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DESIGN FOR ALL

7+ Principles of UNIVERSAL DESIGN

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NOTE FROM THE CHAIRMAN'S DESK

One day I was passing from a remote village and felt thirsty and started looking for a shop for bottled water or someplace where I could have filtered water. My search proved in vain, and I stopped my vehicle close to the well for drinking water. I was a little apprehensive about unfiltered water. Still, one villager who was pulling water with the help of rope and bucket assured me the water quality is better than filtered water. That person tilted, holding a water-filled bucket to allow me to drink by joining both palms. I noticed spill water out of my palm was channelized by an open drain for the agriculture fields for irrigation. An idea of sustainability struck and admired the wisdom of our ancestors. How beautifully they fed back the water into the system with the prevailing knowledge.

I remembered an activity in a religious function where my mother used to burn the clarified butter (Ghee) oil earthen lamp all night by half-covering the flame with another round metal pot for the smoke of the wick to strike the inner surface for collection of carbon. She adds the butter into the carbon collected in a covered pot for eye care preparation. It is nothing but sustainability where smoke has the nature of being lost in the air, but the collection of smoke for fine powder for designing various applications amazed me.

I admire how our ancestors designed the utility of banana plant leaves, stems, and fruit for the benefits of living. It is amazing. I do not know where my mother learnt the art of covering the boiling pot with a lid, but it makes cooking better and faster. Once the steam can go back to the content, it works in two ways. One is that the latent heat of the steam is higher than boiling water, which helps in fast cooking, and another is generating high pressure for faster cooking. One day I noticed that my mother avoided water when cooking specific vegetables. It might turn too sticky, but invented a new idea for making proper cook by keeping water-filled cover for proper condensation of steam of vegetable and again goes back to vegetables. It was a great idea of sustainability. The same principle of sustainability is when fire brigade personnel use the blanket for

covering the person with fire. That blanket blocks the supply of oxygen, and second, it uses smoke close to the fire for blocking air. Whenever a massive fire breaks out in the forest, they deliberately ignite the fire from the other end to make an envelope of smoke in the air, blocking the oxygen supply. This concept of sustainability is centuries-old wisdom known to our ancestors and helps extinguish forest fires.

The idea of designing manure by burying the dry leaves in the ground that fell on the ground is an ancient practice, and covering with soil allows the bacteria to turn leaves into manure. In west Bengal, every kitchen drain pipe end is opening in the small fish pond, and I was surprised to know that whatever wastewater for washing rice or pulses or vegetables goes to the pond and turns out to be fish food.

I have noticed that urban people waste a lot, but old sustainability is a way of life in rural areas. In India, women or even men use uncut, unstitch dresses for covering their bodies by using the centuries-old concept of the process of wearing. In rural areas, people use uncut dress material for other applications to develop clothes. Once any dress material is cut to meet the particular design, its life turns out to be the life of the clothes where uncut is nothing but inventing new application that extends the life of the clothes.

Dr Sugandh Malhotra has focused on the principle of Universal Design by Mace and the Indian concept designed by Prof Abir Mullick and his team suiting the Indian environment by retaining the overall picture of the universal design but made minor changes for India. The beauty is that they requested their students to think of these principles as design drivers. These new concepts will give further insight to our readers in developing a detailed understanding of these principles.

Lambert Academic publication for celebration of 150th special issue by publishing a book by compiling the editorials from "Design for All, Drivers of Design", translated in eight different languages from ENGLISH into French, German, Italian, Russian, Dutch and Portuguese. Kindly click the following link for the book from "More books", one of the largest online bookstores. Here's the link to it: https://www.morebooks.de/store/gb/book/design-for-all/isbn/978-613-9-83306-1

Enjoy reading, be happy, and work for the betterment of society.

With Regards

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NOTE FROM THE GUEST EDITOR

Dear friends,

Warm greetings and a very happy Spring season.

Our blue earth, the way it is, teeming with life, is so because everyone on earth is one big family supporting each other and the blue earth itself in its capacity to nurture life. With this the underlying thread, every one of us, down to the smallest life form is an equal stakeholder in the artifacts we design, create and use. Design for All equivocally advocates the importance of accessibility, comfort and convenience for all stakeholders while designing our built environments and artifacts. It should be the fundamental job of all design academicians and researchers to teach the values of inclusivity. While we teach the students elements of design, concepts of scale, proportion, etc., it is imperative to teach important principles of universal design to the next generation of designers. These principles would become values that will enable to design more inclusively for the benefit of all.

The principles are a set of guidelines for environments, products and communications. These principles may also be used to evaluate existing designs, guide the design process and educate both designers and users about the features of more accessible objects and built environments. At IIT Bombay, Professor Lalit Kumar Das and myself took a task to deliberate and detail out what these important principles of Universal Design should mean and how we can make them easy to understand and apply in the regular design activities. Our objective was to study different aspects of each design principle, detail out its meaning and briefly outline some pointers to incorporate it in the design process. We worked with a group of PhD researchers and MDes (Masters of Design) students from IDC School of Design, IIT Bombay for a period of 16 weeks. During the study, the research group went through journals, conference papers, books, website articles and gathered information. The literature review was synthesized, analyzed, compiled and further consolidated by incorporating real life examples and personal experiences to make the information rich yet easy to understand.

There are seven original principles of Universal Design:

1. **Equitable Design**

   All designed products should consider the needs of all users/stakeholders and not ignore any under-representations. The designers should practice fairness and design products that do not discriminate from the perspectives of gender, sexuality, colour and physical or mental abilities. The study highlights distinctions from *equality* and outlines methods and approaches to promote equitable use.

2. **Flexibility in Use**

   Designed objects should have a certain degree of flexibility in use to accommodate for wide range of individual preferences and abilities. Flexibility allows for compactness, space-saving, creative use, extended use, *jugaad* thereby leading to longevity and enhanced engagement. The study elaborately outlines approaches to improve flexibility in products.

3. **Simple and Intuitive Design**

   Simple products are very natural, easy to use, self-explanatory and intuitive but they could be difficult to design. This study aims to explain what makes a simple product design through really simple examples from our everyday life. The study also suggests approaches to make a design simpler.

4. **Perceptible Information**

   For the perception of any information or emotions, the design must communicate necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. This study aims to define the perception of information, outline its technical nuances and provide designers with a toolkit to implement efficiently

5. **Tolerance of Error**

   Objects should be designed so that there is minimal use of isolated or hidden elements, it should have warnings for errors and it should provide fail-safe features but more importantly it should discourage unconscious actions that may require vigilance. This study incorporates several examples of our modern everyday life where technology is used to auto-correct and aid us in managing small errors in our daily lives.

6. **Low Physical Effort**

   Low physical effort is often wrongly linked with induced laziness and wrongly assuming an 'abundance' of time. This study helps in highlighting the importance of working smartly to reduce physical effort to save time and energy to invest in something more important. The study also proposes approaches and techniques to reduce physical effort while incorporating examples from everyday life

7. **Size and Space for Approach and Use**

   All designed objects must consider and incorporate approach, reach, manipulation and use regardless of user's abilities, limitations or special needs. This study helps understand and explain steps and approaches in planning size and space with examples in an urban environment

Additional principles that also been studied and found important for Universal Design:

8. **Affordability**

   This study delves deeper into understanding the broader meaning of affordability which is usually linked with economic consideration to explore other dimensions such as value affordability, sustained affordability and access affordability. Further, the study proposes modern methods that can be adopted by designers to achieve affordability.

9. **Aesthetics**

   All good designed products are usually aesthetically pleasing too. This study explores the close relationship between aesthetics and usability. People often find the products easier to use if they also appear to be simpler to use. The study offers a brief introduction to different elements of good aesthetics and also suggests several approaches and methods to improve aesthetic value. Thoughtful aesthetic & usability inculcates trust, which is in fact the ultimate objective of Universal design.

Through these 10 studies, the study group tried to go deeper into several important aspects of universal design and also propose methods and approaches to improve the accessibility of given design. The study is merely a first step towards documenting and developing a deeper understanding towards these principles by using examples from everyday life with a hope that these factors are widely acknowledged, accepted and used actively in design for all. I sincerely wish that these studies should lead to further development of these principles and more elaborate studies.

I am recalling a great quote from a popular superhero movie that says, *"With great power comes great responsibility*". I think it is about time that the designers use their creative abilities to create the future consciously and more effectively built on sharing and caring for all.

Acknowledgement

I would sincerely like to thank Professor Lalit Kumar Das (Distinguished Visiting professor, IIT Bombay) for his continuous mentoring and guidance during the study. I wish to acknowledge the efforts of students who attended the course DE713: Deepshikha Dash (PhD researcher, IITB) and Abhishek Ayush, Alex Jose, Aritra Mukherjee, Darshan Chavhan, Nagaaswin N., Sanathanakrishnan, Shamil Iqbal, Shivanee Dhakate, T. Abhishek (Batch of 2020-2022 MDes students, IITB) who took keen interest in the

study and worked tirelessly for 16 weeks. Lastly, I offer my sincere gratitude to Sanket Pai (PhD Researcher, IITB) for his help in compilation of works in a common format.

Warm regards,

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PRINCIPLES OF UNIVERSAL DESIGN:

- Equitable Design
- Flexibility in Use
- Simple and Intuitive Design
- Perceptible Information in Design
- Tolerance for Error
- Low Physical Effort
- Size and Space for Approach and Use

Additional Principles:

- Significance of Affordability in Universal Design
- Role of Aesthetics in Universal Design

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EQUITABLE DESIGN

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Abstract

We often believe that being fair entails that everyone receives the same treatment, and we were taught this as children. But that only works if we're all on the same page in the first place. Gender and sexuality, colour, physical or mental ability, and religion are all factors that influence social fairness. It is our job as designers to consider the needs of users who have been excluded from everyday products because they are members of historically underrepresented populations or organizations. The design process can be an example of fair practices, but we must accept responsibility for going the extra mile. As a culture, we become more aware of where we have erred and where we have been insensitive. It is conceivable to reduce gender disparity in our lifetimes; one approach to do so is to change the way we do business.

Key Words: *Equitable, Universal design, Inclusive design, Behavioral design*

1. Introduction

Definitions of social equity can vary but all focus on the ideals of justice and fairness. Equity in old societies involves the role of public administrators, who are responsible for ensuring that social services are delivered equitably. This implies taking into account historical and current inequalities among groups. Fairness is dependent on this social and historical context.

2. Equity vs Equality

Terminologically, **'equity**' and **'equality'** sound similar while hearing or reading it for the first time. But actually, they are just homophones (i.e., sounds similar but with different meanings and different spelling).

Conceptually, 'equity' and 'equality' are completely different from one another. Moreover, the difference between equity and equality helps us to understand the notion of social justice, social equity, social inclusion, racial justice and social security. Even if you take the time to search the words equity and equality in the dictionary, you might walk away thinking they mean the same thing. Merriam-Webster defines equitable as "dealing fairly and equally with all concerned," and equal as "of the same measure, quantity, amount, or number as another." However, much like systemic and systematic, the two words (and their derivatives) can't be used interchangeably. Equality has to do with giving everyone the same resources, whereas equity involves distributing resources based on the needs of the recipients.

When we are talking about equality, we are talking about two things that are the same or have a similar value. When we treat two people or two groups of people equally, we make sure they have or get the same things. To give an example, if Rahul is given some number of apples, then it should be made sure that Raj also gets the same number of apples, so that they are treated equally. But this is different from equity. It can unconventionally also be said that equity is giving everyone what they need to be successful. Which also translates into not giving everyone the exact same thing.

It is imperative to remember that if we give everyone the exact same thing expecting that it will make people equal it considers that everyone started at the same point.

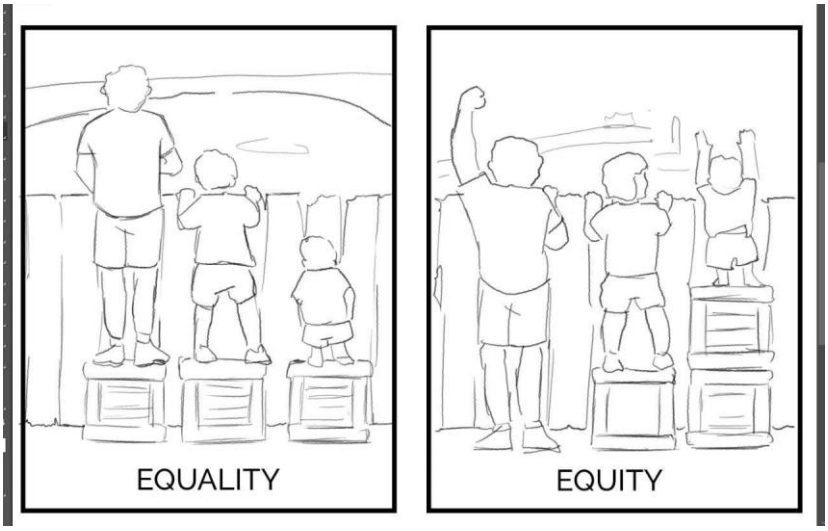

Fig. 1. Equality *Fig. 2. Equity*

In the first picture (Fig 1), everyone is given the exact same box so that they are treated equally in order for them to see over the fence. That is great for the person on the left because he is already tall, but it is not so great for the person on the right, who can't see over the fence. If we look through the perspective of equity, we wouldn't want everyone to have the same box because each person has a different height to start out with. In the mindset of equity, we would give everyone what they need. So that everyone reaches the same level (Fig 2).

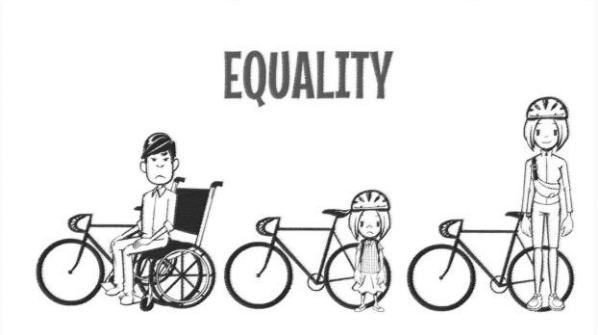

Fig. 3. Equality

Fig. 4. Equity

In another example with equality in mind, if we treat everyone the same and give everyone the same cycle (Fig 3) and that wouldn't help the person on the left who can't write that kind of cycle or the person in the middle who is too short for that kind of cycle. In the same situation through the lenses of equity, we should give everyone a different kind of cycle (Fig 4) so they can all enjoy a ride. This is where the concept of fairness becomes a little confusing. We often think that being fair means that everyone gets the same thing and we were pretty much taught that when we were growing up. But that only works when we are all the same, to begin with. There is a quote, by Doctor Naheed Dosani, which says “Equality is giving everyone a shoe, Equity is giving everyone a shoe that fits”.

3. Types of Equity

3.1 Equity in finance, accounting and ownership

Finance- Ownership of assets that have liabilities attached to them

Stock- equity based on original distribution of cash or other value to a business

Home equity- The difference between market value and unpaid mortgage balance on a home

Private equity- Stock in a privately held company

3.2 Business, Justice and Law

Law- Equity is a particular body of law that was developed in the English Court of Chancery. It is not a synonym for 'general fairness' or 'natural justice'. It exists in domestic law, both in civil law and in common law systems and international law. The tradition of equity begins in antiquity with the writings of Aristotle and with Roman law. Later, in civil law systems, equity was integrated into the legal rules, while in common law systems it became an independent body of law.

Economics- Equity, or economic equality, is the concept or idea of fairness in economics, particularly with taxation or welfare economics. More specifically, it may refer to equal life chances regardless of identity, to provide all citizens with a basic and equal minimum of income, goods, and services or to increase funds and commitment for redistribution.

Educational equity- It is the study and achievement of population proportionate group inclusion and credentialing in education.

Intergenerational equity- Equality and fairness in relationships between people in different generations.

Equity theory- on the relations and perceptions of fairness in distributions of resources within social and professional situations.

Employment equity- a policy requiring or encouraging the hiring of disenfranchised minorities

- Health equity- Fairness and justice in health and healthcare.

3.3 Education and social sciences

- Social Equity.
- Factors influencing social equity can be gender and sexuality, race, physical or mental ability and religion.

4. Equity and design

As designers, it is imperative that we think of designs that are equitable. The most common and probably apt definition for design is usually stated: Design is to solve a problem.

Making fancy products is just not enough. As designers, our duty is much larger. As shapers of the future designers should always look forward to building new and improved experiences for

people. This involves in-depth research and taking into consideration all types of users that might use a specific product or service. As designers, it is our responsibility to include the needs of users who have experienced exclusion while using day-to-day products due to being a part of historically underrepresented communities or groups.

The aim of an equitable design is to create designs that cater to groups that have been historically underrepresented and address diverse identities. An equitable design takes into consideration gender, sexuality, race, ethnicity, nationality and abilities (Raghvani, 2021).

5. Designing with equity as a core value

Equity in design starts with finding systems that unfairly privilege some over others and asking questions on what can be done to balance it out and level the playing field. Through this, design based on equity disrupts power structures that otherwise might be invisible to most.

Almost all design projects which are human-centered start with user questionnaires and trying to figure out what they require. The details of a situation or context, which can provide a starting point to shed light on where current systems are not serving people, especially in marginalized groups. The design process can be a specimen of equitable practices- but we need to take responsibility for taking that extra step.

In order for the outcome to be equitable, the process also needs to be equitable. Just like the journey is as important or maybe even more important than the destination, it is in the small interactions and conversations along the way that equity begins to happen.

