MIE 657: Human Factor Design Engineering
Design Project 2 – Final Report

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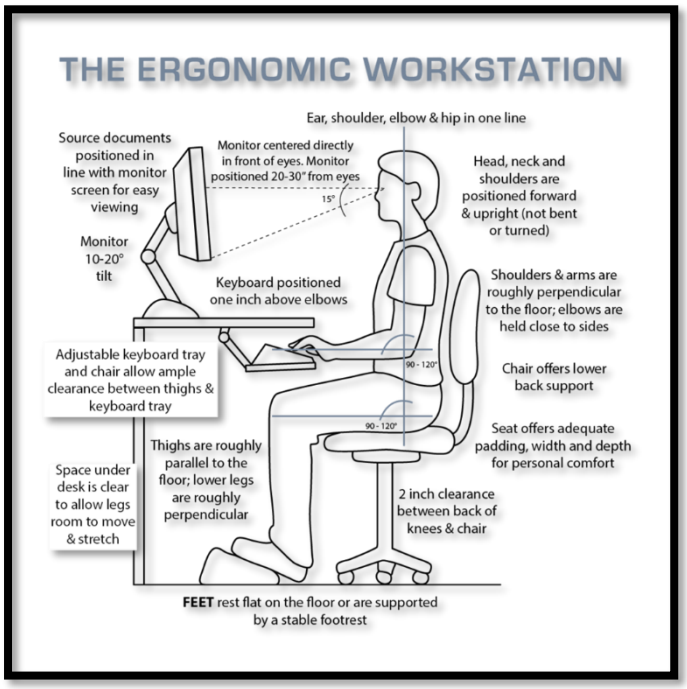
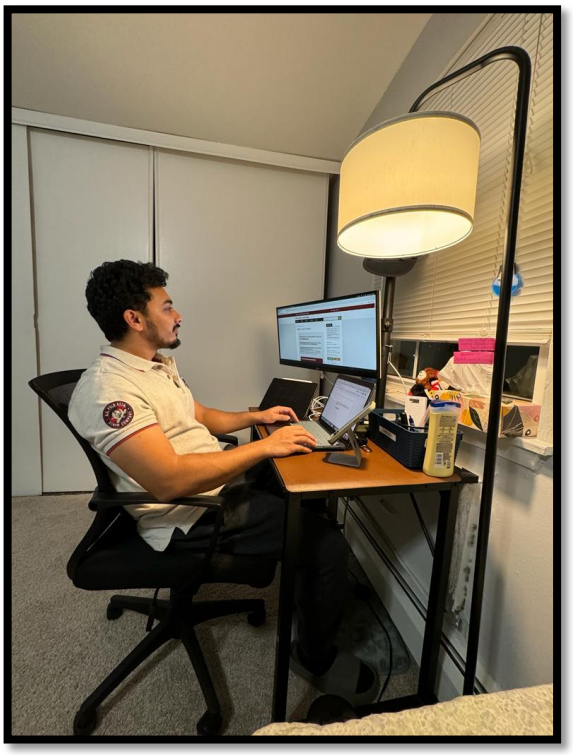
Good Designs

#1 Ergonomic Office Chairs:

1.1 Description of the design with image:





The ergonomic chair's Human Factors Design concept revolves around maximizing comfort, support, and adaptability to meet the varied needs of users. Its design focuses on several key aspects:

- *Adjustability:* The chair is designed to accommodate various body types and preferences. It includes adjustable features such as seat height, armrests, lumbar support, and back angle to ensure a personalized fit for different users.
- *Posture Support:* The chair promotes proper posture by providing adequate lumbar support and a design that encourages the natural curve of the spine. This support reduces strain on the back and supports the body's alignment during extended periods of sitting.

- *Material and Cushioning:* High-quality materials and cushioning ensure durability, comfort, and breathability. This contributes to the overall comfort and reduces discomfort associated with prolonged sitting.
- *Mobility:* The chair allows for ease of movement, enabling users to reach different areas of their workspace without strain. Smooth swivel capabilities and smooth-rolling casters contribute to this functionality.

By emphasizing user comfort, support, and flexibility, the ergonomic chair exemplifies the Human Factors Design idea. Its design allows for a wide range of body types to be accommodated with adjustable settings such as seat height, armrests, lumbar support, and back angle. It is made of high-quality materials and padding, ensuring durability, breathability, and long-lasting comfort. The chair emphasizes appropriate posture and provides critical lumbar support and spinal alignment, reducing strain during long durations of sitting. The chair facilitates mobility by allowing fluid movement and smooth swivel capabilities, allowing users to easily explore their workstation. Intuitive controls provide a simple interface for making individual adjustments, delivering a pleasant and supportive sitting experience for a wide range of users.

