style (1950s) is mainly based on typography and graphic design, but I wanted to translate this into a form of car design. An object. Something that looks clean and easy to understand. This is why I have one crease line stretching down the side, round the back and onto the other side of the vehicle. It is one simple line that speaks for itself, just like graphic design or typography. The polestar logo is placed on the side of the vehicle with no background or anything fancy. It stands by itself, and by doing this; it sort of, in

its own way, brings attention to itself. In my opinion fancy graphics and a busy design shouts out something loud like it is desperate to look good when it really does not. But a simple design using the Swiss/International Style (1950s) makes you intrigued into the minimalistic details like the logo as it stands for itself on a plain background.

The second design style that I have chosen is Human Centred Design (2000s–Present). The reason I have chosen Human Centred Design (2000s–Present) is because I believe that when a vehicle (or anything for that matter) is designed based around a human being, it fits its purpose a lot better. For example, it is like designing a container for a pet dog to drink out of. They can't pick up a glass and drink out of it. Therefore, it is much better to design something for the user that it is intended for. In this case, a vehicle will be driven by a human being so the ergonomics of the design should be for human beings. An example of where I have demonstrated this would be the chair that someone will sit in. The sides of the chair wrap around the user to make them feel comfortable. The head rest is designed with this "wrap around" comfortable design too. Another example of where I have used this is the door handles and the doors themselves. This is because the rear doors open in the opposite direction. If you think about it, when you open the door of a car you naturally want to push your arm away from you 90 degrees left or right (depending on which side of the car you are sitting in). This is why Rolls Royce have designed their cars with the same suicide doors that open backwards: they are easier to open. I have also placed the door handles on the side of the car next to each other so you can open the front or the rear doors from the same place. It is just easier than having two different handles, on the side of the car, in two different places.

Identifying appropriate source material and carrying out the necessary research

Social Research

I have done research into autonomous vehicles as I believe the future of cars could be autonomous, especially for Polestar. I have found out that there are 5 levels of autonomy. The first one is 'Level 0'. This is no automation and the car would be driven by a human. The second is 'level 1'. Level 1 autonomy is 'Driver Assistance'. This is where the driver still has to be occupied driving the car. The vehicle will still accelerate and decelerate but only to assist the driver (not by itself). It can also assist with steering and keeping a car in the same lane but it cannot steer and accelerate/decelerate at the same time. Most modern brand new cars today have these features but they are not really autonomous. Level 2 autonomy is 'Partial automation'. The vehicle can control both steering and acceleration/deceleration, just like level 1 autonomy. However, the driver must monitor the environment and remain ready to take control. Level 3 autonomy is 'conditional automation'. This is where the vehicle can only handle all the driving tasks under certain conditions. An example of this would be a Tesla. The certain conditions that the car would need to do this would most probably be on the motorway. The car could accelerate/decelerate, it can steer and brake suddenly but the driver must be able to intervene if requested. Level 4 autonomy is 'high automation'. This is where the car can operate

without human input for driving around the city, in an urban environment. However, the car may need assistance in other situations. The last level of autonomy is level 5 which is 'full automation'. The vehicle can drive anywhere under any conditions without human input and is fully autonomous.

I have found out that there are 4 key technologies in autonomous vehicles. The first are sensors and cameras like radar, lidar and ultrasonic sensors to detect their surroundings and understand road conditions. The second is the use of artificial intelligence and machine learning. This is where artificial intelligence can make decisions itself and machine learning can be used to improve its driving capabilities over time because it learns from experiences just like a human - which is clever and makes you wonder what humanity can achieve after autonomous cars. Anyway, the third key technology is mapping and gps. This will mean the vehicle can use a map ahead of time to know where to go, plan a route and plot efficient routes as well. The car could possibly update the map based on traffic and go down a different road to avoid it. The fourth is V2X. This stands for 'vehicle to everything'. And V2X technology allows vehicles to communicate with each other and surround infrastructure such as traffic signals. This can improve safety and anticipate potential hazards.

The benefits of autonomous vehicles include: safety, increased accessibility, traffic efficiency, environmental impact and cost savings for businesses. The drawbacks of autonomous vehicles include: technology limitations, ethical and legal issues, cybersecurity, cost infrastructure and probably the most important which would be public acceptance and TRUST.

I believe that autonomous vehicles would be first implemented into taxi services and then private cars. Autonomous vehicles can also offer increased independence for young people who can't drive yet.

