Sustainable Thinking & Western Transportation Design

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With growing concerns about climate change and environmental degradation, sustainability has become a strategic priority for many that are inclined to the idea. Different industries have touched on the topic as well as taken precaution and action towards sustainability and environmental awareness. From the fashion industry with clothing and how they are produced, to the food industry and how they grow crops and maintain food sources, to even the energy industry and how the production of energy makes up one of the biggest industrial contributions to carbon emissions. Collectively making up 28% of the United States Greenhouse Gas contributions. (etee.com) All of these industries are vital to human society and leave an indelible mark on our world as we know it. Although an industry just as big and very much part of energy consumption, societal functions, and human advancement is the transportation/automotive industry. This includes trucks, cars, boats, planes, and trains. Pretty much any non-human powered or electric mode of getting from point A to point B, with emissions from cars and 'light duty' vehicles making up 60% of the contributions. These statistics are only considering the fuel burned to power the vehicles and not the actual production of them. (etee.com) Which brings us to the topic of discussion; How good sustainable car designing can lead to environmental benefits. As designers in the art industry one may think it is none of our concerns how sustainability can affect our designing of these machines for the betterment of the environment, However it can play a huge part in the influencing of using sustainable material and engineering to create well crafted modes of transportation that both serves our society and environment and look great while doing it.

Firstly, one must know how we got here? Why does this matter? And how can we compare the significance of sustainable thinking and non sustainable thinking. Throughout the twentieth century one of the first car manufacturers Ford Motor Company thrived off innovation. In chasing the next big technological improvement in motorized vehicles, Ford alongside many other arising automobile companies such as General motors, at the time thrived off using whatever means that could lead to efficient engines powering their vehicles. Though at the time this was seen as okay because car production was relatively new, little did society know that this would spiral out of control. Degrading environmental health and causing emissions and pollution to increase in the coming decades. This is an example of non sustainable thinking; though it is no one's fault, due to the time period in which this took place no one could foresee the incoming degradation. However with failure comes experience and learning from ones mistakes. Presented in this manuscript “Design for sustainability in automotive industry by researchers at Clemson University International Center for Automotive Research ” are the current sustainability research within the automotive industry. “ Through a comprehensive review of the different studies in vehicles’ life cycle, disposal and end of life analyses, and the different sustainability metrics and models used to quantify the environmental impact. The sustainability research in this study targets the measures and studies at the three basic elemental levels involved; environmental, economic, and societal. The presented review categorizes the literature into four main research areas; the life cycle assessment approach, the end-of-life per-spective, the design for X, and the light-weight engineering and material selection studies. Also, the text attempts to draw the link between these research themes and expose any inter-relationships, and discuss the physics behind some of the sustainability models presented to analyze automobile sustainability.” (Mayyas et al) The researched text is an example of sustainable thinking as it basically insights

the viewer on the current life cycle of everyday vehicles. Raw materials are gathered for the production start, then after are prepped for part manufacturing, the parts are made then goes forward to product assembly and remanufacturing. Afterwards once production is finished the vehicle is on the sales floor, once purchased and used it is onward unto disposal, incineration, landfills, or storage; and whatever can be salvaged from the disposal process will be reused, recycled of parts, and recycled of materials. The overall goal of the research is to evaluate the chances of reducing the disposal process through looking at it through the lens of physics and graphs.

After some background research on how this affects the population, rest assured that there is action being taken. Nowadays most car manufacturers participate in a process called "Eco-design" where the manufacturer takes an "environmentally conscious" approach to translating eco legislation into the engineering design process. In a study conducted by Chrysanthi Makri, Rajkumar Roy and Peter J. Sackett at Cranfield University, the research discusses "a case study on how an Original Equipment Manufacturer's technical design center translates and integrates legislative environmental requirements into their product range. The integration of these environmental requirements during the conceptual design phase, where the significant proportion of resources is committed, is of utmost importance. Additionally, with increasing levels of product development being conducted by the first-tier suppliers, there is greater emphasis on the Original Equipment Manufacturer, who controls the product specifications, for translating and filtering the environmental requirements down the supply chain. A Requirements Management based model addressing environmental issues is described." (Makri et al) The study demonstrates the industries attempt to push things in the right direction

