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TOLERANCE FOR ERROR

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Abstract

According to Tolerance for Errors, which is one of the seven principles of Universal Design, objects or elements shall be designed in a manner that allows minimal use of isolated or hidden elements. It shall provide warnings for errors and fail-safe features, but more crucially, it should be able to discourage unconscious actions which may require vigilance. This study assimilates various examples from our daily lives, where technology is used to auto-correct and aid us in managing small errors effectively.

Key Words: *Universal Design, Design, Diverse, Fundamental, Requirement*

1. Introduction

A good design is inclusive and barrier-free. It should be accessible to everyone from the young to the old. The requirement for an inclusive environment is higher the older a person gets, as the challenges for mobility, vision, memory, and hearing increase (Tedx Talks, 2016).

The perfect example is a wheelchair, which can be used by people of all ages and capabilities. One can say that a universal design is respectful and receptive, as they allow us to reap their benefits to the fullest, allowing us to live within our full potential. (Tools for Life – Georgia AT Program, 2020)

There are seven different principles of a universal design, and we will be reading about one of them, tolerance for error.

2. Tolerance of Error

Let's take a detailed gander at the meaning. One of the seven design drivers, its purpose is to minimize hazards and errors of most used elements. It is also used to eliminate, isolate or shield

hazardous elements. It is used to provide warnings of hazards and errors, and fail-safe features too. Last, but not least important trait, it is also used to Discourage unconscious action in tasks that require attention (Palacios, 2015).

A well-designed product shall be able to provide a fail-safe experience for the user, which in turn reduces the frustration of the user in the event of an accidental function. For example, notice how the keys in a television remote are aligned. There are spaces between the keys in a uniform fashion. This is done to not press another key which may be kept close to the key of choice, and lead to an unwanted function (Cooper, 2020).

There are plenty of examples, from the way the handle grip of a bicycle is designed to the high-tech but simple to acknowledge "autocorrect", all the way to hybrid languages being spoken and the way our eyes adjust vision in dark and light (NRC CLIT, 2015).

3. Guidelines

3.1 Four Guidelines for Allowing Tolerance of Errors in A Universal Design.

According to Universal Design Project (2020), the four guidelines for allowing tolerance of errors in a universal design are as follows:

1. Eliminate or minimize the use of elements that are hazardous, isolated, or hidden.
2. Provide warnings of hazards and errors.
3. Provide fail-safe features.
4. Discourage unconscious actions in tasks that require vigilance.

3.2 Tolerance in Religion

Nature and Religion, as once told by the highly respected Shekhar Kulbhushan Kapur, who taught us as a guest lecturer in class, is the most successful and one of the finest designs too. Why do we say that? Because the same God of similar faith is seen in a different light in different communities. The way one venerates a God and Goddess may be different at someplace else, according to the civil agreement and cultural appropriateness accepted by the people present in the area or region.

3.3 A Story

My mother used to tell me that there was once a king from a distant country, who when he visited

our country and had set up a camp, decided to extend an invitation to the ruling King of the region. The Hindu king politely accepted the invitation and visited his campsite.

During the feast, both the kings started to eat by hand. When enquired by the visiting king's subordinate as to why he was not using a spoon, he simply replied that it is an exception for the time the Hindu king is present, to make him feel rather welcome and equal. This kind of gesture makes for a healthy and cordial relationship between the two kings.

But there again, we have to ask, isn't the human mind capable of designing a solution that is tolerant of errors, a la appropriate adjustment is done by the native king to make the visiting king feel welcome? There you go, I present you food for thought.

4. Examples

To understand this particular design driver in more depth, let us discuss some examples which are fairly modern, relatable, and influence our day-to-day activities.

4.1 Rerouting in Google Maps

4.1.1 Explanation

People, who often employ the use of internet-operated navigation systems have an automated self-correcting system called "Rerouting." This happens majorly when a user eclipse-passed the point of direction changes on the road, due to many imaginable factors like forgetting to check the map earlier, couldn't check the map in time while driving on a busy road, or not being able to change directions at the mentioned distance or area. (Fig 1) In such a scenario, the maps employ and display a different route for the same destination via navigation signals, redirecting the user to the originally desired location.

4.1.2 How Is This a Good Example?

The re-adjustment just allowed the user to not be frustrated or panic rather provided reassurance that there could be another alternative route without having to return to where the road started.