1.2 Design's function and purpose:

The design of the ergonomic chair serves multiple functions and purposes:

- *Comfort and Support:* The main purpose of this is to give those who are sitting for long periods of time comfort and support. To lessen strain and guarantee comfort, the chair's design incorporates elements like padding, ergonomic shapes, and adjustable lumbar support.
- *Posture Improvement*: Its goal is to maintain the spine's natural curvature, which helps to promote good posture. This feature aids in the reduction of muscular tension and back discomfort brought on by bad sitting position.
- *Customizability:* The chair's design for a high degree of customisation to satisfy each user's unique requirements. Seat height, armrests, and back angle are just a few of the adjustable features that let customers customize the chair to their level of comfort.
- *Enhanced Productivity*: The chair seeks to maximize productivity by reducing discomfort and distractions brought on by unpleasant by providing comfort and support.
- *Health Benefits:* Reducing the danger of musculoskeletal problems brought on by extended sitting also serves to improve people's general health and well-being.

In conclusion, the main goal of the design is to give users who spend a lot of time sitting down with supportive, comfortable, and customizable seating that improves their posture, productivity, and general well-being.

1.3 Context of use:

Ergonomic chairs find extensive use in various settings where prolonged seated activities occur. They are essential in corporate offices, home offices, healthcare facilities, educational institutions, and personal homes. Specifically designed to enhance posture and reduce musculoskeletal issues, ergonomic chairs offer comfort and support for individuals engaged in desk work, remote work,

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teaching, and gaming. These chairs contribute to well-being by minimizing pain during extended periods of sitting, making them versatile solutions for those immersed in screen-related activities. Whether in professional workspaces or leisure environments, ergonomic chairs prioritize user health and comfort, promoting a conducive seating experience across diverse settings.

1.4 Users of this design:

The users of ergonomic chairs encompass office workers, executives, administrative staff, freelancers, students, educators, healthcare professionals, remote workers, gamers, creatives, and individuals seeking comfort during leisure. Anyone in need of better support during prolonged seated activities or relaxation can benefit from this design.

1.5 Human Factor principles which make this design good and are being followed:

A well-designed ergonomic chair includes several Human Factors concepts to assure user comfort, safety, and usability. This design often adheres to ergonomic principles, which emphasize fitting the chair to the natural shape and motions of the human body. The capacity to adjust the chair to fit the user's individual body proportions and preferences is a vital feature, harmonizing with the notion of anthropometry.

An ergonomic chair adheres to ergonomic principles by offering adjustable seat height, armrests, lumbar support, and tilt mechanisms. These changes fit different body sizes and shapes, helping users to maintain appropriate posture and reduce spine strain, which accords with the comfort principle. Furthermore, the chair's materials and cushions contribute to comfort, assuring that prolonged use does not cause discomfort or pain.

In conclusion, by offering comfort, adaptability, and usefulness, a good ergonomic chair adheres to the principles of human factors. By keeping these guidelines in mind, a well-designed chair promotes users' health, lowers their chance of developing musculoskeletal problems, and improves their general comfort and productivity when they are sitting for extended periods of time.

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#2 Sensor bottle filling device:

2.1 Description of the design with image:

Consider a situation where an individual walk up to a sleek, modern water fountain. As they approach, a sensor detects their presence and the nozzle automatically extends. They place their bottle underneath, and the water flows smoothly, stopping automatically when the bottle is removed. This is the vision of a sensor bottle filling device designed with human factors in mind.

The sensor bottle filling device redefines hydration with a human-centred design. Gone are the days of clunky levers and overflowing bottles. Now, sensors seamlessly detect your presence, extending a welcoming nozzle. No need for awkward manoeuvring, this device caters to everyone, especially those with limited hand mobility. Precise sensors work like magic, stopping the flow exactly when your bottle is full, saving water and preventing messy spills. You're even in control of the pace, choosing the perfect flow rate for your bottle size and preference. Comfort is king, with the device positioned at an ideal height and angle, welcoming all users with open arms, regardless of physical limitations. Worried about instructions? Fear not! Clear visuals and intuitive cues guide you through the process, making hydration effortless. And to top it all off, high-quality materials ensure this device is built to last, standing strong against frequent use and cleaning. So, ditch the struggle and embrace the future of hydration, where ease, comfort, and inclusivity flow freely.