Achievement of equity becomes possible when we question ourselves and our perspective and challenge the system that made us think in a particular way. Accepting the fact that we know so little makes things easier. Admitting that you have been partial while approaching something and letting others critique you thereby doing it differently and better can turn out to be the first step towards a new relationship with the identities we bring to the table and emphasizing equitable design practices.

6. Examples

Examples of equitable design and in-equitable design can be found around us if we look closely. It is very likely that most of the examples of inequitable designs that currently exist were established a long time ago. One reason for this can be that we as a society were not as inclusive as we are now. We were not as sensitive to the needs of the less privileged as we are now. Hence while these products or services were made, there was less effort to take into consideration the

less privileged, the physically disabled etc. in the design process.

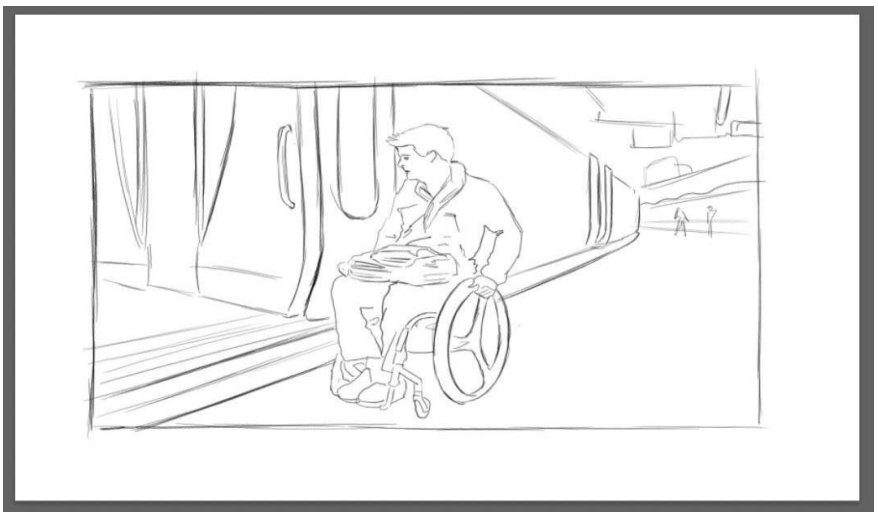

Fig. 5. Example of inequitable design

Let us take the example of the picture (Fig 5) given above. Railway stations in most parts of the world were made decades ago. Due to which some design flaws in terms of equity are still visible, like the egress and ingress into and from the trains for people who are physically disabled. Another example of inequitable design is more common to us. The stairs lately. There has been a good amount of effort being made to make the stairs more inclusive by building ramps to accommodate the physically disabled. Most of the public places have made it mandatory to have ramps so that people who cannot access stairs can also reach their place of destination. As a society, as we progress, we realize where we have made mistakes and where we have been insensitive. Another good example of inequitable products is fairness creams. Fairness creams were being sold like hotcakes in our country where the media made us feel that it is not okay to be dark-skinned in a country where most of the population are brown-skinned or dark-skinned. We were made to feel insecure about our skin colour to push their seals. It was much later we realized that beauty standards are not something that the corporations should be allowed to set. And finally, advertisements for any kind of duty products were made illegal, more efforts are being made to teach people how to feel comfortable in their own skin. Whatever new products we come up with, there should always be an effort to make it equitable by making the design process more inclusive.

7. Behavioral design

We as human beings are biased; we are built to be biased. This is a natural tendency we have adopted to make sense of our world but unfortunately this natural tendency. When applied to people can result in Bias. So, we need to avoid this unconscious bias to build a better society through behavioral design. It is possible to bring down gender inequality in our lifetime, one way

to do this is by changing our organization. To state one example in the 1970s, major US or case stress came up with an idea to select musicians by judging them based on their musical skills and not their looks by adding a simple dark curtain at the time of the audition. This resulted in, not only the selection of better talent but also the fraction of female musicians grew by a fraction of 35%. Simply removing the name and photos from the resume can avoid bias to a certain extent. This results in access to a full talent pool of candidates. Behavioral designs like these have doubled the fraction of women in some of the largest companies. Seeing women in such a position of higher power be it in business or politics changes how people think and opens new possibilities for the younger generation and motivates them. This also results in getting new insights and encourages women to speak up. The greater number of women in this area, the more girls in the community are motivated to stay in school, marry later and delay having their first child. We have the tools to quickly redesign how we work, learn and live (Harvard University, 2016).

8. Equitable use as a principle of universal design

When we talk about equitable use it means that the design must be useful and marketable to people with all abilities. This principle brings attention to what we hope to achieve with universal design.

Along the same lines of the definition of the equitable use principle, there are four guidelines to ensure proper implementation.

8.1 Provide the same means of use for all users

This allows all the users to use the same features at the same time. For example, automatic doors for people who are walking, using a wheelchair or using rolling luggage.

8.2 Avoid segregation or stigmatizing any users

If we look into history, the concept of "separate but equal" has not been equitable for all people. It isolates the person and more attention is drawn towards the fact that the person has a disability.

8.3 Ensure provisions of privacy, security and safety, equally to all users

Designs like restrooms for families give privacy and security for people who would require assistance. Safety is also to be taken into consideration so users are not injured when using a design.

8.4 Make the design appealing to all users

Designs that are appealing to the eyes can bring together those who want to use them. However, it is imperative that the designs should be just as appealing in their function. To put it in other words, designs should be marketable to anyone.

9. Conclusion

In conclusion, equitable design in today's world is something that should not be overlooked. Equitable design should not be just a fancy word for the corporation to market their products. It is something that should be in the roots of the product right from the beginning of the design process. Equitable design aids in the removal of barriers that generate division and differentiation. It gives everyone equal access, regardless of their identification. By investigating and studying a varied spectrum of users, the equitable design aims to provide a framework for people that empathize with human differences. Designers and researchers use this paradigm to make design decisions that consider human characteristics such as gender, age, sexual orientation, language, race, and talents.

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FLEXIBILITY IN USE

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Abstract

Flexible design is a form of design that allows for interim feedback that may change the course of a trial or experiment. It's sometimes used synonymously with adaptive design. Flexibility in design can allow a building to evolve over time as the user needs change. The flexibility of a building or elements of its design can allow it to be used efficiently despite changes in operational requirements, whereas an inflexible building might become obsolete. The study elaborately explains the types of flexibility such as adaptability, transformability and convertibility. It also lights on various examples which are available in our surroundings and designed using the flexibility principle

Key *Words:* *Product Design, User Research, Methodology, Adaptability, Transformability, Convertibility, Flexibility*

1. Introduction

1.1 What if flexibility isn't there?

People always tend to look for change. No one can live with the same scenario, same habits, same body for so long. In this world, everything is changing at every microsecond. And I feel this is very essential to grow as a part of nature. Flexibility is not only about materialistic things; it could be anything from mental flexibility, physical flexibility to emotional flexibility.

Freedom also can come under flexibility. If we consider life without flexibility; that is everything around us feels rigid. Trees that are naturally growing towards sunlight only because of flexibility might look like rigid linear statues. Considering life without 'flexibility' itself gives the feeling of

goosebumps. Flexibility can help improve every aspect of your life – your work, relationships, health, family, creativity, success, and more.

Even in the human body, decreased flexibility may also lead to abnormal stress on structures and tissues distant from the initial site of inflexibility. One example of this is that tendonitis in the knee can be related to calf tightness.

In terms of design, flexibility can be defined within three broad types- Adaptability Transformability, Convertibility, relating to the amount of change that occurs and the degree of permanence of that change.

1.2 Product Flexibility

Product flexibility can be defined as the amount of responsiveness (or adaptability) for any future change in a product design, including new products and derivatives of existing products.

A flexible design will reduce redesign costs and allow quicker response to customers with increased performance. Many manufacturers offer products that are specifically designed to present additional flexibility for the end consumer and product lines that can serve their entire market base.

1.3 Flexibility in Automotive Design

Even in automobile design, a flexible approach is essential. The automobile body shop is currently facing an accelerating process of change caused by shorter product life cycles, increasing customization, and the co-existence of electric and combustion engine vehicles. High automation and rigid production systems prevent cost-efficient responses to changing boundary conditions. This paper presents the results of a comprehensive study across the automobile industry, analyzing obstacles and approaches to handle the challenges faced. An approach for a fixtureless body shop, increasing flexibility and reducing costs, is described. The approach is based on part-integrated fixture functions, enabling fixtureless assembly, and joining of the body parts.

2. Types of Flexibility

2.1 Adaptability

Adaptability is a measurement of how well a design handles change. A static design is incapable of handling change while a fully dynamic design gracefully handles any change within anticipated limits.

There is often some cost associated with making a design adaptable. In some cases, this cost isn't warranted if there is a low chance of occurring. This trade-off doesn't always exist. In theory, a design can be both inexpensive and adaptable. (Andreasen, 1988; Kahler, 1988; Swift, 1988; Lund, 1988)

Embracing change and a future of infinite possibilities, though daunting, will inevitably strengthen your ability to adapt — and in turn, design. The ability to adapt can arguably lead to success in any field, but it has multifaceted importance for designers. Beyond adapting to ever-changing tech specs, rotating team members, and the demands of clients and users, designers can set themselves up for success by learning to remain flexible cognitively, emotionally, and situationally.

Examples:

- A dynamic website that displays content from a variety of data sources.
- Rooms that can be joined and reconfigured for multiple purposes.

2.1.1 Cognitive Adaptability

To adapt well, it's important to understand the value of progress and react accordingly by trying to keep up with the changing world around you. Designers do this by not only being competent in art and visual communication but also by becoming fluent in coding and knowledge of relevant software and technologies. Your clientele will also expect you to anticipate, understand, and design for the wants and needs of their business stakeholders. While wearing multiple hats can be undeniably challenging, well-rounded designers are better equipped to succeed professionally.

The constant evolution of technology also requires a certain level of adaptability from designers. Twenty years ago, you could only design handheld 3D games and augmented reality experiences in your dreams. On the flip side, designers may notice a rise in seemingly inconceivable jobs like gamification designer, chief drone experience designer, and human

DNA and organ designer sooner than you'd think. We can't predict the future, but we can welcome it — and that makes all the difference.

2.1.2 Emotional Adaptability

Creating a design that enriches the end user's experience necessitates putting yourself in the shoes of your client and their audience and learning to overcome your own confirmation bias. This can require a level of emotional intelligence that transcends everyday empathy.

"If a company is using new tech but only the engineers are working on it, then it's missing those touches that designers [have to] give it — the human element, the emotional element, the user experience," explains Krista Van Guilder, a senior UX designer. "We as designers are doing more than just dressing something up and making it look cool. We understand how to use the tech in a meaningful way, not just adding all of the bells and whistles because we can."

This isn't likely to change anytime soon, either. It's becoming common knowledge that creating for human beings is a more effective strategy than focusing on mastering metrics. As the ubiquity of personalization increases, so will the amount of emotion be informing the development and design of user experiences. The more memorable and meaningful the design is, the more it will resonate with users.

2.1.3 Situational Adaptability

Rather than letting challenging circumstances control you, a flexible worldview is fundamental for designers. Approaching change as an opportunity rather than a threat can positively influence both the way you work and your work itself.

Because the realm of tech is constantly evolving, it's important that designers can stay both optimistic and realistic during times of adjustment or transition. Good leaders can acknowledge shaky situations and plan for a better future by demonstrating confidence, and this applies to design as well.

For example, a designer who invested hours in a project only to be told by their team leader that they need to start over with new data. Rather than focusing on the amount of time and effort lost, a flexible team member would likely confront the challenge head-on. The same goes for designers working in a team with revolving members or facing a finicky client. This

kind of adaptability increases productivity and helps keep teams stable through times of change.

Becoming an engaged part of the design community is an easy way to anticipate and keep up with technological trends and working alongside your peers and predecessors can help you learn from their trials and tribulations.

Challenging yourself to try new things can help keep you on your toes, too. "Today's designer needs to pivot quickly as things move fast, industries transform, and start-ups go belly-up overnight," says Van Guilder. "Don't let yourself become stagnant… [and] don't get comfortable."

Paying attention to the style and success of your peers' responses to various scenarios can help you to become more situationally adaptable; whenever you find yourself faced with a similar set of circumstances, you can draw on your observations for reference.

Designers can also work on increasing their emotional flexibility by recognizing and understanding the restrictions of their preconceptions and biases, whether that includes assumptions about their audience's abilities or opinions on user experience. Working on the development of certain soft skills such as conflict resolution also helps you to become more emotionally and situationally adaptable — and manage your client's expectations, too.

While adaptability is a critical quality, there's something to the adage that there can be too much of a good thing. This is especially relevant when it comes to cognitive adaptability, as no one wants to be a jack of all trades but a master of none. We delve further into this issue here.

2.2 Transformability

In the field of design, transformability is an important way of actively responding to ambient conditions while also meeting the needs of users and addressing issues of user experience. Within contemporary design, there is a growing interest in motion; products and their parts are gradually shifting from static to dynamic. However, contemporary activities in design education are evidence of a lack of a holistic approach to the study of motion in design, and the design of motion as an alternative mode of design thinking is still in its infancy.

2.2.1 Transformable Design

Transformable design, though it is not a newly coined design term, has rarely been acknowledged as a critical component of design pedagogy. Due to a relative lack of history regarding transformable design resulting from the dominant tradition of understanding design as a collection of static artifacts, motion study has not progressed to a place within the pedagogy of architecture, and the impact of transformable design on pedagogy has predominantly been underestimated. The pedagogy of transformable design is founded on a pervasive design language called the Language of Motion Formation. The language of motion, as an integrated learning framework, offers a common foundation for the design of transformable architecture.

A recent studio-based course offered at Virginia Tech became a testing ground for the pedagogy of transformable design, bringing forth the opportunity to examine the concept of transformable design pedagogy within the context of an accredited design program. In the spring of 2014, by engaging the vocabulary and syntax of motion language and manipulating their bounds and constraints, design students examined the potential of motion language by designing and making different mechanisms in a variety of shape-shifting forms that offered the possibility of change. By inspiring new avenues in the exploration of transformable design pedagogy, this design studio attempted to expand the current domain of transformable design to a broader perspective of design pedagogy and contributed toward adding value directly into the content of the curricula, and thus into the field of design education. For the sake of better understanding the design process and the relationships among internal and external factors that craft dynamic and responsive products, this studio presented a sequential design development of different mechanisms from a seed idea through the fabrication phase in which motion evolved into physical models. The studio aimed to be a mediator between ideas and reality. In this studio, the making of a series of iterative models, as a way of knowledge gathering and design thinking, was integrated into the design intent. Therefore, different models, ranging from small to full-scale mock-ups, were made to thoughtfully engage motion design principles and manipulate their bounds and constraints.

2.3 Convertibility

Convertibility is defined as the capability of a system to adjust production functionality or change from one product to another. End-users of manufacturing systems are struggling with the issue of how to measure and quantify convertibility. Metrics for convertibility are proposed in this paper so

that different manufacturing systems can be compared concerning this area of performance. These metrics are based on assessments of the configuration itself, and the system components such as machines and material handling devices. Metrics for quantifying convertibility are useful for comparing system configurations during the early phases of design, without requiring detailed product or process plan information.

With increased consumer demands for a wider variety of products in changeable, unpredicted quantities, manufacturing system responsiveness has become increasingly important for industry competitiveness. Manufacturers need systems that can be rapidly adjusted regarding both functionality and throughput capacity over the lifetime of the system.

2.3.1 System Convertibility

System convertibility includes contributions due to machines, their arrangements or configuration, and material handling devices. One important factor in system performance that has not yet been included in flexibility or convertibility metrics is the nature of the material handling devices that are used.

When companies design and install new systems, they must be concerned not only with the products being manufactured today, but also those that will be made throughout the lifetime of the system. Thus, the ability to respond to future market conditions is important. By measuring the convertibility of the configuration, machines, and material handling elements, the convertibility metrics defined here provide a quantitative assessment for characteristics of manufacturing systems that make certain design alternatives inherently better than others in terms of responsiveness. (Van Wie, 2002)

Intrinsic metrics of convertibility are particularly useful during the early phases of design, when detailed product and process plan information may not be known. These assessment techniques can be used to compare candidate systems and configurations. It is often the case that more flexible and convertible systems require a higher initial investment. Intrinsic convertibility metrics can be used to justify the purchase of these systems, particularly for manufacturers who deal in highly volatile markets or have products that require frequent design changes (Bischof,2007, Blessing, 2007).

3. Examples of flexibility

3.1 Flexibility in products

3.1.1 Mobile phone

Mobile phones are used for a variety of purposes, it shows flexibility in use and purpose, such as keeping in touch with family members, conducting business, and having access to a telephone in the event of an emergency. Some people carry more than one mobile phone for different purposes, such as for business and personal use.

3.1.2 Nail cutter

A nail clipper (also called nail clippers, a nail trimmer, a nail cutter, or nipper type) is a hand tool used to trim fingernails, toenails, and hangnails. It provides flexibility to the user to use it in different ways.

3.1.3 Walking cane

Fig 1. Different types of walking cane

(https://www.seniority.in/blog/senior-safety-what-s-better-walking-canes-or-walking-sticks/)

One can improvise a walking stick from nearby felled wood. More ornate sticks are made for avid hikers and are often adorned with small trinkets or medallions depicting "conquered" territory. Wooden walking sticks (Fig.1) are used for outdoor sports, healthy upper-body exercise, and even club, department, and family memorials. This product talks about flexibility in users according to the flexibility in use.