Fig. 1. A person finding relief due to "rerouting" in Google Maps

4.2 Autocorrect

4.2.1 Explanation

In various portable devices like a phone, tablet, or in some cases laptops, there exists a feature called by the word used in the title of this explanation. Autocorrect automatically replaces and corrects the misspelled words and at times, suggests alternative words and sentences of the piece, given the context. This results in a more coherent and complete composition making it convenient for the receiver to understand what is being written, and preventing misspelled words that may lead to misunderstanding the piece.

4.2.2 How Is This a Good Example?

In various busy scenarios when time is scarce to write a well-documented message, there may be a lot of missed types, as the mind is preoccupied with other thoughts. In such a case, autocorrect may prove to be a boon for people who may unintentionally write a wrong message, which has a great potential to be deciphered as being inappropriate (Fig 2). However, it may equally prove to be a peril while being employed in the case of informal compositions, as they are usually created for quick instructions or messages.

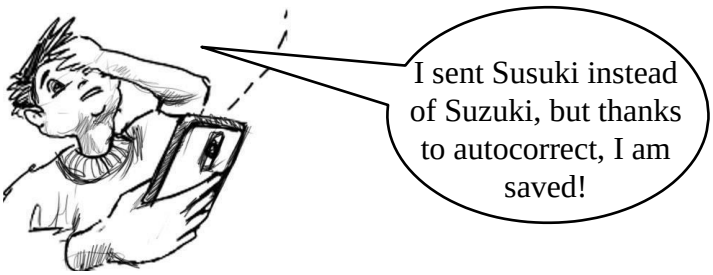

Fig. 2. A person finding relief due to autocorrect while sending a message.

4.3 Auto-brightness

4.3.1 Explanation

In similar portable technology which has at least one display system, there exists a function that allows the user to access visual information without leading to too much stress on the eye. This is actuated by the system present in current technology, which automatically adjusts the brightness of the phone in response to the intensity of the light the device is exposed to (Fig 3). The contrast in the brightness of the screen to the intensity of light in the surroundings make for a more convenient decipherable and distinguishable information display, thereby reducing the stress of the user.

4.3.2 How Is This a Good Example?

Consider a situation, where a student has to sit late in the night to prepare for the online exam. Living in a tiny room where his mother and little sister are sleeping peacefully, it would be very inappropriate for him to switch on the light to see his phone screen for the notes. The student can quietly turn on the screen of his smart phone device and let the auto-brightness adjust itself. The screen will sense the ambient light and will decrease the brightness allowing him to look at it and be able to read the text. Many websites also provide the feature of 'Nightview' or 'Darkmode' where the screen colours invert and white background becomes dark while the text becomes light. Therefore, it is less stressful on the student's eyes to read during the night.

Fig. 3. A person being exposed to the harmful bright light while being sat in a dark room.

4.4 Autosave

4.4.1 Explanation

Autosave happens in the event of accidental shutdown or malfunction of an ongoing function, so that when the file is reopened, it may load the desired recovery state of work. This leads to a sense of security for the user who could feel distressed and be stressed with the task of restarting the job altogether.

4.4.2 How Is This a Good Example?

Imagine you have to submit your work to your boss the following day. You wrote a fantastic document guaranteed to make your boss offer you an invitation to the club, but just then, your laptop loses charge and dies. You frantically search for a power source to put your charger on as time is ticking towards the deadline. When all is well, and you open your laptop and click on the same software, a pop-up button asks if you want to open the document you were still writing on. You press on it, and voila! (Fig 4) It's right there where you left, and you thank the stars but what you also should be thanking is this particular design driver attribute the designer thought of when they put years of development into the laptop when you have time.

Fig. 4. The AutoSave option is a lifesaver as it stores a backup of your progress.

4.5 Recovery Registry and Recovery Software

4.5.1 Explanation

When your computer or your mobile phone accidentally deletes files, they are stored in a recycle bin, awaiting your approval for permanent deletion, while also allowing a chance for the user to recover it. This mitigates the frustration of the user as well.

4.5.2 How Is This a Good Example?

Imagine you did delete a few from the recycle bin, in an attempt to erase things, you didn't want before but now you do. You become stressed and open the recovery software, and scan the drive from where it was originally deleted. You find that files don't vanish even if you permanently delete them, but rather stay in some folder for a while. You find the particular file and restore them to the desired location. In this way, you can mitigate the stress of having to worry about losing your files forever.