Historical Research

The first 'automobile' was a steam powered vehicle produced in late 1700s - early 1800s. They were heavy and slow but got the job done. The combustion engine car was a new era produced in the mid 1800s. It was produced by a Belgian engineer in 1860, it was a 4 stroke engine which became standard for car engines back then. The first true and real 'car' was developed by Mercedes in 1885 by Karl Benz. From this moment the car industry grew and cars like the Ford model T were released. New types and segments of cars have been released since then. And in the 1990s - 2010s the cars began to develop safety features with that as a priority. For example, ABS (anti locking brake system). From the 2010s up until now cars have developed technology in terms of what the car can do for the user to make their experience more seamless and combine the use of artificial intelligence. Ever since the 'automobile' was released, design has been more and more about the user and what a human being actually needs and what they do not need. From steam powered inventions to AI driven vehicles.

Contemporary Research

What companies are currently advancing in self-driving technology? Well, Waymo, Tesla and Uber have been researching autonomous vehicle technology. The only current problem with Uber is that they have to stick massive sensors on all their experimental cars and they look quite ugly. But if they keep developing this further they could squeeze the technology needed into something much smaller, less obvious and less intrusive - just like when the first computer was created it was bulky and nowadays it is possible to have an impossibly thin one.

The bigger question nowadays is; what is being done about climate change? Currently, renewable energy technologies are being developed such as: solar, wind, geothermal and tidal energy. But the main focus for vehicles right now is improving battery storage and infrastructure to make renewable energy for vehicles more viable and accessible. By developing batteries, emissions will be reduced to help with climate change. This is because electric cars that use batteries have zero emissions. Another way of helping to reduce climate change is by carbon capture and sequestration. This basically means capturing the existing carbon dioxide emissions in the atmosphere and storing it underground or repurposing it to something useful. Getting cars to have zero emissions for the future means that they could be electric. If this is the case, an electric car needs a battery and a battery needs to be charged. The problem with this is that a typical combustion engine car can be refuelled instantly but a battery electric car needs to be charged. Charging can take multiple hours. So what's being done about this? Currently, fast charging technologies are being developed because if they aren't developed, no one will want to swap to an electric vehicle (EV) instead of using their current combustion engine car. There is no sense in "upgrading" to a car that has a longer refuel time because it is not an upgrade. Research is being put together for batteries that do not degrade when using high power chargers. If we can use high power chargers, the charge time will be significantly less. It is just a matter of implementing this infrastructure. There is also no point having EV's if the battery cannot be recycled as this is the whole point of an electric car: to be environmentally friendly and reduce climate change. So there is research into sustainable materials and recyclable batteries. On top of this there is research into less expensive and rare metals to construct these batteries. There is also talk about wireless charging. This could be quite a challenge but if implemented into the current infrastructure the refuelling process would be better than combustion engine cars could. If this can happen the user won't have to do anything - they could simply drive over a wireless charging pad and it automatically charges their car. Or you could have wireless chargers built into the road itself. This would probably cost lots but there wouldn't be a need to ever worry that your vehicle hasn't got enough charge for a trip.

Design Research

I have completed research about the current design trends and what I have found is that there are currently 10 different trends. The first is minimalistic and futuristic exteriors. This includes sleek, simplified lines with unbroken creases, perhaps down the centre side of the car stretching from the front to the back. This could also improve the aerodynamics of the vehicle as the air can flow over one line straight to the back of the vehicle where it exits. There are also flush door handles - this improves aerodynamics too. The second trend is the 'electric vehicle design influence'. This is basically taking a traditional combustion engine car and making it look like it's new and electric. For example, a closed off grill (it doesn't need to cool and engine) or

blue/green highlights around certain design elements. The third is: eco-friendly materials. This could be the interior or the exterior. For the interior it could be using recycled plastics and natural fibres. As for the exterior it could be a certain type of paint which has a reduced carbon footprint during the manufacturing process. The fourth is: screens. Screens in general actually. Car interiors are becoming more and more controllable with the use of a multitouch surface that can do almost everything in the car like music, air con, windows up or down (just to name a few). Heads up displays are also being integrated into the windscreen of modern vehicles which shows the speedometer, navigation and safety information. This is so that the driver doesn't have to look away from the road. Speaking of which I also found that controls can also be accessed without the use of a screen. A screen is quite distracting and you would have to take your eyes off the road to do something. Whereas, voice activated controls with AI integration mean that you don't have to take your eyes off the road and it does almost everything that a screen does. The fourth is: ambient lighting. I find this feature quite cool, unlike a gimmick though. The reason for this is that if the user is stressed, the ambient lighting can change to a nice blue colour to help you calm down. It can also warn the user of hazards on the road by flashing red or indicating left or right by showing left right in the interior cabin as well as the exterior indicators. The lighting can also sync with music that is playing in a subtle pattern that really enhances your senses. The sixth design trend is: spacious interiors. Thanks to EV platforms with a flat battery under the car instead of a transmission tunnel. A spacious interior could also mean chairs can recline further, there is more storage space/seating or chairs could face one another to make the experience more social. Floating consoles seem to be quite popular with floating centre consoles or armrests which add more legroom underneath them but also adds a touch of luxury. The seventh is: driver convenience. For example, cruise control, lane keeping assist or cameras instead of wing mirrors that stick out (not helpful when trying to park in tight spaces which is quite ironic since they're supposed to help with that). The eighth trend is: more colour options. Instead of black silver and grey (like most cars out there) there are new colour combinations like matte, satin, two tone finishes and warmer retro hues. The ninth trend is: a focus on the user experience and simplification. For example, minimalist dashboards to help focus on driving or just to make you feel less claustrophobic. There is also haptic feedback, which I find very interesting. This gives the user a feel inside the vehicle which helps take away from the fact they are inside an electric car. An electric car doesn't make a sound, so to some, it might seem a bit boring. But haptic feedback, whether it's on a chair or the steering wheel, might help to make the experience feel like it's still there and not lost. The last design trend is: aerodynamics and sustainable wheel designs. Aero wheels make the car more aerodynamic and can help preserve the range of the car by reducing drag. Along with aerodynamics comes making the car lighter which also helps with saving energy and preserving range.