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2.2 Design's function and purpose:

The Sensor Bottle Filling Device, which smoothly integrates technology to improve user experience and suit a variety of needs, is the embodiment of Human Factors Design Engineering. Its main purpose is to make drinking water easy using sensor-activated features that put inclusivity and user convenience first.

With no buttons or levers, the sensor-activated flow of the device reacts to the user's presence in a logical manner. Because of the streamlined interactions and reduced physical effort, individuals of different capacities can utilize it. The sensor's human-centric design creates a warm and intuitive experience by detecting users and extending the nozzle in response.

Accurate cut off, enabled by the sensors functioning as "water wizards," takes care of the efficiency and conservation aspect that affect humans. The design avoids needless spills and saves water by monitoring bottle fill levels and stopping the flow at the right time. This is in line with ergonomic principles, guaranteeing that technology fulfils human requirements and promotes sustainability.

Users may tailor the flow of water to suit their own tastes and bottle sizes thanks to the adjustable flow rate feature. This adaptability acknowledges that there is no one-size-fits-all approach to hydration and is in line with the human component of variability in user requirements. The ergonomic design addresses the human factor of comfort by cradling the bottle at an ideal height and angle, ensuring users, regardless of physical limitations, enjoy comfortable and convenient access to hydration.

Beyond functionality, the device champions hygiene by minimizing surface contact, appealing to users concerned about cleanliness. Its sustainability features make environmental consciousness, turning hydration into a responsible and mindful endeavour.

In essence, the Sensor Bottle Filling Device, through its sensor-activated and user-centric design, embodies Human Factors Design Engineering principles by prioritizing ease of use, inclusivity, efficiency, adaptability, and sustainability in hydration.

2.3 Context of use:

The sensor bottle filling machine is intended for usage in public areas, where it will meet a variety of user requirements while encouraging sustainability and hygiene. By removing manual interaction, sensor activation lowers the possibility of contamination. Spills and water waste are prevented by the automatic shut-off when the bottle is removed. Different users and abilities are accommodated with adjustable flow rates and clear directions. Everyone can use the device comfortably because of its accessible height and ergonomic design. By utilizing human-centred design concepts, the sensor bottle filling system creates a better atmosphere, encourages hydration, and improves the user experience.

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2.4 Users of this design:

The sensor bottle filling equipment warmly welcomes users of diverse abilities, catering to health-conscious individuals with touchless functionality, those with restricted hand dexterity for automatic hydration, people of varying heights with an ergonomic design, kids with clear directions for ease, and convenience seekers with a speedy and clean encounter.

2.5 Human Factor principles which make this design good and are being followed:

Human Factors Principles in Sensor Bottle Filling Device Design

The sensor bottle filling device excels in its user-centric design, adhering to several key Human Factors principles:

- *User-centred design:* The device prioritizes the needs and capabilities of users, ensuring ease of use and accessibility for all. Sensor activation and automatic shut-off simplify the filling process, while adjustable flow rates accommodate different preferences and bottle sizes.
- *Compatibility with human capabilities:* The device's height and angle are ergonomically designed for comfortable use by users of all physical abilities. Clear instructions and visual cues minimize cognitive load, making the operation intuitive for everyone.
- *Minimize user error:* Automatic shut-off eliminates the risk of overflowing bottles, saving water and reducing spills. The intuitive design with minimal manual interaction minimizes the potential for errors and ensures a smooth and efficient filling experience.
- *Feedback and information:* The device provide clear visual cues through lights or displays, indicating the filling status and preventing unnecessary waiting. This feedback loop keeps the user informed and in control of the process.
- *User satisfaction:* The combination of functionality, ease of use, and visual appeal promotes user satisfaction. The touch-free operation contributes to a clean and hygienic experience, further enhancing user satisfaction.
- *Affordance:* The device's design clearly communicates its function. The shape and placement of the nozzle intuitively guide users on how to position their bottles for filling. This affordance minimizes the need for instructions and promotes intuitive interaction.
- *Cultural sensitivity:* The device's design avoids cultural biases and ensures inclusivity. Clear visuals and minimal text minimize reliance on language skills, making it accessible to users with diverse cultural backgrounds.

By adhering to these Human Factors principles, the sensor bottle filling device provides a positive user experience, promotes hydration, and fosters a more accessible and inclusive environment for all.