3.1.4 Swiss knife

Fig 2. Swiss knife
(https://uniortools.com/eng/product/1655EURO17-multitool-euro17)

Swiss knife (Fig.2) a versatile tool that you'll find will often be your "go-to", all-purpose fix-it tool. From cutting to scraping, sawing, or sanding, the convenience of a multi-tool often wins out over more specific power tools.

3.1.5 Scissor

Fig 3. Scissor design considering left-handed as well as right-handed users
(https://www.designideas.pics/carpal-tunnel-special-designed-handles/)

The primary difference between left- and right-handed scissors is the way the blades are connected. The special thing about scissors (Fig. 3) for left hands is that when you open them, the blade on the left-hand side goes to the top. This means the blade on the right sits on the bottom. This provides flexibility in users solving the purpose of universal design (Ulrich, 2003).

3.2 Flexibility in Surroundings

3.2.1 Flexibility in Spaces

In architecture, the flexibility of space use is the space character that probably can change to various functions according to the activities even without changing the order of the

spaces.

3.2.2 Flexibility in Nature

Fig 4. Different types of eggs in one nest
(https://avianres.biomedcentral.com/articles/10.1186/s40657-020-00220-x)

Photos of blue model egg (Fig. 4) in the nests of the four species (a. Chestnut Thrush, b. Chinese Thrush, c. Elliot's Laughingthrush and d. White-bellied Redstart). A cuckoo bird lays its eggs in the nests of other birds, which act as foster parents for the young cuckoos. This shows how nature adapts flexibility.

3.2.3 Flexibility in Trees

Fig 5. Different shapes of trees of the same type
(https://www.pxfuel.com/en/free-photo-jgiwb)

Trees (Fig 5) are flexible. When subjected to a force due to the wind, or a force applied artificially, they bend. What is less obvious is that the bending is not merely a curving of the stem. The base of the stem inclines also because the roots flex so that the attachment to the ground is not rigid. The rotation is assumed to be about the point where the stem center line intersects the ground plane and the elasticity of it is described here by the term root-anchorage stiffness.

3.3 Flexibility in Technology

3.3.1 Alexa

Alexa is a virtual assistant technology developed by Amazon. It is capable of voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts, playing audiobooks, and providing weather, traffic, sports, and other real-time information, such as news. Alexa can also control several smart devices using itself as a home automation system. Users can extend the Alexa capabilities by installing "skills" (additional functionality developed by third-party vendors, in other settings more commonly called apps) such as weather programs and audio features. It uses automatic speech recognition, natural language processing, and other forms of weak AI to perform these tasks.

3.3.2 Personal Care Robots

A personal robot is one whose human interface and design make it useful for individuals. This is by contrast to industrial robots which are generally configured and operated by robotics specialists. A personal robot enables an individual to automate the repetitive or menial part of the home or work life making them more productive.

3.3.3 Smart Home

Home automation is building automation for a home, called a smart home or smart house. A home automation system will monitor and/or control home attributes such as lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of Things.

3.4 Flexibility in the Automobiles

3.4.1 BMW Gina

Fig 6. BMW Gina car offers flexibility to transform its shape
(https://www.bbc.com/future/article/20120206-have-concept-cars-lost-their-way)

The GINA (Fig. 6) Light Visionary Model is a fabric-skinned shape-shifting sports car concept built by BMW. GINA stands for "Geometry and functions in 'N' Adaptations". GINA allowed his team to "challenge existing principles and conventional processes." This beautiful vehicle gives itself the flexibility to change its emotions by moving its stretchy skin.

3.4.2 Tesla Pods

Fig 7. Tesla's interchangeable travel-pod system shows modularity in transportation
(https://www.yankodesign.com/2019/01/22/teslas-interchangeable-travel-pod-system-shows-modularity-in-transportation/)

Tesla pods (Fig 7) give flexibility to users to use the same frame with different vehicle categories assembled on it according to need (Stone, 1997).

3.4.3 The Flying Car

Fig 8. The hybrid car-aircraft, Aircar
(https://www.bbc.com/news/technology-576518403)

The new era of dual mobility vehicle; the automatic transition from a road vehicle to an air vehicle and vice versa, including deploying/retracting wings and tail.

The flying car (Fig 8) made its successful landing, and the flight represented a significant development milestone. The aeroplane transformed into a sports automobile in under three minutes with the push of a button, and it was piloted by its inventor.

4. Conclusion

In fast-changing environments, systematic product development must be extended from the classical approach. Flexibility is often proposed for product developing companies to stay competitive under these conditions. The development of flexible products is one form of the proposed flexibility. In this paper product development, guidelines were presented, which can be used by product designers as a supportive tool to develop these flexible products.

To achieve more unambiguous results and create a better too for the product development process, the guidelines must be revised. A first step to simplify understanding and remembering was taken by visualizing the textual guidelines. It must be investigated if this visualization supports the product developers' work without restricting the solutions. Additionally, the research will be continued to identify further flexibility guidelines to be integrated with the existing set.

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FLEXIBILITY IN USE – *part 2*

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Abstract

Universal Design is the design and composition of an environment so that it can be accessed, understood, and used to the greatest extent possible by all people regardless of their age, size, ability, or disability. Universal design encompasses flexible design of the system so that designed objects can have a certain degree of flexibility in use to accommodate for a wide range of individual preferences and abilities. Flexibility allows for compactness, space-saving, creative use, extended use, jugaad thereby leading to longevity and enhanced engagement. The study elaborately outlines approaches to improve flexibility in products.

Key Words: *Flexibility, Adaptability, Design, Inclusive, Multipurpose, Modular*

1. Introduction

The Disability Act 2005 defines Universal Design as the design and composition of an environment so that it may be accessed, understood, and used, 1) To the greatest possible extent, 2) In the most independent and natural manner possible, 3) In the widest possible range of situations, and 4) Without the need for adaptation, modification, assistive devices, or specialized solutions by any persons of any age or size or having any particular physical, sensory, mental health, or intellectual ability or disability.

In relation to electronic systems, this means any electronics-based process of creating products, services, or systems so that they may be used by any person (Center for Excellence in Universal Design, n.d.).

The application of universal design principles minimizes the need for assistive technology, results in products compatible with assistive technology, and makes products more usable by everyone,

not just people with disabilities.

The 7 Principles of Universal Design were developed in 1997 by a working group of architects, product designers, engineers, and environmental design researchers, led by the late Ronald Mace in the North Carolina State University. The purpose of the Principles is to guide the design of environments, products, and communications. According to the Center for Universal Design in NCSU, the Principles "may be applied to evaluate existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environments" (Center for Excellence in Universal Design, n.d.).

The purpose to incorporate flexibility in usage aligns with the intent of the universal design objective. Flexibility in use allows for a wide range of individual preferences and abilities. It also allows for the compactness and space-saving nature of products with the trade-off with complexity. Thus, a flexible design is one, which adapts to the needs of the users, and if implemented thoughtfully, it also eliminates the use of additional assistive devices. Proper application of flexible design eventually leads to inclusive design.

The definition of flexibility can be as:

noun
the quality of being easily adapted or of offering many different options
the ability to bend easily or without breaking
the ability and willingness to adjust one's thinking or behavior (Dictionary.com, n.d.)

synonyms. *noun*

Pliability, suppleness, pliancy, malleability, mouldability, stretchability, workability, limberness, ductility, plasticity, elasticity, stretch, stretchiness, whippiness, springiness, spring, resilience, give, bounce, bounciness, bendiness, tensility, adaptability, adjustability, open-endedness, openness, openness to change, changeability, freedom, latitude, mobility, variability, fluidity, versatility, wriggle room, willingness to compromise, accommodation, amenability, cooperation, tolerance, forgivingness.

2. Understanding the aspects of flexibility

2.1 Story

Last summer, before the pandemic, I was traveling from Kolkata to my home. I took a train from

Howrah railway station in the evening. This train used to be fairly crowded as there were not many trains running on this route. I was sitting on my window seat listening to the band "One republic", and taking a view of the outside. After passing a few stations, it turned dark eventually. I could hear some faint noise from the next coach. I guessed it might be some person taking tobacco or beggars. As I guessed, it was a group of beggars. So, I gave away a 10 rupee note like always. Just when the group went past, I saw a blind man right behind them. He was playing this small drum, and he was good at it. It felt wrong to me to give 10 rupees to a person begging and not to a specially-abled person who was actually trying to make his living. So, I reached into my pocket to give him another 10 rupees but all I had were coins. I counted the coins, it was some 13-14 rupees, and I gave him all of them. He took the coins, thanked God, blessed me, and walked away from playing his little drum. Sitting idle, it got me thinking, what if someone cheated on the blind guy? One can easily cheat on them if they want to, isn't it? Not really.

That day I realized why someone designs the coins to be of different shapes and sizes. Although it would be much more economical to make them all of the same size. Coins as a product are to be used by every person in every little corner of this vast country. The diversity of audience it needs to cater to is enormous. Making coins of different sizes is one aspect of adding value to the system to make it inclusive. Making design accessible to a wide range of audiences is one of the core principles of universal design. It demands flexibility in the system to be a universal design. As in the previous example, if we see the transaction system as a whole, the system loosens up to incorporate flexibility in size and accommodates all specially-abled users under its domain.

2.2 The Spectrum of Flexibility (Relativity and Scale)

Flexibility in use can be gauged on a spectrum that ranges from exclusive to inclusive design. Flexibility is also dependent on the scale of the context. For example, consider a steel pipe and a gardening pipe. The gardening pipe has an inherited property of flexibility by virtue of its material, whereas the steel pipe is rigid. But multiple steel pipes can be assembled to form different architectural structures as per the needs. Thus, it becomes extremely important to talk about scale and context when we consider flexibility.

2.2.1 Examples of a Flexible System

A flexible system provides a choice in the way a user uses it. Like a mobile phone one can use it for a great camera also one can use it for his business purpose. Each user uses it as per his taste and need. A flexible system Is inclusive and non-discriminatory like a public bus. The same bus suits the requirements of an old man and a young man. The public bus is

flexible enough to accommodate an entirely different set of people. Also, a flexible design allows flexibility and room for user accuracy and precision like a pencil, it writes for a child and even an artist. Finally, flexible design should be able to adapt to the user's learning curve like a game has multiple modes easy, medium, difficult.

2.3 The Indian Context

Following are a few aspects that showcase flexibility in usage in an exemplary way in the Indian context.

2.3.1 Jugaad

In the Indian context, a shortage of resources and poverty drive the indigenous people's inherited creative mindset to explicitly use things in ways other than what they are intended to be. Jugaad is a colloquial Hindi term that refers to a non-traditional, frugal innovation, often known as a "hack." It could also refer to a creative solution or a simple workaround, a remedy that deviates from the mainstream, or a resource that can be exploited in this manner. It is also frequently used to symbolize creativity: making existing things work or creating new things with little resources.

Jugaad is increasingly accepted as a management technique and is recognized all over the world as an acceptable form of frugal engineering at its peak. Jugaad also applies to any kind of creative and out-of-the-box thinking or life hacks that maximize resources.

2.3.2 Indian Clothing

The simplicity of Indian clothing allows the user to use the fabric as per their needs. Thus, simplicity is one of the key drivers to attain flexibility in usage as well.

Fig. 1. Gamcha

Fig. 2. Saree

Gamcha: It is a small piece of fabric that is popular in the dressing culture of the state of

Bihar. It is made up of cotton and is a very versatile piece of clothing (Fig 1). People use gamcha in various ways as per their needs. For example, they wear it as a lungi, use it as a towel, blanket, and also as a mat. People also use it for carrying food items or fold it and use it as a pillow while traveling.

Saree: It is another piece of fabric that is worn by women in different parts of India. It is a long piece of fabric that is worn by women by wrapping it around (Fig 2). The absence of any stitching makes it extremely flexible to be worn by women with varied orientations and body sizes.

3. Guidelines and Elaborate Examples

Taking care of the following guidelines while designing accommodates a wide range of individual preferences and abilities. This contributes to an inclusive and flexible system.

3.1 Provide Choices in Methods of Use

3.1.1 Multipurpose Products

Multipurpose products are artifacts with more than one intended or realized purpose. Having one product that can perform multiple functions can eliminate the need for additional products (Viswanathan et al., 2016). These products are typically seen as "all-in-one solutions". It also allows for the compactness and space-saving nature of products with the trade-off with complexity. However, if the "feature focus" aspect of products is pursued very aggressively, the essence of the product might get lost in the process (Fig 3).

A Swiss army knife is a great example of remarkable design. It comes in different sizes and shapes, but always with a good set of tools that can help you in a variety of situations, from scissors to knives, everything presented in a compact package easy to carry with you everywhere. The most common of these knives usually come with around fifteen tools. The average user uses around two to four tools max from the whole package. This means that around seventy five percent of what comes with the product gets wasted or in the best-case scenario, it is used on very rare occasions (Upadhyay, 2020).

So, when we end up focusing on building and releasing features because 'that's where the value is, we are on the way to losing focus on other important tasks. This could act as a barrier to thinking outside of the box while designing an artifact.

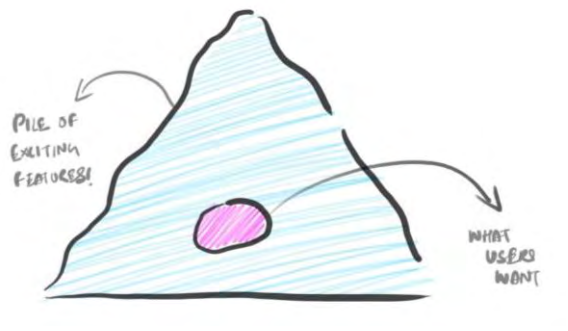

Fig 3. Adding features on top of features consistently for a prolonged period will end up in a mountain of legacy code

3.1.2 Modularity in Products

A modular design is an approach for product designing which is used to produce a complete product by integrating or combining smaller parts that are independent of each other. With the modular design approach, a complex product can be broken down or divided into smaller and simpler components that are independently designed and manufactured. Each of these individual components is then integrated to form the final product. Modular design allows one to customize, reuse, upgrade, and maintain product designs. Additionally, the modular product's independent parts follow a standard interface to easily fit into each other as a finished product. A famous example of modularity is LEGO. These plastic toys contain elements that can easily be assembled and reused as per the creativity level of the users. Modular design products are easier to customize and adapt according to individual customer needs or preferences or catering different customer personas (Yllobre, 2006).

3.1.3 Adaptable Design

The adaptable design aims at developing adaptable products that can be changed, adapted, reconfigured, and upgraded, during the product operation stage to satisfy the various requirements of customers. New adaptability evaluation measures, include extendibility of functions, upgradeability of modules, and customizability of components, to evaluate different design candidates and to identify the optimal one. This definition focuses on changes made to existing entities that make them accessible to people with disabilities or different orientations (Zhang et al., 2014).

3.2 Accommodate Right- or Left-handed Access and Use

3.2.1 Handedness

In human biology, handedness is an individual's preferential use of one hand, known as the dominant hand, due to it being stronger, faster, or better in dexterity. On the other hand, the non-dominant hand is comparatively often the weaker, less dexterous, or simply less subjectively preferred. Right-handedness is by far more common; about ninety percent of the human population are right-hand dominant. Handedness is often defined by one's writing hand, as it is fairly common for people to prefer to do some tasks with each hand. There are examples of true ambidexterity (equal preference of either hand), but most people prefer using one hand for most purposes.

Since the vast majority of the population is right-handed, many devices are designed for use by right-handed people. Left-handed people have either had to adapt or suffer in silence. However, through proper design it is possible to reduce these problems. A task analysis approach, based on force utilization, overcomes many of these obstacles by considering in detail the way tasks are performed. In a systems approach, the required actions and the ways they can be performed by both the right-handed and left-handed are defined (“Handedness,” 2021) (Laveson et al., 1976).

3.2.2 Ergonomic and Anthropometric Consideration in Handedness Neutral Design

Ergonomics is the science of fitting workplace conditions and job demands to the capabilities of the working population. Effective and successful "fits" assure high productivity, avoidance of illness and injury risks, and increased satisfaction among the workforce. The level of risk depends on the intensity, frequency, and duration of the exposure to these conditions and the individuals' capacity. Experimental study proves that left-handed and right-handed users interact differently with the objects in the space. Thus, it is important to consider both the ergonomic as well as anthropological aspects of the users to prevent them from being subjected to fatigue and muscular disorders (Hanford, 2021).

3.2.3 Handedness Inclusivity in UI/UX

Computer interfaces are designed from the ground up for right-handed people. Most mice are ergonomically designed for right hands. Control keys (arrow keys, insert, delete, page up, etc.) are on the right side of keyboards so they can be accessed by the right hand while

both hands are typing. Keyboard shortcuts are clustered to the left of the keyboard so the right hand doesn't have to leave the mouse. The software has hundreds of controls designed for right-handed people (including the right-click menu, designed to follow the natural movement of the right wrist). It makes it difficult to learn to use a computer any other way. According to UX design experts, usability patterns, finger and thumb patterns change when it comes to right or left-handed use (Ullinger, 2018). Babu (2019) suggests the following guidelines to design an inclusive experience:

1. Ask your users: good design practice is to conduct some form of user survey or field research where they try to understand the user's world.
   Layout of the control surfaces: the safest zone for ambidextrous use is seemingly the bottom center area. In addition to the surface area coverage, we can also see that the angle of the swipe also differs.