Formulating key questions and evaluating and discussing my material

Are electric cars better than combustion engine cars?

There are many positives to electric cars but there are also some negatives. Starting with the positives, they have lower operating costs. This is because electricity is mostly cheaper than fossil fuels but also it costs lots to mine for fossil fuels and extract them. Secondly, electric cars have a lower environmental impact especially when using renewable electricity. Thirdly, electric vehicles have a quieter sound around an urban city. If every car is electric the city's noise pollution will be less. Fourthly, electric cars have instant torque from the get go - plus they have smooth acceleration with no gear changes (although some may like this feeling). However, they tend to be faster at accelerating than internal combustion engine cars (ICE).

There are some negatives, unfortunately. The first is limited range compared to combustion engine cars, especially if the area you are in has a lack of charging infrastructure. The second is a longer refuelling time, which I have previously talked about. The third is a higher initial purchase price. No one will see the sense in purchasing a car that is more expensive than their current combustion engine car. Fourthly, the battery can degrade over time which limits the maximum charge of the vehicle. You don't get a smaller fuel tank on current cars as the vehicle gets older.

Analysis

You could say combustion engine cars are better than electric cars because you do not have to wait around for it to charge, they also go further once they have been charged (or refuelled). And as for the selected group of people who love cars; a combustion engine will never fade away for them. They make a thrilling sound, they have a thrilling feel changing gears, starting up the engine and something that is actually interesting. Whereas, an electric car is boring to them. They do not have any gear changes that you can feel, there's no sound to them. And on top of that they are initially more expensive than their current combustion engine car. Oh, and you have to wait around for it to charge up. Not really ideal for someone who bought a car to drive it, not wait to drive it.

However, electric cars have instant torque, which means they can accelerate faster. But they are also cheaper to refuel (or charge up) and run in the long term. All you would need to do is spend the large initial cost of installing some solar panels at your home and then basically charge your car up for free. There are lower maintenance requirements for electric cars as there are less moving parts - so that is cheaper too. But also the annual tax is less. On another note, EV's (as they are brand new cars) usually get all the innovative features that combustion cars do not get. For example, an updated display with cutting edge technology. There are also driver assistance systems. And all of this is sustainable because it can stay updated through simple software updates without having to install anything or upgrade the car entirely.

Are hydrogen cars the way forward?

The reason I have chosen my polestar design to be hydrogen powered is due to several things. The first is they have zero emissions, just like electric cars, but they can be instantly refuelled just like internal combustion engine cars. Even if an electric car is charging with the fastest