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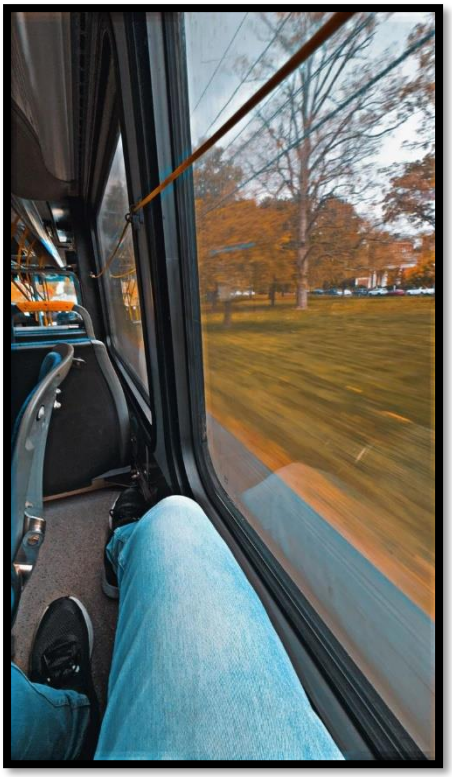
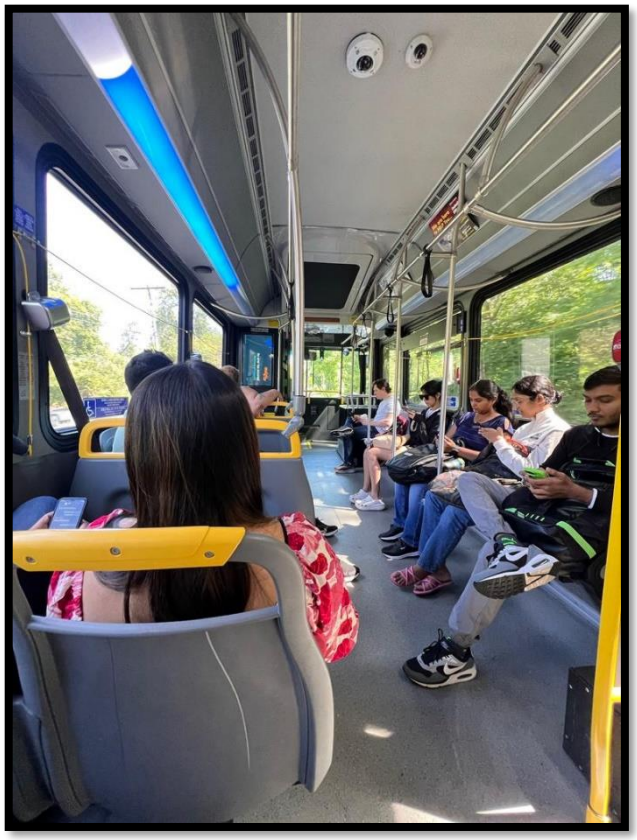
#3 Cord in PVTA buses:

3.1 Description of the design with image:





Along the inside edges of the bus, generally running along the windows or overhead, is a yellow cable or button. When they want to let the driver know that they want to get off at the next bus stop, passengers can either pull the cable or press the button.

In order to make sure that passengers and the signalling system interact in a way that is clear, effective, and improves overall safety and happiness, human factors engineering is essential.

- *Accessibility*: The cord is positioned so that passengers of different heights and abilities may easily grasp it. This design considers the wide variety of people that use public transit.
- *Visibility*: The cable is readily observable due to its position along the inner sidewalls, which usually contrast with the surroundings. Clearly labelled components and visual clues let passengers recognise the stop request mechanism immediately.
- *Ease of use*: The design is so easy to use that communicating a passenger's intention to exit just requires a single action (pulling a cable or pushing a button). Due to its simplicity, anyone of varying ages, languages, and levels of experience with public transportation systems may utilize it.
- *Universal Design*: There is no need for lengthy instructions because the stop request mechanism is made to be understood by everybody. This is especially crucial in a community with different transportation users.

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In general, human factors have been carefully considered in the design of the stop request system on PVTA buses and other comparable systems on other public transportation vehicles to offer a convenient and effective way for passengers to interact with the bus driver.