2. When in doubt, align it centrally: Often, products fail that fail their users. If the user cannot approach your product quickly enough or has to go through self-training to use it due to their handedness

3. Test with both hands: try to use your product with both hands separately. Because we have one side dominant, we are likely to use our favorite side and not test for this usability.

3.3 Facilitate the User's Accuracy and Precision

Design should be such that it facilitates the tolerance for inconsistencies in human accuracy which can happen due to various reasons. Any physical disability, impairment, or aging can cause a lack of agility leading to a lack of precision to complete a given task.

Also, the design should facilitate the time-independent quality of output along with easy access in emergencies minimizing hazards and the adverse consequences of accidental or unintended actions.

3.4 Provide Adaptability to the User's Pace

A learning curve is a graphical representation of the relationship between how proficient people are at a task and the amount of experience they have. Proficiency of performing a task usually increases with increased experience of doing the task. The common expression "a steep learning curve" is a misnomer suggesting that an activity is difficult to learn. In reality, people co-exist on

either side of the curve simultaneously. We will always have an expert and an amateur for any given task. This difference is due to the experience level and familiarity with the task that varies with each individual. However, other factors such as age, agility, mental comprehension affect the pace with which one pursues the task.

One of the fundamental issues to tackle in the design of video games is mostly referred to as creating a well-shaped difficulty curve. This means that one of the core elements of a good game design is to make the game just as difficult as it has to be so that the player feels challenged enough, but not too much.

YouTube includes a "Playback speed" feature that allows you to select a speed anywhere between a quarter times and two times the normal speed, with "one" being normal speed.

This allows the users to speed up a video that they feel is too slow, like perhaps a long presentation, interview, or podcast where everyone is speaking slowly. Likewise, users can slow the video down if they have trouble understanding or if things are moving too quickly (Aponte et al., 2011).

Thus, to make the design usable for users, it should adapt to the learning curve and the pace of the users without overwhelming and frightening them away. Also, design should promote easy access and use for newcomers to get more people on board.

3.5 Design for Newcomers

As design professionals, we must consider design through various lenses to ensure we design for target audiences. If design relies on users' mental models formed by their perceptions and past experiences, are we inherently missing a critical lens? What if an experience is altogether new to a user? What if they're a first-time user, a "newcomer".?

A design lens can work as a mental device for thinking about your design differently. It focuses attention on a single design principle, illuminating issues that may have been invisible before.

Designing for newcomers is good practice as it ensures you are considering the first-time experience, where introducing essential elements of your product or service helps overcome initial friction. Newcomers can represent a large user group for a business. Taking their challenges into consideration is important to business success.

Barua (2020) suggests that by anticipating the needs of newcomers and meeting them, you create happy customers that return and remain loyal. Designing with newcomers in mind can help avoid errors too.

Important Tools when designing for Newcomers:

- Ethnographic research
- Mental models
- Empathy map
- Journey map
- Service blueprint and touchpoint orchestration
- Writing for the layperson
- Transformation and change
- Business model canvas

4. Conclusion

As we are moving toward a more inclusive society, having equal opportunities for all is a must. A designer should be sensitive to user needs and should incorporate flexibility in the design of an artifact to ensure effective usability and user experience. This paper explores guidelines with help of examples to provide a template for adding flexibility in a product or a system.

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SIMPLE AND INTUITIVE DESIGN

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Abstract

Simple design and simple products feel natural and easy to use by the target user. These products are intuitive and users don't have to learn many things before using a certain product. The product has to be self-explanatory. A simple product is easy to use yet very difficult to design and a designer should go through a sequence of processes considering the usability of the user. The designer has to take into account their own varied experiences while designing a product that will feel just natural. This paper provides various approaches and processes that can be used to achieve simple and intuitive designs. Consistency also plays a very important role in designing a certain product where if the design is kept consistent over the generations, then the design becomes and feels much more intuitive to the user and reduces time required to get used to the interface of the product. Consistency can be conveyed in different formats to the user to keep him engaged and experience familiarity with the previous generation product. The overall process of using these products then becomes very easy and task-focused avoiding any unnecessary actions.

Key Words: *Simple Design, Intuitive design, Consistency, Intuition*

1. Introduction

People use multiple physical and digital products on a daily basis. While some products take time to operate, some of them do a specific task within a few seconds, some of them seem easy to use at first glance but they are difficult to use and at the same time some of them seem difficult to operate at first but they are very easy to use. Designers need to understand what makes a product more engaging than others and what makes design simple to use and understand (Chau, 2013).

Primitively, people used to take the help of sun positioning and shadows to find out the exact time of the day. Over centuries, people have used analog and digital watches to perform the same task, and even over here, the designer kept the main essence the same and made it simpler so that the user can identify the time of the day even when he/she is directly not standing in the sunlight.

Some products may seem complex at first glance yet they are easy to use. For example, The Swiss Army knife is a combination of multiple simple tools which could help an individual in their day-to-day life starting from bottle opening to saving a life from life-threatening situations.

2. Simple Design

- Simple design is easy to understand and deal with.
- It communicates its intent clearly and exactly.
- It is clear or has clarity.
- It is not elaborate or artificial. It is plain, crisp, and concise.
- It helps you maintain a clear focus on the thing which is the priority.
- It has the least possible components (Classes and methods). It Does not have unanticipated side effects. It just does one thing and does it well.

For example, a pencil is a simple design. It is very easy to understand, easy to use, and serves its exact purpose. Can we think of even simpler design than that! It's difficult, right? Now, what about chalk? It is even simpler than a pencil. It can be used by both sides, and can be gripped at any point and distance. So, what makes a simple design 'simple'?

The use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level (Botev, 2021). There are a total of 5 guidelines that help designers to make a simple design.

2.1 Elimination of Unnecessary Complexity

By eliminating the unnecessary complexity, the user experience could become simpler and easier to interact with. one way of reducing complexity is to design a product only for one function instead of multiple.
Slate (Fig 1) is a good example of simple design. Users can write on both sides of the slate and also, they can write upside down or sideways. There is no particular up-down or front-back side in

the slate so all the sides are easily accessible without creating any confusion. The functionality is also very simple and users can intuitively use the slate without requiring any prior experience.

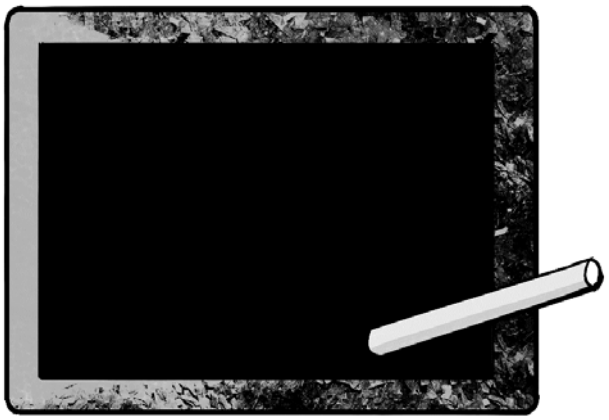

Fig. 1. Slate

Another example would be Remote control for Philips's lightbulbs has four buttons, each for only a single task. In the switch cluster for a product, a Big red button is provided as a kill switch which ensures to stop all the linked processes to it in case of an emergency.

Google homepage is also a good example of a simple and intuitive design where clutter and complexity were purposefully excluded in order to give more importance to the task at hand, which is to search for specific data over the Internet.

An analog watch is another example of simple and intuitive design where the main and only function of the product is to show time. Many people wear a watch as a status symbol, but moreover, it represents the character and personality of a person wearing it.

The computer mouse is one more example where there are only three buttons on the mouse (Left click, Right-click, middle click, and scroll wheel) which are kind of simple and intuitive. It just fits into a hand and users get used to it very quickly.

2.2 Consistency with User Expectations and Intuition

The design has to be consistent in most of the cases and should be obvious if the environment changes or it has to be consistent throughout and should meet user's expectations and intuition.

The meaning of red, green, and yellow lights in traffic signals are the same everywhere and they are consistent.

An elevator is an example of a design that is simple and intuitive. The buttons on the elevator are arranged in a rectangular manner and each button represents the floor number. There is no

complexity at all. Once the user presses the button of the floor where he wants to go, the process of opening the door, closing the door, going up, going down is taken care of by the elevator and the sensors automatically. The current floor is displayed on a small display in the elevator inside and outside along with the direction of the elevator, where it is going.

The design of the spoon (Fig 2) is also very simple and very easy to interpret which side is supposed to be grabbed and which is supposed to be used to hold the food.

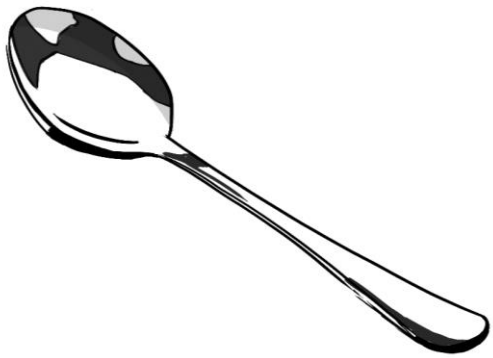

Fig. 2. Spoon as a consistent design with user's expectations

2.3 Accommodating a Wide Range of Literacy and Language Skills

Design has to take the literacy level of the users into account. The design has to accommodate the majority of the people despite the literacy rate or their proficiency over a language. For example, If a person goes to a mall, then he/she should be able to recognize the content, information of the product from its description tag.

The design of the walking stick doesn't require any manual. It doesn't have any barriers and the elderly can use it to take extra support. It doesn't involve any language barriers nor does it affect the literacy of the user.

A notebook is another product that doesn't affect the user based upon the language and literacy of the user. The user can use the notebook according to their needs and for any application as they fit.

2.4 Arrange Information Consistent with its Importance

The design has to be presented consistently over the variety of its variations. The information has to be presented in the manner of its importance and accessibility to improve the usability of the product.

For example, even though the placement of keys on the keyboard (Fig 3) can seem overwhelming initially, once the user gets used to it, it becomes very intuitive. The placement of the keys is based upon their usage, and type. Grouping of keys is done to identify and access them very quickly. Keyboard key "F" and 'J" have a little bump on them which provides the sense of space and location without even looking at the keyboard. Since, the SPACEBAR and the ENTER keys are used very frequently and their shape and size is different according to their importance.

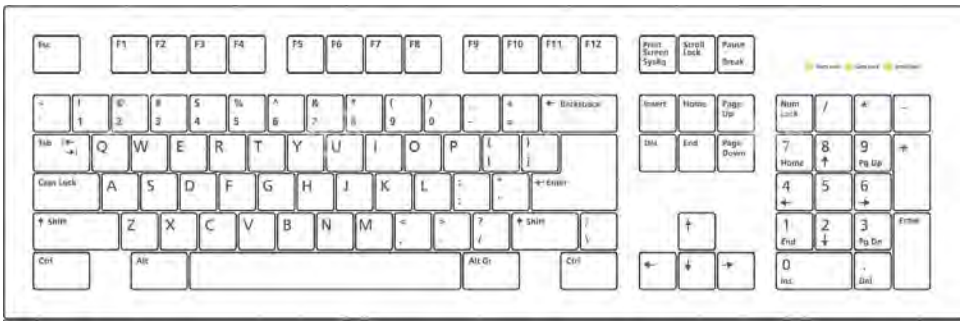

Fig. 3. Grouping of the keys according to function

2.5 Effective Prompting and Feedback During and After Task Completion

Designs use feedback or prompt feedback to enable effective use of a product. Feedbacks are the means to understand that the product is either processing your expected requirement or the work has been completed. Effective prompting helps the user to understand that their input is being recorded and processed by the product.

For example, Google home and Amazon echo gives feedback when completing a task. When the user asks to play a certain song or to search for something, The AI gives a small beep sound indicating that the input from the user has been recorded. After the input is recorded by it, the system partially repeats the Inputs to indicate that the system is processing the command provided by the user, and afterward, it completes the task by playing a certain song or replying by answering the question asked by the user.

3. Intuition

Using or based on what one feels to be true even without conscious reasoning; instinctive. It just comes naturally without or less prior experience. Design is born complex and over time after many iterations it becomes simple. Simple and Intuitive design makes life better. (Nikolov, 2017)

Intuitive design is used informally to describe designs that are easy to use. So, when the user can understand, use and experience the design immediately and without consciously thinking about how to do it, then the design is described as Intuitive design.

Members of the interdisciplinary research group 'Intuitive Use of User Interfaces' argue that intuition is not a feature of the design. Instead, intuitive use is a characteristic of the interaction process between a specific user and the design. So, if we are to evaluate whether a design is intuitive, we must also think about who will use the design (Interaction design foundation, n.d.). Users will feel that design is intuitive when it is based on principles and experiences from other domains that are well known or experienced by them one way or another. Designs can therefore provide experiences that seem intuitive to some users but not to others (Goyal, 2019).

Designers have to carefully derive the knowledge of the targeted audience and they have to design the product specifically for them. By deciding and narrowing down the exact needs and requirements of the user, the product can be made more intuitive.

The iPhone (Fig 4), iPad, and other successful Apple products are good examples of how digital and physical design can be incorporated with each other to make a product simpler and more intuitive. The success of the particular product is also somewhat dependent upon the intuitiveness that the user feels while using a particular product.

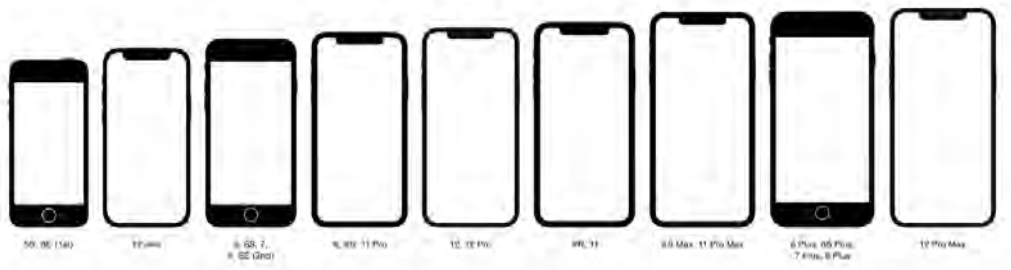

Fig. 4. iPhone evolution

The critical question for a designer is how he/she can design for this ever-growing market and avoid unnecessary processes and wastage of time in the process.

3.1 Counter-intuitive

What creates counter intuitiveness into a product? If something is not intuitive then it might take more time to understand by the user or they might need multiple tries before performing the specific task successfully. The instructions might be either confusing or not straightforward or the design/product wants to perform multiple tasks simultaneously.

Box Puzzles (Fig 5) are an example of counter intuitiveness where no set of instructions was given to the user. The user generally doesn't know what steps he/she should perform to unlock the puzzle box. He has to do multiple iterations, trials, and errors to open that box.

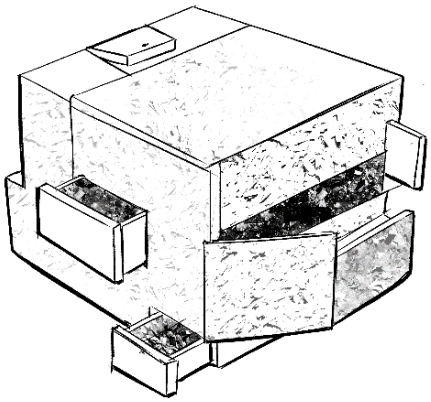

Fig. 5. Puzzle box needs trial and error method to solve (counter-intuitive)

3.2 Intuitiveness Over Some Time

Not all product designers are intuitive from the very start. Some products might need little time to learn and get used to. These products should have a learning curve so that using the product or performing a certain task will become intuitive to the user.

A good example of this is a bicycle. Learning bicycles takes patience and time. Once you learn it, then it becomes so much easier and more intuitive. After a while, it also becomes very natural so that the rider doesn't even have to think about how he/she is riding it. It becomes second nature.

One more example we can take is a computer mouse. Computer mice are used by many users and for different purposes. A computer mouse could be as simple as an Apple Mouse where we have only one single button on a mouse and it performs multiple functionalities and at the same time, it could be as complex as a Gaming mouse when they have as many as 18 buttons on them. This product could be overwhelming to some users in the beginning, but once they get used to it, it becomes very natural to handle it and users can perform multiple tasks on a single command. These types of products are generally based upon time, user, and type of work to be performed by the user.

3.3 Simple and Intuitive Design

An elevator is an example of a design that is simple and intuitive. Conversely, a lift is not always familiar to users. This may cause potential confusion or a lack of comfort with using the device. As a result, individuals may choose to avoid using it. Many people feel very uncomfortable while using a lift because of the closure, or the sudden sense of gravity.

Consistency is a key principle in life and it is very important to keep things consistent so that users can experience the effortlessly in any region or at any time and place.

4. Consistency in Design

Consistency is the core of simplicity which is recognized by anyone very easily. Consistent design is intuitive design. In short, usability and learnability improve when similar elements have a consistent look and function similarly. When the design is consistent, people can use their previous knowledge gained over the period and they use that knowledge to use and access the product which makes things effortless and seamless. When a design is consistent, a small difference in new design can be learned easily due to prior knowledge and the user gets used to the new product. In this way, users can focus more on implementing ideas, exploring new things, and not on learning how the new product works. Humans like consistency by default and they continuously look for balance everywhere. People feel more secure and safe when things are more consistent around them (Yalanska, n.d.).

4.1 Benefits of Consistency

If designers keep things consistent, then users will learn things faster. Imagine that the consistent elements in your design are the letters of the alphabet. Once the user has learned the alphabet, he can go anywhere in your product and still be able to communicate with the interface without friction.

Having an inconsistent interface is like trying to communicate with the user in several languages.