charging speed and cable, it won't be able to outperform the speed of a hydrogen powered vehicle. The second reason I have chosen hydrogen as an energy source for my Polestar design is because (from what I've researched) they have the same amount of range as a combustion engine car or even higher which outperforms both combustion and electric cars. The third reason is that I believe the exhaust pipes on a car give a vehicle character and make it look interesting. But because electric cars don't need exhaust pipes, they lack any characteristics and look a bit boring. However, hydrogen powered cars need exhaust pipes as they emit water vapour (making them environmentally friendly) but also keeping an interesting character. A hydrogen powered car is similar to an electric car, it is just that instead of having a battery, they have a hydrogen fuel cell. And there are a couple of reasons why this is better than a battery, which brings me onto the fourth reason. A hydrogen fuel cell is much lighter than a battery, which saves fuel as the vehicle is not having to work as hard to move such a heavy vehicle. But also hydrogen fuel cells generally degrade a lot slower than batteries, meaning they have a longer operational lifespan with consistent performance. They also have fewer moving parts than an internal combustion engine car, potentially reducing wear and tear. Fifthly, the infrastructure to set up hydrogen powered cars is a lot simpler and easier than an electric car's infrastructure. This is because a hydrogen fuel station can be designed to produce hydrogen via electrolysis on site. By doing this, you will avoid all the problems associated with accessing the grid demand and infrastructure challenges faced with electric cars. Hydrogen can also be easily stored and transported to fuel stations. Sixthly, hydrogen is easier to gain access to than fossil fuels and it can even be made with excess energy from solar panels or wind. You still have to mine for certain materials like lithium and cobalt to create an electric car battery and this is not sustainable for the future if it runs out just like fossil fuels will. Seventhly, batteries do not perform well in colder temperatures like at winter which could reduce the total range of the car but hydrogen powered vehicles perform better in extremely cold temperatures. They will also start up better than combustion engine cars in colder weather.

Of course, there are some issues with hydrogen powered vehicles. They currently have limited refuelling stations compared to EVs, but this can be easily changed. It is also more expensive to produce the hydrogen, especially if not sourced in a renewable way. But overall, they excel where fast refuelling, long range, light weight energy storage, and heavy duty performance is needed. So I believe they can compliment electric cars instead of replacing them. They can just be used for what they are good for. One thing is for sure, internal combustion engine cars are not the way forward but hydrogen could be along with electric cars.

What does my user need from my Polestar design?

I have researched everything that my customer could need out of a hydrogen powered Polestar SUV. I have found that the first thing they would want is cheaper hydrogen, as it is currently quite expensive. But in terms of the design of the vehicle they would need around 700 miles of range or more - for a big car it makes sense to have a large range. I am aiming for my target user to be a group of employees at a firm who need to travel places and work at the same time - to save time. This could mean that the seating positions inside should be set up to accommodate for a working environment. Therefore, I would like to place 5 seats in total inside

the car, with the fifth seat as a spare. But for the main focus to be on four seats which are facing inwards. The front two seats are facing backwards and the rear two seats are facing forwards with a spare seat between them. For it to be a working environment there could be a table in the centre for the workspace.

In terms of safety, my user will expect the highest standard. This is because Volvo has had the highest safety standards for a while now and everyone knows Volvo is one of the safest brands. Due to this, as Polestar is a sportier version of Volvo, safety is still a number one priority. Therefore, I would need to ensure the vehicle is fitted with hydrogen leak detection as hydrogen is a flammable gas so it can alert everyone inside the car (not just the driver as this SUV will be autonomous level 5). In the rare occurrence of a crash, the hydrogen tank will need to be crash resistant so it doesn't explode.

In terms of assistance, I don't particularly believe in screens built into a car as they make it date faster and become less timeless over time. Therefore, I would like to integrate the use of AI as a voice assistant into the vehicle for anything like checking the weather at the destination or playing work focused music inside. As for the air con and windows, I would prefer for it to be a physical button for each user on their arm rest. I think it would also be easier for the user to operate the car with the use of their smart phone as well, just because it is personal to them. This means they could have a seating position, the air con or any information read out to them like the weather every time they are inside the car.

As this vehicle would be mostly used for long distance working, I think it should be capable of heavy duty towing. Maybe towing work supplies instead of renting a van. Or even extra cargo in the form of a roof box. The car itself could also be used as a power house to charge phones, laptops, working equipment multiple times over and still have enough energy to power itself.

Conclusion

Safety and environment are my top priorities for this hydrogen powered Polestar SUV. Safety; because it represents the Polestar brand very well but also because it gives the peace of mind to my customers which they deserve to have. Environment; because it is sustainable for the future needs. A hydrogen powered car has zero emissions, it's lighter than an electric vehicle, and it can charge much quicker than an electric vehicle.

The success of a hydrogen powered vehicle greatly depends on the infrastructure that is put in place. But since it can be built a lot easier and a lot quicker than the infrastructure needed for EVs, it should not be a large issue. Furthermore, hydrogen can either be transported or even made at the fuel station by the use of electrolysis. If it's transported, it is still cheaper than storing electricity for electric cars. And if it is made on site, it is also still cheaper. Electric cars still depend on improving battery technology which can degrade over time. Hydrogen technology does not need further assistance or to be improved as they don't degrade as much as electric car batteries. However, the fuel tank itself may need to be improved to be safer during a crash.

Overall, my Polestar design may need to continue to prioritise safety and the environment. But should also think about luxury as an element of design as Polestar are the sub-brand of Volvo and are slightly more luxurious and sportier.

References

I have used Generative AI to support me in all of my research.