3.2 Design's function and purpose:

- *Accessible Location:* On the inside sides of PVTA buses, signalling wires and buttons are arranged in a deliberate manner. Due to the ergonomic positioning, passengers may engage with the signalling mechanism without experiencing unnecessary physical strain, whether they are seated or standing. Making a design that is easy to use and accommodate people with different levels of mobility is the aim.
- *Clear Signage and Visual Cues:* To improve user comprehension, the signalling system makes use of either clear signage or visual cues. Passengers who may not be familiar with the system or who have visual problems can particularly benefit from this. By reducing uncertainty and offering a clear communication channel, the integration of tactile and visual aspects promotes a more inclusive design.
- *Clear Interaction:* It is intended for the act of signalling to get off the bus to be simple and clear. As a result, there is less chance that users may hesitate or make mistakes when operating. Passengers may confidently utilize the system to inform the driver of their intended stops because of its straightforward signalling mechanism, which also enhances user satisfaction.
- *Auditory Feedback:* Alarms or alerts that notify the driver when a passenger pulls the wire or hits the button are installed on buses to improve communication even further. In addition to swiftly alerting the driver of a passenger's request, this audible feedback reassures the passenger that their action has been recorded. An auditory signalling system becomes more dynamic and responsive when it is integrated.

3.3 Context of use:

The stop request system in public transportation vehicles, like PVTA, prioritizes smooth passenger contact through human factors. Its colour-contrasting rope, strategically placed inside, ensures universal visibility. This design maximizes accessibility, accommodating various heights and abilities. Simple and intuitive, it caters to passengers of all ages and language backgrounds, promoting ease with just a rope pull or button press. By considering thoughtful placement, visibility, and simplicity, the system embodies human factors, contributing to an inclusive and user-friendly bus stop signalling design.

3.4 Users of this design:

Passengers worldwide who ride public transportation buses, like PVTA, use the stop request system. By using this design element, a diverse range of riders—including those with varying ages, abilities, and linguistic backgrounds—can indicate to the driver when they want to get off at a particular bus stop, making public transit more accessible to all.

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3.5 Human Factor principles which make this design good and are being followed:

The PVTA's stop request system is an excellent example of a well-designed public transportation system that complies with human factors principles and improves usability, accessibility, and the user experience in general.

Throughout the inside of the bus, the stop request cord or button is conveniently located. This guarantees that users of different physical abilities, mobility, and heights may access and use the system with ease.

Using wires or buttons with different colours increases visibility. Orienting them along the inside edges, frequently close to windows or above, guarantees that passengers can find and recognise the mechanism with ease, especially in congested or poorly light areas.

The straightforward design facilitates intuitive operation. It is simple for passengers to hold onto the cable, tug it, or touch the button to indicate that they want to get off the aircraft. Because of its straightforward design, it may be used by a wide variety of users, including those with various levels of literacy or who may not be familiar with the particular bus system.

The stop request system is comprehensible and functional for a wide range of languages, cultures, and demographics since it adheres to universal design principles. Its worldwide applicability is enhanced by its limited reliance on language and clear visual clues.

The passenger receives feedback from the bus immediately upon registering their request, such as an audible or visual acknowledgment. In order to preserve user confidence and guarantee that passengers' requirements are met, this feedback loop is essential.

The boarding and disembarking procedures are designed to be as efficient as possible. Clear and timely communication of purpose by passengers promotes efficient operations for drivers and passengers alike.

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Bad Designs

#4 Bad Parking signs:

4.1 Description of the design with image:

These signs are notoriously hard to understand, especially when driving. We understand that traffic rules are very complex and are vital, and as a result, the designer saw the need to cram all the rules on the allotted small metal sheet provided for street signage. Signage has improved over the years; more improvements are needed for the visual ability for faster comprehension for drivers.

The aforementioned design, which is renowned for compressing complex traffic laws onto a tiny metal street sign, is an example of a past attempt to communicate a large number of regulations in a constrained area. Given the complexity and relevance of traffic regulations, the designer probably felt obliged to provide all pertinent information on the available signs. However, in terms of driver understanding and human factors, this technique has serious shortcomings.

Human factors concepts highlight the need of designing with users' cognitive and perceptual abilities in mind. Presenting important information in a way that enables drivers to quickly and properly understand the regulations while navigating challenging traffic scenarios is a difficulty when it comes to traffic signs. This goal is undermined by the cluttered design, which increases visual clutter, reduces legibility, and may cause confusion for drivers.

Due to the complexity of traffic laws, it is necessary to strike a delicate balance between giving drivers access to complete information and enabling them to process it quickly. In this instance, the densely packed design can overload

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drivers and hinder their capacity to quickly digest information while driving. The problem is made more difficult by the metal sheet's restricted space, which prevents the designer from implementing more user-friendly layouts and hierarchies that give priority to important features.