Only the advanced users will be able to finish their tasks. Consistency eliminates confusion! When the user feels confused the next step is to feel frustrated. Consistency saves money and time! Consistent design is frequently built by predefined components. This allows designers and stakeholders to make decisions quickly without spending precious time arguing. This saves time that can be used to build the product and make incremental improvements.

4.1.1 Visual Consistency

Similar elements that are seen or treated the same way create visual consistency. It increases the learnability of the product. Fonts, sizes, buttons, labeling, and similar need to be consistent across the product to keep visual consistency.

4.1.2 Functional Consistency

Similar controls that work similarly or the same way creates functional consistency. It increases the predictability of the product. Predictability of the product leads to the user feeling secure and safe.

For example, the reversible compatibility of the product should be the same way across the product.

4.1.3 Internal Consistency

It is the combination of both visual and functional consistency in the product design. It improves the usability and learnability of the product over time. Even if we introduce new functions/features/pages users will feel easy to use them as long as the designer keeps internal consistency.

4.1.4 External Consistency

This type of consistency is achieved when there is design consistency across multiple systems/products. Using this method, the user's knowledge and experience for one product can be reused in another product or the next generation of the product. This method provides a great user experience and eliminates unnecessary encounters or activities (Laja, 2019).

A good example of external consistency is the user interface and usability of Adobe products. Once you know Photoshop it is easier to reuse the same experience and knowledge to start using Adobe Illustrator and other adobe products. Achieving these four types of consistency will help the design gain better usability, a learning curve, overall simplicity, and intuition.

4.2 Designing Consistency in a Product

The essence of being consistent is to be able to replicate the same action and experience or element multiple times and still be able to support the user with achieving and completing the task. Color, shape, orientation, and textures help a designer to retain simplicity along with its consistency over time or generation which helps to make a design intuitive (Lde, 2017) (Laja, 2019).

4.2.1 Visuals

Grid, size, positions, colors, and typography needs to be defined properly in one central place and it can be used across multiple system or platform that a designer is designing. Defining a strong visual hierarchy is the most important aspect. Using the same color pallet across the product will simplify things. If everything is made and constrained in the

grid of our choice then that allows the arrangement of all components in a nice, simplistic and aesthetic way. Creating consistent visuals will allow the user to learn the system and the functionality very quickly and it will provide a smooth experience.

4.2.2 Voice and Tone

The voice, tone, notifications, sounds that we use throughout the user flow will influence how your user perceives the product. Keeping the voice and tone consistent helps the user to be familiar with the system. If the designer wants to keep the funny and friendly voice in the product, then it can be kept all the way up till the error and fail message. Mail-Chimp is a nice example of Consistent voice and tone.

4.2.3 Using Familiar Patterns

People who use certain products have been around for some time. This means that they have experienced and learned other designs and know the patterns used in them. The designer should take advantage of that and incorporate similar, familiar patterns and experiences into their product and design. The user will feel much more comfortable and his/her journey will be much smoother.

4.2.4 Bend Consistency, Don't Break It

You might argue that consistency could bore the heck out of the user. If we keep things always consistent there will be almost no innovation and the user will not find it interesting enough while using or experiencing it. Designers have to learn the rules first before they bend them. Broken consistency equals a broken user experience. The time interval for a particular process gets slowed down. A lot of time gets wasted over what color is the best for that particular product.

4.2.5 Preserve and Build Consistency

How can a designer keep things consistent and at the same time make the design interesting?

Keeping things consistent means change will be slowed down. Designs have to make the product easy to understand, use and feel. They have to delight the user while experiencing it.

The secret to doing it is to understand the user. All the understanding about the product should come from the user. Making big adjustments should be carried out only when the

user requires it and demands it. It should be coming from the user research and the previous user experience. Making small changes once at a time will keep the product consistent and will provide a better user experience (Luigi, 2015).

We have to remember that little change is good, more change is not necessarily better. Creating consistency will improve the usability of the product and it will delight the customer and user reducing unwanted and unnecessary surprises.

Innovative and unique designs are rarely simple. The process of designing is messy. Prototyping and iterations take time. Over the period, the unnecessary things are removed from the design. The non-user-centric or non-prioritized functions have to be redesigned or have to be removed. Iteration becomes subtractive and the designers can focus upon the exact things which make a difference. When designers reach the design phase of the product, they can and have to ask themselves, what can be removed or modified from the design and functionality without hurting the performance? The designer has to keep simplifying and removing and this process keeps on going. Simplifying is great as long as it doesn't hurt the performance and objective of the tool/product you're designing.

5. Conclusion

Products are born complex and they are made simple over a rigorous process to attain exact needs. Products might be complex or maybe simple in operation and mechanism but they have to be intuitive and simple to understand and use by the user for them to be accepted easily. Designs and Products don't have to be complex to appeal to the users. Design just has to have a strong engagement with users so that products will feel natural and intuitive while interacting.

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PERCEPTIBLE INFORMATION IN DESIGN

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Abstract

Everything that we see in the modern world, is/was designed by someone or a group of people. The design leverages our perception of information to convey information or emotion to our brain, to which we have certain triggers. The basic seven design drivers are the principles that drive a design towards perfection. For the perception of any information or emotions, the design must communicate necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. This Paper aims at clearing what is the perception of information and its technicality, to describe perception in the field of design and to provide designers with a toolkit to implement the design driver efficiently.

Key Words: *Perception, Information, Emotion, Design*

1. Introduction

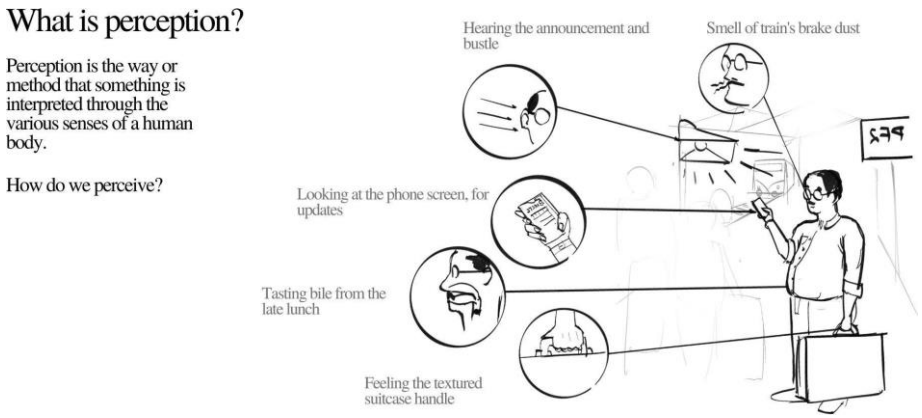
1.1 What Is Perception?

Touch, sight, audio, smell, and taste are the five senses that constitute perception. It also includes proprioception, a combination of senses that enables you to detect changes in your body's position and movement. (Cherry, 2020) It also includes cognitive processes that are necessary to analyze information, such as identifying a familiar face or smelling something familiar. Learn how we move from sensing stimuli in the environment to taking action based on that data (Fig 1).

1.1.1 Types of Perception

Some of the main types of perception include: vision, touch, sound, taste, and smell. Along with these, Balance, time, bodily position, acceleration, and the experience of

internal states are among the additional senses that allow us to perceive. Many of them are multimodal, involving many sensory modalities. Another crucial sort of perception is social perception, or the capacity to recognize and apply social clues about individuals



and relationships.

Fig. 1. Understanding perception

1.1.2 How It Works

The perceptual process is a set of stages that starts with the environment and ends with our perception of a stimulus and our response to it. It happens all the time, but you don't pay much thought to the actual process that occurs when you perceive the myriad stimuli that surround you at any one time.

The process of converting light falling on your retinas into a real visual image, for example, occurs instinctively and naturally. Without thinking about it, the minute changes in pressure against your skin allow you to sense objects happening.

1.1.3 Steps in the Perceptual Process

The following steps should be followed to carry on Perceptual process (Centre for Excellence in Universal Design. (n.d.)):

- The Environmental Stimulus
- The Attended Stimulus
- The Image on the Retina
- Transduction
- Neural Processing
- Perception
- Recognition Action

1.1.4 Impact of Perception

1. Environmental stimulation: The world is rich with stimuli that may be accessed through several senses to draw attention. Everything in the environment that has the potential to be recognized is considered an environmental stimulus.
2. The attended stimulus is the exact thing in the environment on which one's attention is focused.
3. The picture on the retina: This is accomplished by light traveling through the cornea and pupil of the eye and onto the lens. The cornea helps concentrate light as it enters the eye, and the iris of the eye determines how much light to let in by controlling the size of the pupils. An inverted picture is projected onto the retina by the cornea and lens working together.
4. Transduction: In the process of transduction, the picture on the retina is converted into electrical impulses. This permits visual signals to be delivered and understood by the brain.
5. Neural processing: The electrical impulses are next processed neurally. The path that a signal takes is determined by the sort of signal it is (i.e. an auditory signal or a visual signal).
6. Perception: You perceive the stimulus item in the environment in this phase of the process. This is the point at which you become aware of the stimuli (Centre for Excellence in Universal Design, n.d.).
7. Recognition: Perception entails more than simply becoming aware of the stimulus. The brain must also be able to identify and comprehend what you are feeling. The following phase, known as recognition, is the capacity to understand and provide meaning to the item.
8. Action: In response to the observed and acknowledged stimulus, some sort of motor activity happens in the action phase of perception. This might be a large action, like sprinting toward a distressed person, or something as minor as blinking your eyes in response to a cloud of dust in the air.

The perceptual process allows you to experience the world around you and interact with it in ways that are both appropriate and meaningful.

1.2 The Three Brains

The information that we perceive processes in our brain, most of which are in the most visceral parts of the brain. That is also known as the reptilian brain.

It took millions of years for our brain to evolve into what it is today. Even today, the functioning of the brain is understood by its evolution. The brain is distinguished into three broad parts- The visceral, behavioral and reflective parts. The visceral brain is the oldest and behavioral the newest level of the brain, as per evolution.

The new brain constitutes its latest development in evolution, and it represents the conscious part of the brain. It is responsible for logical decisions and reasoning. The midbrain is responsible for processing emotions and controls the behavior of a person. The old brain helps us in survival since it developed millions of years ago when survival was the basic need.

The old brain controls instinctive impulses, like fight or flight responses, physical maintenance, personal grooming and mating. It works voluntarily, on a visceral level but has a considerable impact on our decisions and life (Eissen et al., 2014). This old brain plays a large role in the perception and processing of information. The reason it is called the reptilian brain is that it represents the modern-day brain of a reptile. The other two brain levels also play a role in how a human responds to the triggers from the reptilian brain. During anger or rage, the reptilian brain takes over the other two parts of the brain. When people feel they are making decisions from the heart instead of the brain, they are using the old brain (Fig 2).

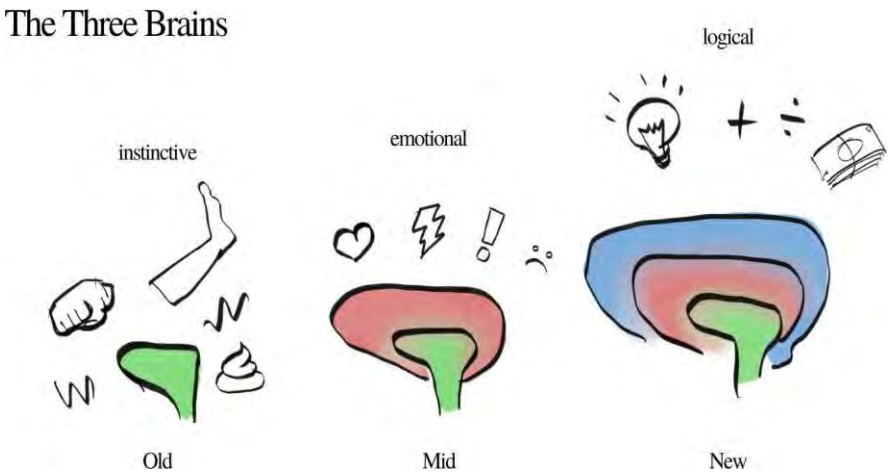


Fig. 2. The three levels of the human brain

1.3 The Visceral Brain Level

Our 'old' or reptilian brain level is linked to what we term the visceral level. Unconsciously,

automatic and quick judgments are produced at this level. This is what we refer to as our gut instinct. It is a reaction to exterior appearances that causes us to classify something as "beautiful" or to associate a colour with a mood. This level influences how something impacts us, and emotions emerge as a result of this response.

The behavioral level is concerned with the efficiency of usage and can promote or inhibit both other levels. The reflective level, which rationalizes and intellectualizes, is the third. It receives no sensory input directly, but it guards and attempts to bias the behavioral level. Cultural variations become apparent at this level, and views are formed, which then affect and alter our behavior. Everyone's visceral level is pretty much the same; it operates by matching patterns. Our old brain is still actively hunting for patterns that were imprinted at an early period in development, even if our initial cave home has given place to city and rural residences.

1.4 Patterns

We can tell the difference between positive and negative patterns. Bright, vivid hues; warmth; symmetry; round, smooth curves; sensuous shapes are all examples of positive patterns. Unexpected strong light; darkness; naked, flat terrain; too dense environment; large crowds of people; deformed human forms; looming things; sharp items are examples of negative patterns. Note how nicely these fit in with primitive survival; the flowers and fruits are symmetrical and have brilliant, intense hues. To protect our safety, we must be aware of unexpected changes in light or sharp objects, among other things (Fig 3).

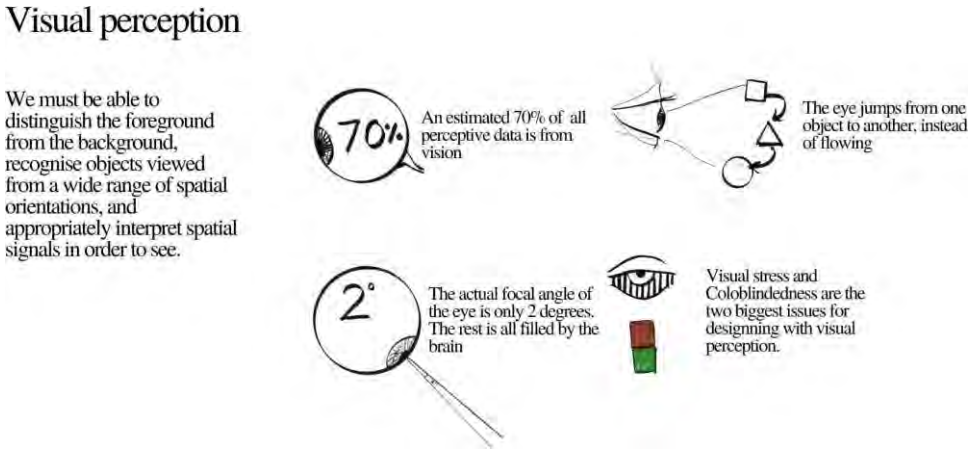


Fig. 3. Understanding visual perception

1.5 Acquired Taste

The brain began as a reptile brain, then evolved to include the midbrain, and finally evolved into

a reflective brain. When we compare this to how people develop from kid to adult, we can observe that the sequence in which the various brain levels are utilized is very similar. The visceral (survival) level of the brain is mostly used by little children. As a result, visceral concepts are frequently displayed in toys for young children. We tend to explore experiences beyond this level as we get older. We begin to use our reflective and behavioral brains, which can eventually overrule visceral responses. Viscerally bad things can be transformed into reflectively positive things. Crowds or noisy cities, for example, become second nature to us (or we conquer our dread of them). Another example is the bitter flavour found in many delectable and rich foods. In addition, our colour preferences become more complex and sophisticated. Acquired taste refers to the exploration and appreciation of things beyond the visceral level's constraints.

2. The Function of Gestalt theory in Perception

The Gestalt principles can aid in the organization and unification of visual information. We'll concentrate on prägnanz, closure, figure-ground, proximity, likeness, continuity, experience, uniform connection, and symmetry, among the roughly one hundred and forty Gestalt principles. Gestalt theory is characterized by concepts derived from investigations on how people interpret different types of visual information (Eissen et al.,2014).

Reading emotions is critical for survival in evolution. We tend to read emotional responses into anything, animate or inanimate, as a result of this. The act of putting human thoughts and feelings onto animals (pets) and inanimate things is known as anthropomorphism (Fig 4).

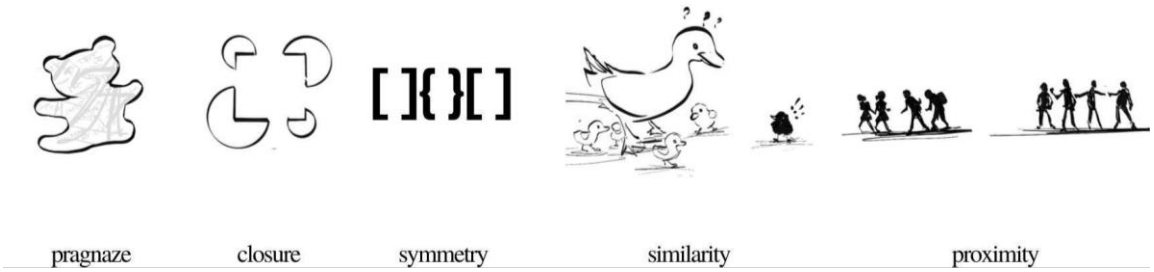


Fig. 4. A few gestalt principles through doodles

2.1 Gestalt Theory: An Introduction

One of the optical illusions of eyesight is the belief that you can see everything in front of you. In

truth, you only see a small area of your range of vision when you're 'active.' The foveal visual field is defined as a vertical angle with a 2-degree angle. It is encompassed by the parafoveal vision field, with which it forms a 22-degree vertical angle (Eissen et al., 2014). This area roughly corresponds to the space covered by your hand when you extend your arm in front of you and open it up; your hand now covers your active vision field. Isn't it quite small?