4.6 Crop Images

4.6.1 Explanation

Cropping Images to fit a desired size or ratio is a great example of a flexible and open system, majorly manageable by the user. It can also be used to point out a specific reference point in the picture which may surmount the relevancy of the rest of the image, with regards to a context.

4.6.2 How Is This a Good Example?

During photoshoots, one may want to eliminate unnecessary elements which take the focus off of the intended subject of display. This happens when the photographer may be subjected to an area where he/she may be exposed to an undesired perspective. Hence, however, the photo could be taken, the unnecessary part can still be cut out to obtain the desired result.

4.7 Zooming functions

4.7.1 Explanation

Zooming functions prove a function similar to a telescope when the user requires to magnify a specific or the whole of the image to be able to adjust to his plane of vision of convenience, generally to gain a more detailed insight.

4.7.2 How Is This a Good Example?

A person with myopia may find it difficult to see things on a tinier scale, and hence may be able to see things when zoomed. This eliminates the physical stress of a person having to squint his/her eyes to decipher details or take the physical burden to get his/her

spectacles and put them on or carry them all the time.

4.8 Daytime running lamps in vehicles

4.8.1 Explanation

Day-Time Running Lamps in vehicles are strategically placed and illuminated to allow the vehicle to be spotted from a distance by other drivers, walking passers-by, and animals, in some cases. This leads to collision aversions and prevents accidents from occurring, by making other drivers aware of the approaching vehicle.

4.8.2 How Is This a Good Example?

Daytime running lamps are typically situated at both sides of a vehicle to display their size and area one may need to give space for them to pass by. This results in averting sudden maneuvers or accidents on the road.

4.9 Reflective Surfaces

4.9.1 Explanation

Reflective surfaces in accents of clothing and around a vehicle allow people to spot an obstruction as such from a safe distance. This allows for a safer preparation and dodge.4.9.2. How is this a good example?

Imagine driving down the road at night and suddenly finding a motorbike out of nowhere in sight. This may cause the user to panic and be involved in an accident. However, reflectors, just like daytime running lamps can be seen from a further distance and allow the driver to be able to spot the motorcycle from a safer distance, thereby averting an accident.

4.10 Reserve Fuel Indicator

4.10.1 Explanation

Reserve Fuel Indicator illuminates acts as a warning light to display the information to the user that the fuel level has become lower. The reserved fuel is the fuel in use. This alerts the driver to drive more responsibly to the nearest fuel station.

4.10.2 How Is This a Good Example?

It requires an extreme amount of experience and great hearing capability to be able to shake a previous generation Royal Enfield Classic to gauge the level of fuel left, as it is not possible to see it through the tank lid. The motorcycle did not come equipped with a fuel gauge, but rather a reserve fuel indicator, which made it difficult for less experienced riders to have stress-free travel. But will a car without a reserve fuel indicator still be as easy to check? How about a bus for a new driver? Now imagine a scenario without even a reserve fuel indicator, traveling down a deserted area known to be infested with roadblocks of crime, and can't even risk stopping to check the vehicle fuel level. The amount of anxiety will lead you to pray to God you don't suffer dire consequences along the way. Hence, a reserve fuel indicator is an error – mitigation and tolerance in disguise.

4.11 Funnel

4.11.1 Explanation

A funnel may be used to guide a fuel to the direction of where the opening is mounted. It has a wider diameter at the top to allow uneven flow, and a conical surface towards the bottom to allow the fuel to flow at a regulated flow towards the direction the bottom opening is directed to.

4.11.2 How Is This a Good Example?

Imagine you're putting refined oil that you bought from the market into the container you would specifically have in your kitchen for this purpose. How do you refuel the container? You put a funnel on the mouth of the container, and there you go. All you must do is pour out the contents onto the funnel so that it doesn't flow all over and create a mess. The mess could have been the error of operation, and hence the funnel becomes a beautiful example of a design driver.

5. Conclusion

Every design driver is important to consider while completing a design. The design shall be made compliant to these drivers to not allow any error in operation, but rather offer a seamless and comfortable experience for the user. This makes for a more generous environment for the ever-growing and ever-aging population and creates a formula to enjoy life to its full potential.

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