4.2 Design's function and purpose:

The primary function of traffic sign design is to effectively convey crucial traffic laws and guidelines to drivers, ensuring a clear and understandable presentation. It serves to provide essential information on speed limits, parking restrictions, and directional assistance, contributing to a safe and efficient traffic flow. Human factors considerations play a pivotal role in the design's functionality, emphasizing efficient information transfer in constrained spaces.

To facilitate quick comprehension, the design prioritizes readability, suitable typefaces, and contrast. Reducing cognitive load is crucial for rapid assimilation of information, achieved through a visual hierarchy that emphasizes key details and promotes organized understanding. The design also addresses the complexity of traffic situations, such as parking lots and junctions, by providing clear direction and clarity to minimize uncertainty.

Symbolism and universality enhance the design's effectiveness, making use of universally understood symbols for broader comprehension across diverse audiences. Beyond comprehension, the design encourages regulatory compliance by effectively communicating legal requirements and expectations. Striking a careful balance between thorough information and avoiding visual clutter, it upholds safety and order on the road.

In essence, a well-designed traffic sign adheres to human factors principles. It supports drivers' cognitive abilities, improves legibility, and expedites quick, well-informed decision-making while driving. By fulfilling these objectives, the design becomes a crucial tool in promoting road safety, fostering an environment where drivers can easily adhere to traffic laws, leading to an overall improvement in the efficiency and orderliness of road traffic.

4.3 Context of use:

Traffic signs systems, which are typical on streets and roadways, use this style. From city crossroads to rural highways, these signs' thoughtful information design helps drivers quickly and easily understand important information. Located at essential locations including parking lots, regulatory zones, and junctions, the design prioritizes important information, uses well recognised symbols, and maximizes visual hierarchy to reduce cognitive burden. Its use is crucial for encouraging legal compliance, assisting drivers in tricky situations, and eventually enhancing the efficiency and safety of road networks in a variety of demographic and geographic circumstances.

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4.4 Users of this design:

Drivers use these traffic signs for clear, organized information on city streets, country roads, or highways. The design prioritizes quick comprehension, minimizes cognitive load, and ensures adherence to traffic laws, enhancing safety and efficiency for a diverse range of drivers.

4.5 Human Factor principles which make this design bad and are being followed:

Based on human factors principles, a few elements of the stated traffic signs design might be considered bad design:

- *Information Overload:* Drivers may become confused and experience cognitive overload if a large quantity of information is crammed into a small sign.
- *Bad Readability:* A design does not maximize readability and impedes rapid comprehension if it has unreadable typefaces, insufficient contrast, or poor visibility in different lighting circumstances.
- *Absence of Visual Hierarchy:* Drivers may find it difficult to prioritize information in the absence of a clear visual hierarchy, which might hinder their capacity to act quickly and intelligently.
- *Limited Symbolism:* The absence of well recognised symbols in the design may make it difficult for people to grasp, particularly those from varied linguistic backgrounds.
- *Problems with Cognitive Load:* Inability to reduce cognitive load through clear and structured information presentation may cause delayed decision-making and maybe mistakes.
- *Inadequate instruction:* Rather than facilitating drivers' easy navigation of junctions or parking lots, the design may cause confusion if it does not provide clear instruction in complicated settings.
- *Ineffective Promotion of Compliance:* The design may not be successful in motivating drivers to follow traffic laws if it fails to clearly convey the expectations and legal requirements.
- *Visual Clutter:* When too much information is packed onto a small sign, it can lead to visual clutter, which reduces the design's overall effectiveness and makes it harder for drivers to focus on important features.

4.6 Proposed Design Changes:

To optimize the effectiveness of traffic signs, it is crucial to address several design challenges. Firstly, overloading with information can be mitigated by prioritizing essential elements on each sign, ensuring drivers aren't overwhelmed. Enhancing readability is key; using larger, more readable fonts with sufficient contrast and reflective materials improves visibility, particularly in low-light conditions, facilitating quick comprehension.

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Establishing a logical visual hierarchy through colour, size, and location guides viewers systematically, highlighting crucial details. Incorporating well-known symbols alongside text aids comprehension for diverse audiences, overcoming language barriers and acting as effective visual clues.

To tackle cognitive load issues, adopting a minimalist design that delivers information clearly and rationally reduces visual clutter, easing cognitive strain and enabling rapid decision-making. Enhancements in guidance involve incorporating directing arrows, clear spatial layouts, and easily understood symbols, especially in complex scenarios.