How did we come to believe that we can see everything in front of us? Because our eyes do not generally gaze, they travel at high speeds, recording everything in front of us and helping our brain to fit up all the jigsaw parts. As a result, the brain gets millions of sensory signals every second and attempts to make sense of them. The brain associates tastes, odours, and other sensations with what we see with our eyes. It contrasts current observations with earlier ones. Our brain interprets by looking for meaning in and connections between the numerous things it perceives. This is referred to as perception (Eissen et al.,2014). These eye movements are known as motion parallax, and the short moments when our eyes rest are known as fixations. These fixations do not occur at random but are concentrated in specific areas. This phenomenon was researched by scientists as early as the 1890s. They noticed that the test participants' fixations centered on the eyes and mouths in the image, which are important locations for face and emotion recognition. We seek significance and also for a connection between the components we perceive. As a result, we typically prefer to gaze at harmonious visuals rather than ones that lack harmony. On rare occasions, you may even recognise shapes that do not exist, such as seeing clouds shaped like an animal or a face on the moon. Although the principles do not specify how to convey your visual information during a product presentation, they do explain how this information is viewed.

2.1.1 The Principle of Prägnanz (concise)

We shall aim to arrange or reduce visual information to the simplest form feasible, i.e., more regular, symmetric, and orderly, according to this concept. It's a powerful idea that can be applied to our overall sense of perception, not simply visual perception. We seek simplicity and purpose in the things we see. We attempt to perceive something basic and meaningful even in complicated shapes. We want simple, straightforward (symmetrical) forms with as few as feasible (Eissen et al., 2014).

2.1.2 The Closure Principle

We complete partial pictures or objects in our brain according to this approach. To form a coherent or meaningful overall image, we fill in the visual gaps. This was necessary for human survival in the early stages of evolution. Many predators would hide in the shadows, just partially visible to humans.

2.1.3 The Symmetry Principle

We tend to interpret items as symmetrical. Most things may be split into two almost symmetrical parts. We instinctively unite two symmetrical things into one cohesive form when we observe them.

2.1.4 The principle of Similarity

We tend to group things or objects that have similar characteristics or that appear to be the same. Colour, value, texture, size, location, and other characteristics can be used to connect them. This idea, for example, underpins brand identity, among other things.

2.1.5 The Principle of Proximity

This is the perceptual propensity to combine visual elements that are close together, but elements that are further off are perceived as autonomous, or not related. This is due to relatedness, which allows us to see groupings or chunks rather than separate, independent items.

2.1.6 The Uniform Connectivity Principle

This concept states that items with uniform visual qualities are viewed as being more connected than those without uniform visual features.

2.1.7 The Continuity Principle

The concept of (good) continuity, continuation, or linearity expresses the idea that things moving in the same direction are regarded to be related to one another. In this way, the brain may sense lines even when they are not physically there. As a result, we can readily read road maps or distinguish between the 'figure' and the 'ground.'

2.1.8 The Experience Principle

We make instinctive comparisons between what we see and what we already know. Icon designers have made excellent use of this idea. When referring to a letter or a trash can, use an envelope icon to represent email and a trash can icon to represent 'delete.'

2.1.9 The Figure/Ground Principle

Objects are distinguished from their surroundings by the eye. Objects such as silhouettes, forms, or contours automatically become the 'figure,' while the surrounding space becomes the 'ground' (Cherry, 2020).

3. Examples of Perceptible Information in Design

3.1 Good Examples of Design

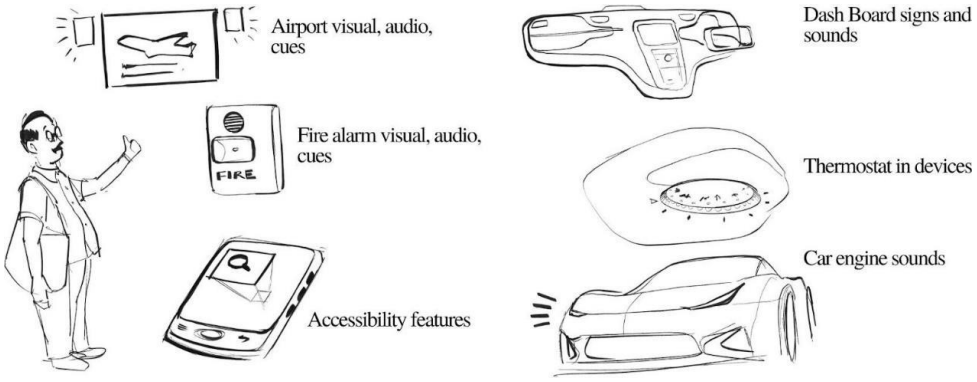


Fig. 5. Some good examples of design based on perceptible information

Airports have a lot of information flowing around, which is managed very efficiently. Airport sign boards and announcements make it very easy and intuitive to perceive information equitably. Signages are large and clear, information boards have all the information that a passenger might need to travel, like time difference, departure, arrival, flight number, boarding time, check-in, etc. Fire alarms have visual and auditory cues that help to perceive a fire emergency quickly. They have pulsating lights and loud sounds that can make everyone aware of the situation. Accessibility features in smartphones like magnifier, narration and voice assistance help a diverse range of users to make the most out of smartphones.

The dashboard of a car is designed in such a way that all the vital information can be perceived

by the driver in an effortless manner, be it a HUD or the switches and gauges, in a close call situation it helps the driver gain control quickly by various feedbacks.

Thermostats in devices, like electric iron, is also a very good example of the application of perceptible information in the design. They make a clicking sound with each unit rotation and has bumps on the surface, which makes tactile perception easier. By a combination of all the indicators, thermostats ensure the perfect setup and prevent mishaps.

Engine sounds of cars are important, as even electric vehicles are being mandated to have some sound as an indicator that it's passing by. This sound makes people perceive the awareness that a car is perhaps approaching and apply caution while crossing a road, or changing lanes while driving (Fig 5).

3.2 Bad Examples of Design

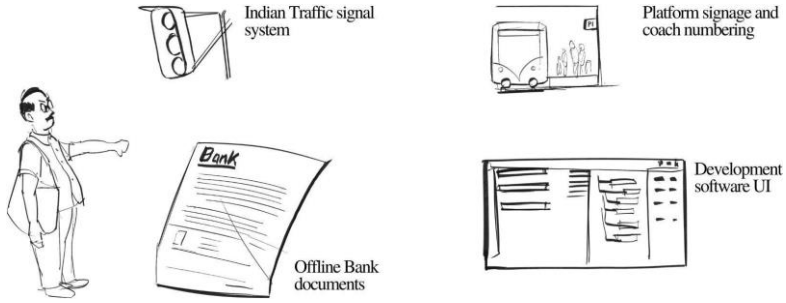


Fig. 6. Some bad examples of design based on perceptible information

There are a lot of bad examples of design that are not very perceptible at a glance.

The Indian traffic signal is very confusing and faulty. With improperly planned road systems, traffic signals are a nightmare.

Offline bank documents are supposed to make various bank procedures easier for people who do not want to do them digitally. Instead, they are extremely difficult to read and understand, hence making it not perceivable.

Platform signage and coach numbering in Indian Railways is not updated in many stations and trains, hence creating confusion and sometimes resulting in loss of money and time (Fig 6).

4. Guidelines for Designers

Centre for Excellence in Universal design proposes following guidelines for Designers to

implement perceptible information (Fig. 7):

1. Using visual, auditory and tactile feedback to the design process, to integrate equitable design principles.
2. Using Gestalt principles, like visual order, spacing, etc. to make it stand out.
3. Implementing clarity and contrast to help make a design easily perceivable.
4. Providing compatibility with other designs to make the perception process equitable.

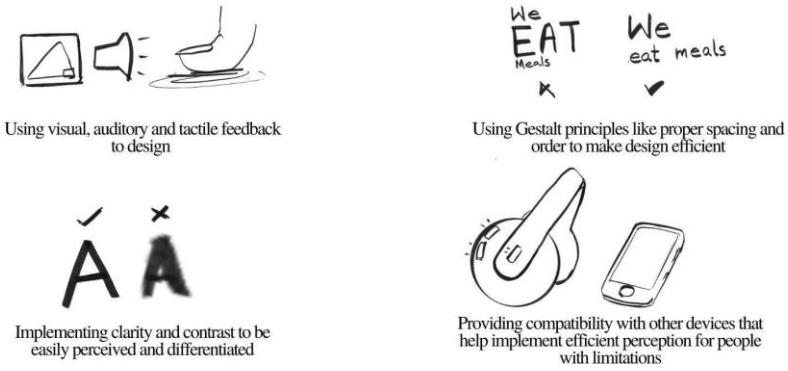


Fig. 7. Guidelines for Designers to implement perceptible informations.

5. Conclusion

In conclusion, everything that we see, hear or touch has an initial registration in our brain, which is the starting point of a perception process. Our job as Designers is to make this process as intuitive and easy as possible. By implementing the Universal Design Principles, we can make any experience better and easy. We should always keep in mind the guidelines and then proceed with a design to make it more perceptible.

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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.

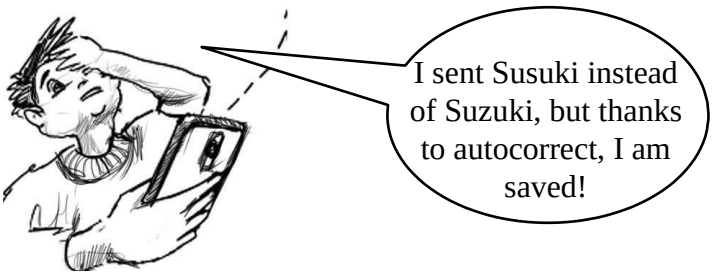

Fig. 2. A person finding relief due to autocorrect while sending a message.

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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LOW PHYSICAL EFFORT

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Abstract

As the world becomes smaller and connected, the relevance of principles of Universal Design keeps becoming more relevant and pertinent. Exclusivity has become a luxury while inclusivity has become a necessity. This paper tried to broadly examine one of the important pillars of universal design known as "Low physical effort". “Low physical effort” is often wrongly linked with induced laziness while falsely assuming an ‘abundance’ of time. This paper helps in highlighting the importance of working smartly to reduce physical effort to save time and energy so that it can be invested effectively. The paper also proposes approaches and techniques using examples from everyday life that could help reduce physical effort.

Key Words: *Less physical effort, physical effort, design driver, universal design, smart-work, inclusive design.*

1. Universal Design

Universal Design is a design approach where the outcome of the design caters to a wide range of users. Just because a design is accessible to a large mass doesn't mean that it is Universal. A design is universal when it can adapt users of different categories as if they seem like they were designed solely for that particular user. This adaptability in design requires some use of constraints and aiding elements to function as desired. Low physical effort is one of the 7 principles of the Universal Design approach that could help achieve this adaptability.

2. Low Physical Effort

Low physical effort is a design driver in Universal design which becomes the core idea behind the

seed of every design in the present world. Design means to bring some improvement in an existing solution for a problem or finding a solution for one which hasn't been solved yet. When we go out in the market to buy some product to replace a product currently existing with us, our primary criteria might be the ease with which the new replacement could get the job done. It's an innate urge with humans or intelligent species to achieve better results day after day. If our ancestors had stopped thinking of bettering themselves and the environment they lived in, the world wouldn't have progressed. All the inventions, products, services, etc. we see today are the present link of a chain reaction of thought and design started by someone in the past (Zheng, 2021).

2.1 Laziness Drives Inventions

It is quite impossible to pinpoint how humans started inventing things. The first few inventions must have been accidental discoveries rather than well-thought-out ideas. But once we discovered that certain things can make our lives easier, we must have started thinking about what other things could make it even better. It is human curiosity and laziness in human nature that formed the driving force behind this. Mr. Bill Gates once said, "I will always choose a lazy person to do a difficult job because a lazy person will find an easy way to do it." Accidental discoveries which turned into useful inventions include fire, water transport, building shelter, etc. These accidental discoveries solved many problems we never knew existed. But once we got comfortable with the solutions, we urged to make them better and started identifying new problems.

2.2 Time and Effort

When we think of physical effort, we often overlook 'time'. Physical effort and time are directly proportional. The more effort you need to put in to accomplish a particular task, you would require more time accomplishing it. Human life is a race between birth and death. When humans realized this and understood the concept of time, it became the most valuable thing in our life. And the race between birth and death became the race against time. Every day we are striving hard to save time. One key to doing this is to reduce the physical effort in any known activities. It can be as simple as using a knife to cut vegetables than tearing them apart using our bare hands.

3. Why Reduce Effort?

There's always a priority matrix for a day's work for a person. We are not machines. Time as I mentioned earlier is extremely precious as we are not eternal. So as per this priority matrix, different people will have different preferences. None of us would want to waste time on menial

tasks postponing the important ones in our life. But some menial tasks are unavoidable. Let's think about a very simple example we all can relate to. We all need to eat to survive right? And most of us prefer home-cooked meals. But not everyone enjoys the process of cooking. For such people, it becomes a menial task. Most of us don't like doing dishes after a wonderful dinner. A dishwasher can take this boring chore away from us and save us some time and energy. A dishwasher might be a complex example here. Something not everyone can relate to, but no one would have missed the TV commercial about dishwashing soaps. In the ad, they clean a soiled pan with just a single wipe of sponge with their product. It's been the advertisement formula for so long, but it is still very tempting, right? Why is that? Because we know the hardship of scrubbing such a dish. All it reduces is the number of moves we require to scrub. It saves time, and energy. That makes it a better design at least in theory (products are often misrepresented in ads, and that's the topic for a whole another discussion).

National Center for Biotechnology Information (2021) suggests, in simpler terms, that we need to reduce the physical effort to: -

- Save time
- Save energy
- For better allocation of effort to something more important

3.1 How Effort Is Reduced

Physical effort is the usage of our body's energy over a period of time to get something done. It might not always be a muscular effort. For example, reading is a physical effort where the muscle has very little to do with. So, to reduce physical effort, we have got two choices. Either reduce the energy requirement or reduce the time consumed by the task. This can be achieved by the assistance of an external appliance for the same task or by simplifying the task itself. There is always a balance point between these. A good design is about finding that balance point. But a reduced physical effort or improved time savings may not always result in an overall reduction in the effort as people tend to get more work done as result. This can be the flipside of the coin but not necessarily a bad side to having.

3.2 Reduce Physical Effort Doesn't Always Result in Reduced Physical Effort

For example, imagine you are driving a screw to a wooden plank. Scenario 1: with your bare hands. There is only a certain amount of force you can exert to rotate the screw. Still, you might not be able to accomplish the task. Scenario 2: with a screwdriver. The amount of force you can

exert remains the same, and you might even be using the same amount of force to rotate the screwdriver. But this time the screw drives in without much hassle. So, what really happened here? If you were using the same amount of force in both scenarios, why were you not able to drive the screw with bare hands? The screwdriver here helps you concentrate the force you applied the exact way it requires to drive a screw. So, what did we achieve here? Sometimes reduced physical effort can help us do otherwise impossible things.

4. How Do We Achieve "Reduced Physical Effort"?

While designing any product, we should be well aware of the use case of the particular products. We should consider every possible user who might use our product. We aim to attain a universal design. The key to achieving this is to make our design as inclusive as possible. An extensive user study is required. The design should be able to be used efficiently and comfortably and with a minimum of fatigue.

Reduced physical effort can be achieved by performing the following:

1. Allow the user to maintain a neutral body position.
2. Use reasonable operating forces.
3. Minimize repetitive actions.
4. Minimize sustained physical effort.

4.1 Including Everyone In The Process

Low physical effort not only makes it easier for an average person but also makes it accessible for differently-abled people across the globe. Let's go through a simple example. We may not first associate physical efforts with using the web. Anyone can easily just sit down and use a mouse, but technology is now integrated and ubiquitous in workplaces. Many people are using their computers for eight or more hours to perform tasks at work. The amount of time we spend on our computers is taxing on our bodies. In fact, people with physical disabilities have even more difficulty with using the web than normal users do. For example, those with mobility issues may have a hard time moving the mouse to the desired target. This is why designing for low physical efforts is vital to bear in mind whenever we work (Smith, 2013; Ranahan, 2017).

5. Low Physical Effort Is Non-Negotiable

There are multiple reasons the world is calling universal designs. Inclusivity is the key in the 21st century. All major countries in the world call for equality and equity. In order to practice these,

everything should be accessible to everyone. Also, in the era of mass production, there is very stringent competition between manufacturers or service providers to attract a maximum customer base. The price of a product/service is inversely proportional to the number of products reaching the market. Major players are running on a thin profit margin. They can't afford to produce exclusive products. Every product should overlook gender, class, ability/disability to become affordable to the masses. It's not just about the multinational giants making a profit out of their products. It's about accessibility and affordability too. Exclusive products are now termed designer/artisan products. So, like every 'Universal design driver', 'Low physical effort' is non-negotiable too. No designer can ignore it.