as these legislations are enforced to the supply chain to equate to better sustainability practices as the vehicles are designed and engineered. This translates back to said designers as they now must have sustainable thinking when designing their next vehicle. These positive habits will lead, and have led to major benefits for the user and the environment. Stated here by “Blue and Green Tomorrow,” “A key advantage of green eco cars is the reduction of fuel costs. You will be able to drive your environmentally friendly car at a significantly lower cost than a conventional car." (B&GT) This is here to demonstrate that not only the environment benefits but the user eventually as well, if companies continue down this sustainable path.

Thankfully due to these habits being exercised by these vehicle companies there have been many steps taken towards new innovation. Eco friendly cars are a reality and alongside with it is the rise of electric cars which also brings a slew of benefits to the environment. Besides lower fuel costs, electric vehicles also serve as a greener alternative to gas or diesel vehicles. By eliminating exhaust, they can reduce a car fleet company’s greenhouse gas emissions. This advantage helps businesses stay sustainable and compliant with government guidelines. Aswell as help the global emissions expense decrease. Another more prominent type of vehicle is in the works however. Alongside eco-friendly cars and electric vehicles there is a vehicle concept called “Hypercars.” Right now the term “hyper car” is used to describe the highest performance a vehicle can have. Lamborghini is one of the leading manufacturers in hypercars however these cars are only available to the one percent of people looking for that tier of performance. In a Paper entitled “Hypercars: A Market-Oriented Approach to Meeting Lifecycle Environmental Goals by Jonathan W. Fox and David R. Cramer from Rocky Mountain Institute” they go into the prospects of the fundamentals surrounding hypercars. They state that “Growing social and

regulatory pressures are compelling automakers to make cars with not only higher quality but also lower lifecycle environmental impacts. Examples include rules and incentives for clean manufacturing, low-emission vehicles, and recycling. Yet focusing on any single issue or stage of the car's life cycle in isolation can easily turn into a zero sum game: any improvement in one area can worsen other issues or stages, or even render the car unmarketable or unprofitable. This paper describes a system-level approach to car design that could minimize life cycle environmental impacts without sacrificing the features that make cars attractive to consumers, such as price, performance, safety, comfort, and styling. This approach is the ultralight, hybrid-electric "hypercar" concept developed at Rocky Mountain Institute's Hypercar Center since 1991. The paper details how a car optimized to meet market and regulatory requirements can also have a minimal life cycle environmental impact." (Fox and Cramer) The use of this research is to somehow take the essential principles that go into hyper car designing and implement them into the ninety nine percent of cars being made today. This is imperative because they are essentially trying to bridge the gap between the high performance vehicles and everyday consumer vehicles. The hyper cars have so many contributing factors that could as a whole bring more stability to the automotive industry. They have 63% lower mass, 55% lower aerodynamic drag, 65% lower rolling resistance, 300% more efficient accessories (lighting, HVAC, audio system, etc.), 60% efficient regenerative braking (i.e., braking energy recovered), and 29% efficient hybrid driving. (Fox and Cramer)

The numbers do not lie, they are incredibly more efficient however vary expensive that is why the point of the study is not to make hypercars the only cars that should be produced, that would be tremendously expensive for companies to conceive and would make vehicle shopping

the equivalent to purchasing a full house, and it is already close enough to that as it stands today. The goal is to once again, learn from experiences and take advantage of what is already working and available out there and utilize it to better the industry as a whole as it pertains to environmental awareness and benefits. From openly addressing the design for sustainability in the automotive industry, addressing our faults in the matter and research leading towards getting better, to translating environmental legislation into the concept design and engineering design domain so that sustainable thinking is present when developing the latest and greatest, and even looking at new eco friendly alternatives concepts such as eco friendly cars, electric vehicles, and hyper cars, our industry can and have taken broad steps towards the betterment of environmental degradation. This has shown that with sustainable designing in mind there will be more triumphs in environmental benefits for the road ahead.

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