Addressing visual clutter by removing extraneous details and maintaining a tidy layout enhances aesthetic appeal, allowing drivers to focus on crucial information. These improvements, aligning with human factors concepts, collectively enhance overall usability, readability, and safety on the road, ensuring that traffic signs effectively convey information to drivers.

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#5 The UMass door with a big handle:

5.1 Description of the design with image:

The Human Factors and Design (HFD) concept in this scenario relates to "Affordance," referring to how objects suggest their usage or functionality through their design. In this case, the absence of push/pull signs on big, heavy doors indicates a lack of clear affordance. Without visual cues or indicators, users must rely on trial and error to determine whether to push or pull the door to gain entry.

The heavy doors at building entrances lack clear push/pull signage, leading to confusion among users. The absence of visual cues or instructions makes it challenging for individuals to discern the correct way to open the door, resulting in frequent instances of pushing when it should be pulled, and vice versa. This absence of clear indicators impacts user experience, causing inconvenience, delays, and occasional embarrassment for those encountering the doors. Improved signage or design modifications are necessary to enhance the doors' affordance, ensuring a more intuitive and user-friendly experience for anyone accessing the building.

5.2 Design's function and purpose:

The design's goal is to make it easier for people to enter and depart the building while maintaining user convenience and security. The hefty doors serve as a barrier to regulate entry and protect the property. The goal of their design is to allow authorized people to enter while preventing unauthorized persons from doing so. The lack of obvious push/pull indications affects the door's operation by making it more difficult to operate and occasionally annoying for users. As a result, the design's intended aim is to assure convenience and efficiency of entry to the building, which is hampered by the lack of obvious indicators, while still providing safe access.

5.3 Context of use:

When restricted access and security are required, buildings, office complexes, or institutional settings are the typical contexts in which these heavy doors are used in the absence of obvious push/pull indications. These doors are used at points of entry and departure that are often used by a variety of people, such as staff members, guests, or public. The situation calls for striking a balance between security and accessibility, but in the absence of obvious push/pull signs, confusion may arise, particularly during busy times or when people are rushing. This could negatively affect user experience in general and lead to annoyance or delays when trying to enter the building.

5.4 Users of this design:

The users of these heavy doors without clear push/pull signs are diverse and include employees, visitors, delivery personnel, and the general public accessing the building. They comprise anyone needing entry or exit from the

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designated spaces, creating a varied user pool with differing levels of familiarity with the door mechanism.

5.5 Human Factor principles which make this design bad and are being followed:

When large, heavy doors lack obvious push or pull indications, the design frequently deviates from the Human Factors concepts of "Affordance" and "Signifiers." It is difficult to intuitively comprehend how to interact with the door when there are insufficient visual clues present, such as handles that do not clearly indicate the right action. This violates affordance. Indices that are easy to read and comprehend, such as labels or symbols that denote "push" or "pull," are essential for directing user behaviour and guaranteeing a seamless and natural interaction. Lack of these indicators makes using the system more difficult and increases the likelihood of mistakes, which may be frustrating and even dangerous. As a result, its design is deemed inadequate as it is unable to satisfy users' natural expectations and successfully direct their behaviours.

5.6 Proposed Design Changes:

Redesigning the doors without clear push/pull signs:

- *Change Handle Design*: Use handles that naturally suggest the required action. For instance, rounded handles typically suggest a pull motion, while flat bars imply a push. Adding a label or embossing directly on the handle with "Push" or "Pull" clarifies further.
- *Add Visual Indicators*: Place clear and prominent signs near eye level on the doors. Using universally recognized symbols (arrows or hand icons) indicating the direction of the intended action (push/pull) makes it easier for users to understand.
- *Color-Coding or Highlighting*: Painting or highlighting the door frames or handles differently for push and pull actions can be intuitive. For example, painting the area around a pull handle green and the area around a push plate red.
- *Text or Icon Stickers*: Affixing removable stickers or decals directly onto the door surface with clear text or imagery indicating the action required ("Push" and "Pull" icons, or arrows) is another straightforward solution.
- *Motion-Sensing Doors*: Implementing motion-sensing technology that automatically detects user movement and opens the door in the right direction without physical interaction could be an advanced and user-friendly solution, although this is a more complex and costly option.

Redesigning with any of these solutions or a combination thereof aims to create a more intuitive and user-friendly experience, reducing confusion and errors when interacting with the doors.

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#6 US Socket:

6.1 Description of the design with image:

Given that it lacks user control and safety precautions, the lack of switches on USA sockets can be viewed as a design flaw in terms of human factors design (HFD). Since there are no switches, an appliance that is plugged in stays plugged in until it is physically unplugged. This design flaw causes users to experience multiple inconveniences and raises safety concerns.