5.1 Low Physical Effort Is Not Always Desired

It's all about balance. Our body needs to be punished a little to stay healthy. We have heard a lot from our grandparents saying "people got addicted to technology these days, and that's the reason for every disease in the world now." Even if we catch a common cold our mobile phone would be the culprit. But yes, our body requires some workouts. Does that mean the designs calling for lesser physical effort are not good? Imagine this. Instead of carrying big boxes on your head around a warehouse, you use a forklift, get the job done and save some time. You might be able to complete 8 hours of physical work in 1 hour with the help of the right tool, saving 7 hours, and later use 1 or 2 hours out of it to work your body out at a gym to stay in shape. You're still saving 5-6 hours. You get more work done, save lots of time and balance the equation by working out. So, no! designs calling for lesser physical effort are not bad (National Centre for Biotechnology Information, 2009; Better health channel, 2020).

6. Conclusion

Low physical effort was the key behind inventions and it was the driving force of designs since the history of humankind. Once a reason for design has now become the backbone of the philosophy "Universal Design". Universal design is much more than what meets the eye. It's a movement towards a better world with humanity and equality celebrated over exclusivity. It's not just about physical effort. Any physical effort from our end requires a lot of processing inside our brain. Brain exhaustion is real. The human mind is a priceless thing. As of now, there's no true replacement for it. We should be using our mind for something great than spending it on menial tasks. So, every time you reduce physical effort, you're freeing up your mind to think of something great.

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SIZE AND SPACE FOR APPROACH AND USE

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Abstract

The Principles are a set of design guidelines for environments, products, and communications. The Principles can be used to evaluate existing designs, guide the design process, and educate both designers and users about the features of more accessible objects and places. One of the universal design principles is the size and space for approach and use. All designed objects should consider approach, reach, manipulation, and use to be very crucial, regardless of the user's abilities, limitations, or special needs. This paper helps understand and explains steps and approaches in planning size and space with examples in an urban environment. To create easily accessible design for all, understanding the various people who are disabled or small in size is critical.

Key Words: *Space, Size, Use, Size and space,*

1. Introduction

Size and space for approach and use is one of the universal design principles. The size and space of everything designed should be considered crucial for approach, reach, manipulation, and use regardless of the user's abilities, limitations, or special needs.

This principle emphasizes the need for design not only for aesthetic or visual aspects but also for delivering a practical and empathetic design that people can use to their maximum potential. It can be applied to a variety of fields, including product design, mobility design, and architectural design.

For approach and usage, four rules may be applied to goods, interfaces, and environments to create designs that everyone can use effectively.

2. Guidelines

2.1 Provide a Clear Line of Sight to Important Elements for Any Seated or Standing User

A person of any size can easily see all of the important elements of the product from any position, whether standing or seated. It is critical to design a product that is easy to approach in real life by taking all aspects of people into account.

2.1.1 Lower Help Desk

A low counter allows individuals and customer service desks to interact whether they are seated or standing, tall or short, or have any physical disabilities. The lowered counter section at the nurses' station improves patient visibility and access to vital equipment.

2.1.2 Home Planning

A home with an open floor plan allows visitors and residents to interact and move freely from one area to another. A full-length entry sidelight allows for outward visibility for people of all heights. Furthermore, the floor must be free of obstacles or partitions so that the person in the vehicle chair can move around the house without personal assistance.

2.1.3 Interior of Tram

The interior of the Alstom Citadis tram, which has a hundred per cent ultra-low floor, has both large open areas and two by two seating. As a result, wheelchair passengers can easily board and exit the tram and travel around without assistance.

2.2 Accessibility to Components for Any Seated or Standing User

A person of any size, standing or seated, can easily for reach all of the important elements of this product from any position. Furthermore, it is equally important for people of various sizes and mobility to have access to artifacts in the environment.

2.2.1 Lift Operation System

By providing a horizontal lift operation system, users who are short or seated in a wheelchair can gain access without the need for assistance. As a result, the product's efficiency rises while the number of users rises as well.

2.2.2 Subway Fare Machines

Subway fare machines place controls at various heights to provide convenience to both seated and standing customers. A person equipped with an RFID-compatible transmitter or a mobile phone can receive navigation cues to assist them in entering or exiting a station. All users have equal access to a fair vending machine.

2.2.3 Lower Kitchen

Instead of providing a kitchen top at a lower height with reachable controls and overhead cabinets, a standard kitchen table top comes at the height of two and half feet, allowing easy accessibility for differently-abled people who need assistance while cooking.

2.3 Accommodate Variations in Hand and Grip Size

When designing a product, keep in mind that it must be suitable for people of all hand sizes. When designing for children or adults, the design must be simple to use at any angle or size.

2.3.1 X-Box Adaptive Controller

Some people may not have the same functionality as others, and most products are designed for the general public. However, there are some products, such as Microsoft's X-Box controller system, that are specifically designed for specific audiences. The basic concept is that the product must reach all types of users, whether they are disabled or not, and that they should experience the product and its use.

2.3.2. Hand Grips

It is simple for the younger generation to use the public restroom. Whereas it is difficult for the elderly or disabled to access and use the toilet. The availability of various handles is desirable for older people who find using the restrooms challenging without assistance.

2.3.3 Chopping Knife

The chopping knife's loop handle accommodates a wide range of hand sizes and is very easy to grasp from any angle, allowing us to use it in a variety of ways.

2.3.4 Home Entrance

Initially, some doors are very short in height, and some people are very tall and large, making it difficult to enter the house. In addition, the seated person and children are having difficulty opening or reaching the door handle. By making the door very light and providing a door handle that allows a seated and small user to access the handle without strain while opening or closing the door. The door handle is suitable for larger doors and can be easily opened by hands of all sizes.

2.4 Provide Adequate Space for The Use of Assistive Devices or Personal Assistance

There should be enough space for the product to be used with devices for people in wheelchairs and for carrying oxygen tanks or service animals without disturbing others.

People who use assistive devices for mobility may find it difficult to maneuver in small spaces. In such cases, providing adequate space for them would ensure their safety, convenience, and efficiency.

2.4.1 Metro Station Space

Wider areas at metro stations or other train stations are typically provided at varying widths to allow wheelchairs to pass through, as well as a height that is easily accessible to check-in while seated in a wheelchair.

2.4.2 Fare Gate

Fare gates are accessible to a wide range of people. The gate assembly is sufficiently long that exiting passengers will not have to slow down or stop walking for the gate to open. To assist with fare collection, the gate has several smart card targets.

2.4.3 Providing Ramps

By designing the vehicle in such a way that wheelchair users can enter using the ramp provided, they will be able to travel with their families. And they can enjoy the trip without putting any strain on their bodies.

2.4.4 Vehicle for The Wheelchair Person

Wheelchair users can drive a vehicle that is an electric automobile that can fit one person by entering the vehicle through the back door. As a result, disabled people can travel

independently and without limitations. In addition, the vehicle must have a wide opening door that allows a wheelchair or walker to get close to a seat.

2.4.5 Floor Planning

The floor plan and layout of the house allow for wheelchair transit and maneuverability in the hallways and rooms. At the same time, the home layout must be simple for elderly people to remember.

3. Origin

The origin of universal principle goes back to our ancestors in the stone age. They were aware of, followed and passed through the generations some of the principles of Universal design, including but not limited to size and space for approach and use. Now in the modern era, we have a plethora of techniques and approaches for generating artifacts that make our life easy. However, we find some similar sensitivity towards needs in a lot of artifacts produced in the stone age as well. A good example of this sensitivity can be found in the hammer. A hammer is a very effective utilitarian tool which was used during hunting and for making oher tools, It was designed to be handy, easy to carry and made with readily available material like wood, stone and bone (Smith, n.d.).

4. Size and Space Matter

Size, generally, refers to the dimensions of a product. In our day to day life, size and space play a very important role in altering our experience. This is particularly noticeable in densely populated areas.

4.1 Urban Planning

Urban planning is the process of developing a city by taking into account both the design and regulation of space, with a focus on the physical form, economic function, and social impacts of the urban environment (Fainstein, 2021). Urban planning is concerned with both the development of open space and the revitalization of existing city areas, involves goal setting, data collection and analysis, forecasting, design, strategic thinking, and public consultation.

Many large cities have redeveloped the older congested parts of the cities wherever possible or developed new extensions with more 'thought' and plans for expansion for the future. Roads, streets, walkways, trees, boulevards add spaces for movement as well as breathing spaces in the

cityscape. Haussmann's plan of Paris, the modernization plan of Georges-Eugène Haussmann transformed many areas of Paris by adding wider boulevards, better lighting, water sanitation, new parks, and improved rail transportation. It improved the cleanliness and reveals the beauty of the city by planning and recreating the proper city layout starting from the heart of the city and moving outward. Since the sewer system was relocated underground, the streets became more efficient and visually appealing. This promised a city with cleaner drinking water and fewer disease outbreaks. His proto-modern style, which incorporated geometric designs, was visually appealing and eventually increased Paris's functionality (Kumari, 2015).

4.2 Analog Products of Human Scale: Pencils

One of the best inventions made by mankind is the pencil. It is very simple to use, and the size is small enough to fit in your hand, allowing you to grip it perfectly while writing without difficulty, and it does not take up much space. Originally, it was just a piece of charcoal struck between two kinds of wood and tied with rope, but it has now been perfected with continued evolution. As a result, it can accommodate small hands such as children's and big hands like adults', making it a portable and effective writing tool (Popova, 2013).

4.3 Digital Products of Human Scale: Smartphones

A smartphone is a portable device that combines telephone and computing functions into a single unit. In the beginning, the mobile phone was bulky and difficult to transport. This has become much more compact and powerful as a result of continuous upgrades and evolution. It assists children in learning new things through the use of smartphones. It has various features such as a camera, audio and video recording, and some other features that come in a small package. It also comes in a variety of sizes, allowing people to find the one that is most comfortable for them. Smartphones are developed in a variety of sizes to appeal to a wide range of market consumers. When it comes to iPhone 13, they come in a variety of sizes and specifications. As a result, everybody can have their cell phone, which is more convenient.

5. Concept of Sharing Space

The concept of sharing space is an urban design method that reduces segregation between modes of road users. Privately owned vehicles are becoming more common in urban areas, while space is shrinking as a result of increased traffic and crowding.

Using public transportation reduces the number of owned vehicles on the road while also saving time. However, not everyone is interested in using public transportation, and we cannot force

them to do so. Where different people use and require different things for their daily needs. As a result, many automobile companies are developing shared mobility based on various people's needs. Some recent examples of shared mobility are listed below for discussion.

5.1 Toyota e-Palette

Toyota's Global Mobility Services Platform will be used by the *e-Palette* Alliance to develop advanced vehicle and related mobility services for business applications. The *e-Palette* Concept Vehicle will be a self-driving, battery-electric vehicle equipped with connected technologies. The vehicle is adaptable to a variety of uses, including ride-sharing, logistics, and mobile shops (Toyoda, 2018).

5.2 Hiriko Fold

Some automobile projects try to design folding cars that provide solutions to urban issues. The Hiriko Fold, a super-compact two-passenger electric car, was created specifically for city driving. The main advantages of this vehicle are that it folds upright to fit into tight parking spaces and can travel up to 75 miles on a single charge. The Hiriko Fold has first-rate maneuverability thanks to zero-turn radius wheels that allow it to move sideways, making parallel parking a breeze. In this way, we can save parking space in the urban zones (Ashley, 2012).

6. Conclusion

The universal design principle of size and space for approach and use is one of the oldest principles that was used by humankind to design and shape our surroundings for comfort and effectiveness. The use of this principle by designers ensures that people with different physical or mobility characteristics can access and use a building, space, or product to its full potential.

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SIGNIFICANCE OF AFFORDABILITY IN UNIVERSAL DESIGN

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Abstract

Affordability is an important consideration while trying to create democratic interventions. However, it does not feature as one of the seven principles of Universal Design. Traditionally, affordability has primarily been concerned with economic aspects. However, mere economic considerations are not sufficient to create holistic mass interventions. Hence, this paper explores a broader meaning of affordability and identifies three critical levels of consideration. The first level of consideration is 'Value Affordability'; what values do we want to make affordable? The second level of consideration is 'Sustained Affordability'; how do we make these values affordable across time and scale? The third level of consideration is 'Access Affordability'; how can we increase affordability to make these values accessible to more people? In conclusion, the authors highlight the importance of affordability for creating preferable futures and suggest making it the eighth principle of Universal Design.

Key Words: *Affordability, Universal Design Principles, Universal Design India Principles, Values, Sustainability, Democratic Design, Social Sustainability.*

1. Introduction

Over the last few decades, design has emerged as a powerful tool for reducing social disparity. One of the most prominent disparities observed in the world today is that of economic variation. Though many designers have attempted to reduce inequality by making interventions more affordable, it does not feature as one of the seven principles of 'Universal Design'. 'Universal Design' was first defined in 1997 by a multidisciplinary group of architects, product designers, engineers, and environmental design researchers, from The Center for Universal Design, North Carolina State University. The group defined 'Universal Design' as 'The design of products and environments to be usable by all people, to the greatest extent possible, without the need for

adaptation or specialized design.' To achieve this, the group also identified seven principles; 'Equitable use', 'Flexibility in use', 'Simple and intuitive use', 'Perceptible information', 'Tolerance for error', 'Low physical effort', and 'Size and space for approach and use'. (The Center for Universal Design, 1997). Here we see that the essential idea behind 'Universal Design' seems to be to promote social equality. Hence, since economic disparity is a well-known cause for social inequality, it is surprising that affordability is missing. Of course, it may be argued that 'Universal Design' promotes cost reduction by promoting singular design solutions for diverse users. Also, equal opportunity environments encourage disabled people to become more economically independent. However, these seem more of a by-product of 'Universal Design' rather than a deliberate attempt to make interventions more affordable.

2. Inclusion of Affordability In 'Universal Design India Principles'

In 2011, a diverse team of Indian experts from disciplines such as design, disability, and policy making, decided to analyze the contextual aptness of the 'Universal Design Principles' for India. Collectively, they identified five 'Universal Design India Principles'. These were, 'Saman/equitable', 'Sahaj/usable', 'Sanskritik/cultural', 'Sasta/economy' and 'Sundar/aesthetics'. Specifically, the principle of 'Sasta/economy', stressed that the design should respect 'affordability and cost considerations for diverse users. Also, to achieve economically viable interventions, it suggested four guidelines. First, 'ensure affordability, durability, and maintainability'. Second, 'use local materials for energy savings and cost-effectiveness'. Third, 'focus on low unit cost through wide distribution'. Fourth, 'adopt modular approach to offer choice in features and price range' (Khare and Mullick, 2012). This deliberate inclusion of economic considerations or making interventions more 'sasta' (cheaper) raises an important question; Is affordability relevant for only the Indian context? This hardly seems the case as post-industrialization, affordability became a key design priority in many parts of the world.

3. The Role of Affordability in Design

By the end of the nineteenth century, Industrialization and mass production triggered a cultural shift in mindsets. Designed products were no longer limited to only the affluent classes. In 1876, Ducuing highlighted this aspect by stating that, 'taste and luxury are now the patrimony of the classes that are the least well to do' (Ducuing, 1876). Later, the use of modern methods of mass production such as the automated assembly line, further increased the rate of production while reducing the cost per unit. However, more supply was beneficial only if there was a matching demand. To help increase demand, manufacturers attempted to make interventions even more affordable. Hence, affordability became an important aspect for designers. Another factor that

helped propagate affordability was the social and political turmoil that occurred during the first half of the 20th century. Devastation due to The Great Depression and the two world wars, resulted in the need to create clear roadmaps for development. In 1937, economist Simon Kuznets proposed to capture all economic production by individuals, companies, and the government in a single measure. According to him, this measure would rise in good times and fall in bad ones. Later this measure was developed as the Gross Domestic Product (GDP). Finally, in 1944, GDP became the standard tool for sizing up a country's economy. (Dickinson, 2011). Hence, the notion of development and improved living conditions became directly equated with the production of interventions. In the 1960s, the Council of Industrial Design introduced a series of criteria to ensure that products accepted for its exhibition satisfied consumer needs. Featured amongst them was 'cost' (Benton & Baker, 1975). In addition to this, in 1974, 'economy' was announced as one of the criteria based on which Britain's Design Council gave awards (Hiesinger et al., 1993). Hence, affordability became a key aspect of consumer culture and national progress. It also helped pave the way towards democratic design and hence, became an important design driver.

4. Modern Methods Adopted to Achieve Affordability

Over the years a number of methods have been adopted by the industry to make designed interventions more affordable. Some of the prominent examples are listed in (Fig 1).

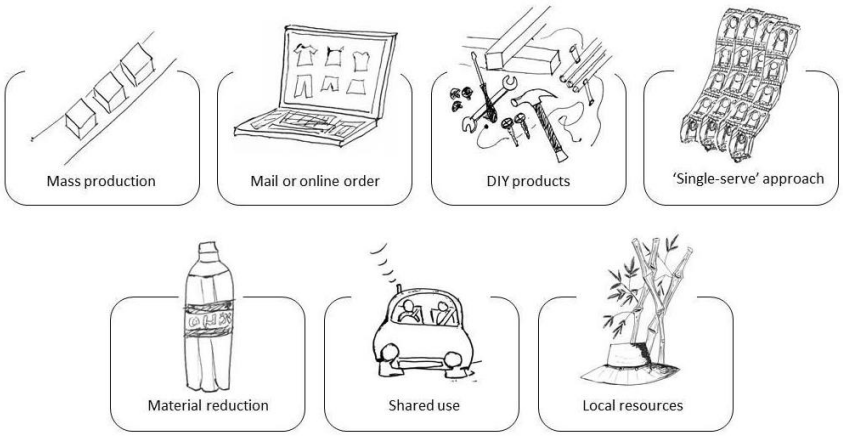

Fig. 1. Predominant methods adopted by the industry to make designed interventions more affordable.