First of all, without switches, there is no way to regulate the flow of power without unplugging gadgets. This is inconvenient because users have to keep plugging and unplugging gadgets to control power, which increases the chance of electric shocks, particularly when handling the plug in damp or wet conditions.

Second, it wastes energy because devices in standby mode keep drawing power and add to the needless use of electricity. When devices are not in use, users find it difficult to turn off the power, which increases energy expenses and negatively affects the environment.

Thirdly, in an emergency, a prompt shutdown is hampered by the lack of switches. Users are unable to quickly cut off the power to impacted devices without physically unplugging them in the event of an electrical failure or fire hazard, which could exacerbate safety risks.

In addition, the absence of switches restricts the user's ability to control the device because plugged-in devices are always powered on, which raises the possibility of damage from power surges or fluctuations**.**

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6.2 Design's function and purpose:

The primary function of electrical sockets is to provide a safe and convenient means of connecting electronic devices to the power supply. In the context of USA sockets without switches, their purpose remains the same, but the absence of switches limits their functionality and introduces safety and usability concerns. Switches on electrical outlets are there to give users control over the flow of power. They act as a safety feature by making it simple for users to switch off a device's power source without having to unplug it. This feature helps to manage power without constantly plugging in and unplugging gadgets, which saves energy and guarantees safety in case of emergencies.

But these functions and goals are ignored by the lack of switches in USA sockets. By making it more difficult to quickly cut off power in an emergency, raising the possibility of electric shock when handling plugs, and restricting control over energy consumption, it jeopardizes user safety.

Furthermore, the absence of switches causes devices to always have power, even in standby mode, increasing utility and energy costs. This inefficiency contradicts the purpose of enhancing energy conservation and promoting responsible energy usage.

6.3 Context of use:

In the USA, the context of use for sockets without switches includes regular electrical connectivity requirements in home, business, or public environments. These are common in public areas, workplaces, schools, etc. They are vital sources of power for a variety of gadgets. They serve broad variety of electrical appliances, ranging from tiny gadgets to bigger machinery. But their lack of switches makes them less useful, making it difficult to regulate power flow and guarantee safety. Even though switches are widely used, their lack compromises user control, safety, and energy management all crucial components of their context of use.

6.4 Users of this design:

The users of sockets without switches in the USA are diverse and include residents, professionals, students, and individuals in public spaces. They cater to anyone requiring electrical connectivity for various devices, encompassing households, offices, schools, and public areas.

6.5 Human Factor principles which make this design bad and are being followed:

For a number of reasons, the design of USA sockets without switches is viewed as a bad idea. It violates important Human Factors principles:

- *Safety:* There is a higher chance of electrical mishaps when switches are left out. In order to avoid unintentional contact with live wires and possible electric

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shocks, switches serve as a barrier. Safety is compromised by a lack of switches.

- *Usability*: It is difficult to regulate the flow of power in the absence of switches. In order to stop the flow of electricity, users may turn to unplugging devices, which is risky and inconvenient, particularly when handling several devices or in dimly lit areas.
- *Feedback and Visibility:* Switches provide visual cues about whether a device is on or off. It is more difficult to determine whether an outlet is live when switches are absent because they eliminate this visual cue.
- *User Control and Freedom:* In the absence of switches, users are not in control of individual outlets. It is difficult to control power distribution or isolate particular devices because of this restriction.
- *Accessibility*: Switches make it simpler for people with impairments or restricted movement to access and control electronics. For some users, it can be challenging to control how much electricity they use when switches are missing.

6.6 Proposed Design Changes:

A redesign of USA sockets without switches might incorporate a number of features to improve user control, safety, and usability:

- *Including Individual Switches:* Make changes to the design so that each socket has its own switch. This improves usability and safety by letting users regulate the electricity flow to particular devices.
- *LED Indicators*: Place LED indicators next to each outlet to give customers a visual indication of the power status. This resolves the visibility issue by showing the status of the socket.

- *App Integration or Remote Control:* Smart socket technology enables voice commands or remote control through mobile applications. This feature accommodates people with mobility limitations by improving accessibility and user control.

- *Childproof Features:* Include childproof locks or other mechanisms to keep small children from unintentionally accessing areas and to ensure their safety.

- *Adaptability for Diverse Users:* Consider inclusive design concepts, such as larger switches for simpler operation or tactile elements for the blind, to accommodate users with different levels of ability.

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