4.1 Mass Production Through Automation and Standardization

Some of the greatest contributions to mass production were made by the automotive industry. In 1913 the Ford company began operating the first moving assembly line to manufacture its Ford Model T cars. This considerably reduced production time. The three other methods adopted by Ford to reduce costs were based on standardization. The first was by giving considerable

thought to logical arrangements. Ford's factories were designed so that workers could complete their tasks using minimum effort. To accomplish this, Ford standardized workers' methods. As a result, each worker performed only a set of repetitive actions. This made the process quicker and more efficient. The second was by consciously standardizing material specifications. Even though Ford could have made the cars in different colour variations as it did before 1914, it decided to opt for only black. This was because Japan Black enamel was the only paint that dried fast enough to match the new production time. However, after 1926 it again began to offer colour variations when the fast-drying Duco Lacquer became available (Georgano, 1985). The third was by the standardization of parts. Ford developed standards for its manufacturing components that enabled the large production of identical parts. This helped break down complex products into smaller and simpler components or modules that could be independently designed and manufactured. The final product was formed by assembling individual components. As a result, certain parts of the car could be added or removed without altering the rest of the car. Hence, designers could create a basic model for consumers and then add 'snap in' upgrades for those who could afford to pay more. Not only was this method beneficial for customers who could buy models based on their economic capacity, but it was also more sustainable for manufacturers who developed new product ranges using old parts. This allowed companies to incrementally upgrade their product ranges over time rather than frequently replace production lines. As a result, product development and testing costs were reduced. Additionally, it gave the manufacturers the flexibility to outsource various components to other manufacturing companies if needed. Hence, multiple companies may share similar standardized parts for their individual unique designs. Today, automation and standardization have become common practices that are adopted by most industries.

4.2 Mail or Online Order

A key way to reduce operating costs while increasing demand was the adoption of the mail-order catalogs that became dominant towards the end of the 19th century. The catalog system drastically changed the consumer retail landscape. Before this system, isolated communities purchased directly from local stores which had limited variety and sold goods at inflated costs. However, with the growth of industry and the increase in purchasing power, the demand for goods also increased. One of the most famous examples of mail-order catalogs is that of Sears. Though it began with a few items, it gradually expanded to include thousands of products attractively and systematically displayed within folded pages (Emmet et al., 1950). This helped customers quickly flip through many products which they might have missed at the store. Also, a major advantage of the mail-order system was that it did not have to waste money on

maintaining and running store space. As a result, its products were much cheaper than store products. Another benefit was that consumers did not have to come to a physical shop. Instead, the catalog and product reached them. This increased customer base and hence, demand. Today online platforms like Amazon provide similar advantages.

4.3 Do It Yourself (DIY) Products

The idea of ready to assemble products first emerged among furniture makers who made products that were easy to disassemble for transport (Europeana Foundation, 2019). However, manufacturers soon realized that this could also drastically cut production costs due to advantages in storage and delivery. Also, to further reduce production time and effort, the assembly function was transferred to the consumer. Over time, ready to assemble furniture became a popular option for consumers who wanted to buy designer products at economical prices. Today the biggest manufacturer of ready-to-assemble furniture is Ikea whose mission statement is 'to offer a wide range of well-designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them' (Ikea website, 2021).

4.4 The 'Single-serve' Approach

The 'single serve' approach or Sachet marketing is the practice of serving products and services in small affordable quantities. It has been used for several decades now and is a popular method adopted by many companies (Singh et al., 2009). In this approach, companies such as those selling detergents or shampoos make 'single serving' versions of their products. It is especially used to address the needs of economically underprivileged societies or emerging markets where consumers may prefer to pay less more frequently. One of the best examples of a successful product that uses this approach is the single-serve shampoo sachet found in India. By 2004, 'more than 60 percent of the value of the shampoo market and 95 percent of all shampoo units sold in India were single serve' (Hammond and Prahalad, 2004). This approach has made branded products affordable to even the most remote parts of the country. As a result, today most people in India have access to both quality and variety when it comes to shampoos. Hence, creating a sense of inclusion and equality through affordability.

4.5 Material Reduction

One of the easiest ways to reduce product cost is to make it lightweight. Not only does this lower material costs but it also reduces transportation costs. However, lighter products lose strength and can easily crush under pressure. Hence, manufacturers began to apply structural supports in

the form of ribs to add more rigidity to the products without increasing material. This is especially seen in water bottles. The less the overall cost the more structural elements one can see on the bottles.

4.6 Shared Use

Another effective method of increasing affordability is to allow consumers to rent interventions for different time durations without having to own them. Shared use of interventions may take various forms such as in automobiles, a consumer may rent a car for a few months or hail a cab either directly or through a platform like Uber or Ola for individual trips. Also, a group of friends may decide to do a car pool so as to save money on daily commute. In the case of weddings or special events, people may rent their dresses and jewelry. In all cases, consumers are able to solve their purposes without having to pay for maintenance and storage.

4.7 Local Resources

The final method explored in this paper to reduce intervention costs is that of using locally sourced resources such as material and labor. This not only reduces travel costs but also costs related to training, research, and development as locally available knowledge and skills are more accessible. Also, this method helps promote local economic development and encourages the upliftment of smaller communities.

5. Moving Beyond Economic Affordability

Though it is evident that affordability has played a major role in promoting democratic design, it is also interesting to note how the design field has primarily concentrated on economic affordability. However, is this limited understanding of affordability sufficient? Whenever an innovation has entered the market, its natural progression has been to adhere to the elite and gradually become more economically affordable for the masses. It can be seen in the car, the phone, the computer, and nearly all other designed interventions. In 1913, Ford dreamt of making the car more affordable for the masses in America. Nearly a century later, in 2008, industrialist Ratan Tata introduced the Tata Nano which intended to make cars more affordable for the masses in India. Yet, is affordability only related to money?

6. Redefining Affordability

The term affordability is so intrinsic to human action that we often use it in our daily lives. Hence, to explore a broader understanding of its meaning we attempt to identify its common usages. To

do this, 250 randomly selected affordability quotes and cartoons were collected from the internet, existing dictionary definitions were considered, and two brainstorming sessions were conducted. As a result, it was found that some of the most prominent aspects that people valued concerning affordability were money, beauty, life (health or safety), social image (reputation), emotions and feelings (mental well-being), energy (effort), time, thoughts (intelligence), space, and habitat (Fig 2).

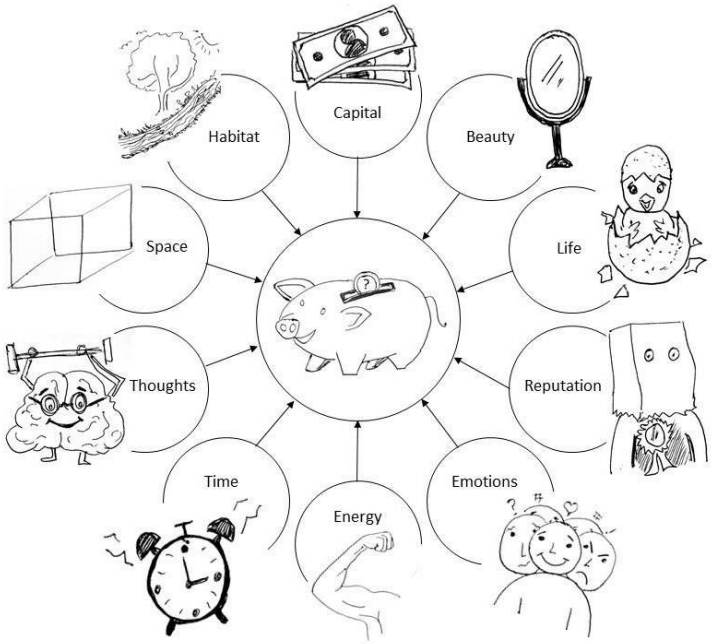

Fig. 2. The different currencies of affordability

These may be considered as the currencies of affordability. Using these currencies humans decide whether they can afford something or not. For example, people often mention 'I cannot afford to lose time, energy, capital, reputation etc. So, when designers ask 'how can I make an intervention more affordable?' What they are really asking is how can they make it affordable in all these different dimensions.

7. The Three Levels of Consideration

In a narrow sense, affordability may be considered as access to an intervention. For example, consumers who have sufficient money can buy 'x'. Hence, it may be said that those consumers have access to 'x'. However, in a broader sense, it is also related to the prioritization of values and the conception of future risks and limitations. Also, it is interesting to note that the limitation of some resources and the risks involved might become prominent only if an intervention is mass-produced or constantly used over time. For example, if the resource of pure air becomes limited over time due to pollution from vehicles, then it may lead to health hazards. Here we see that

affordability can be explored at three levels.

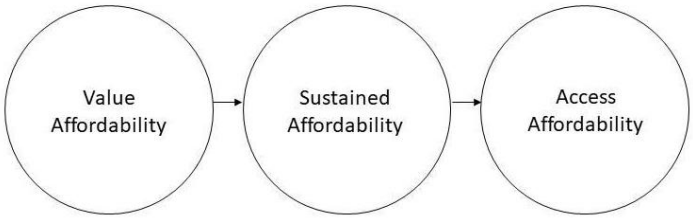

Fig 3: Levels of consideration for exploring affordability

7.1 Value Affordability

The first level of consideration is Value Affordability; what values do we want to make affordable? As designers, before we create interventions, we need to first identify the values that we want people to have access to. For example, is it the car that we are trying to make affordable? Or, are we trying to make the values that we feel the car can provide such as comfort, convenience and safety, more affordable? In which case, the solution may not be a cheaper car. Instead, it may be a new intervention that is able to provide the same values as the car.

7.2 Sustained Affordability

The second level of consideration is Sustained Affordability; how do we make these values affordable across time and scale? For this there is a need to understand interventions as parts of larger systems. First, every intervention has its own life cycle which is important to understand. Second, when interventions are mass produced, they also have a cumulative impact which may hamper the initial values that it set out to achieve, for example; the car was initially intended to save consumers time during their daily commute. However, today, many consumers spend hours in traffic jams. As a result, in places like Mumbai, many people prefer to take public transport simply to save time. If a design is not able to meet its direct purpose in the long run, it cannot be considered a good design. There is also a need to understand the delicate relation between immediate individual affordability and long-term social affordability. For example, individually we might be able to afford the cost of a car, but the cumulative impact of cars on the society may mean that the society cannot afford it spatially, environmentally, or socially. However, community affordability always impacts the individual's affordability. If there is no space to park the car, the consumer will not be able to afford a car based on space currency. Hence, while designing we must constantly ask, is our dream affordable or sustainable in the long run for both the individual and the society?

7.3 Access Affordability

The third level of consideration is Access Affordability; how can we increase affordability to make these values accessible to more people? Traditionally, this has been achieved through economic affordability. However, it also involves other affordability currencies such as time and energy. What can companies do to make their interventions more affordable keeping in mind other currencies? Some of the solutions have already been explored in this paper such as the online shopping approach that enables consumers to save time and energy in traveling and searching for products. As mentioned before, designers often make the mistake of working first on access without considering values and sustainability aspects. There is no point in making an intervention accessible, if it or its context are not designed to be used by many people.

8. Conclusion

Using the three-level approach to explore affordability will greatly improve the ability of designers to create holistic interventions for the future. Though one might say that the existing principles of 'Universal Design' and 'Universal Design India' do include aspects of 'Value Affordability', they do not consider 'Sustained Affordability'. At the same time, 'Access Affordability' is completely missing from 'Universal Design' and partially represented in 'Universal Design India'. Hence, there is a need to acknowledge affordability in its broadest sense as an important design principle for all countries. Therefore, we conclude this paper by proposing 'affordability' as the eighth principle of 'Universal Design'.

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ROLE OF AESTHETICS IN UNIVERSAL DESIGN

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Abstract

Most people consider aesthetics to be the visual value of a design. Anything good-looking like a car or a service is perceived to have more value and more character. How do we understand what to design when our user's senses are influenced by aesthetics? A product or a service has to be designed in such a way that it balanced the ratio of form and function. In other terms, Aesthetics and usability should be balanced and are supposed to be in harmony. A design with such a notion and need in the market is a pure success. According to the aesthetic usability effect, people find designs easier to use if they appear to be simple to use. It is also believed that any aesthetically pleasing design is also easy to handle.

Key Words: *Aesthetics, Design, User, Product, Experience, Sense, Balance, Functionality*

1. Introduction

The Oxford dictionary defines aesthetics as an adjective which is “concerned with beauty or the appreciation of beauty”. It also defines aesthetics as a noun where it becomes “a set of principles underlying and guiding the work of a particular artist or artistic movement” (Oxford dictionary, n.d.).

Aesthetics is a branch of philosophy that may be defined hardly as the theory of beauty that deals with natural and artificial sources of aesthetic experience and decision. The beautiful women, the shabby-looking men, the beautiful portrait, and the repulsive dress are some examples of how aesthetics offers insight into things. It is also taken further into the philosophy of art and design. It has evolved so much in time with people that most decisions and judgments today are based on aesthetics.

2. Aesthetics

2.1 What is Aesthetics?

Aesthetics majorly depend upon various visual factors and fundamental principles of design. While designing an artifact, the designers use the tool of aesthetics to enhance practicality and usability. Aesthetics are about feelings and emotion. For example, The chairs (Fig. 1) serve the same basic purpose but the appearance, feel, and hence how it affects users is different. Each one is a different emotion.

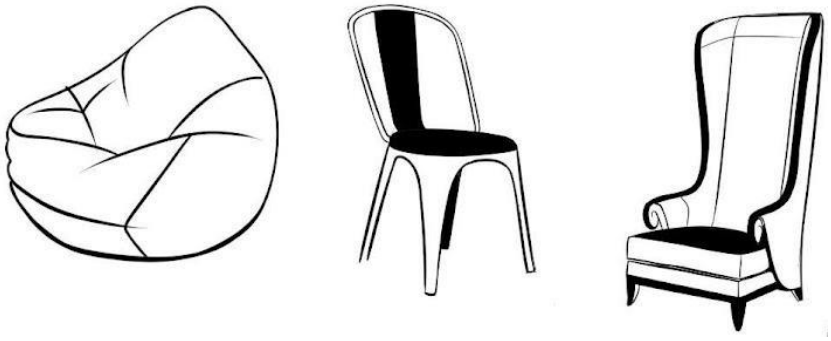

Fig. 1. Chairs of different styles

Humans generally like nice-looking and shiny designs over just functional ones. Aesthetically pleasing designs are satisfying to look at and it's a delight to use. Most of us think that aesthetics is only through what we see. But it is beyond just looks.

2.2 What Is Aesthetic Design?

Aesthetics is also more intended toward the field of philosophy. Edward Thorndike coined the term “the halo effect” which means, most humans tend to believe that good looking people are perceived as people with good qualities and not so good-looking people are often perceived as ones with bad character (Edward Thorndike, 1907). Any product or service that is designed today is also seen in such a manner. today good-looking products and services are valued more than their functionality and lifetime. Margaret Wolfe Hungerford said, “Beauty is in the eye of the beholder” which means that beauty is how we perceive things and it differs from person to person. So, aesthetics are in all our senses, not just sight (Starbuck, 2019).

Fig. 2. Five sensory organs

There are 4 major types, through which we make our decision to admire a design.

It is the way something looks, feels, sounds, smells and tastes (Fig 2). It elicits an emotional reaction in a person. They are the prime deciding factor for many purchases.

2.2.1 Vision

The more knowledge and information that we acquire today is in the form of visuals. We subconsciously learn many things from seeing around us and we can't stop ourselves from looking at things that are pleasing to our eyes. We have the natural tendency to keep looking at more attractive and engaging things. For example, watching a series or a movie continuously without break and scrolling through social media for several hours. We dress up with new clothes and find ourselves attractive. Here, visualization plays a major role in deciding any product acquisitions.

So many products deliver similar functionality but different forms. We usually rely on our emotional response to a product purchase. Hence most consumer products are driven by aesthetics.

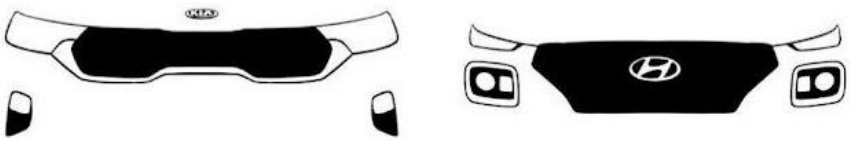

Fig. 3. Kia Sonet(left), Hyundai Venue(right)

The car brands Hyundai and Kia (Fig. 3), are sister brands that share their engines and platform but they differ in form and brand. So, customers decide their choice based on the form which is more appealing based on their emotions.

Fig. 4. Starbucks coffee

Fig. 5. The Marriott VR

Starbucks provides its customers with a cozy atmosphere and relaxed experience by using green and yellow as their interior colours. Starbucks maintains a welcoming feel through their choice of wall paintings and artworks. The employees give customers a warm welcome and smile which creates a positive feel. The seating arrangement is also made in such a way that provides enough space for customers and lounging. For sole coffee drinkers, the tables are designed in a circular shape so they don't feel unaccompanied. The Marriott chain of hotels started providing Virtual Reality service (Fig. 5) for their customers to experience by seeing and hearing the hotel rooms before booking them for their vacation.

Key elements of vision: Colour, Shape, Pattern, Line, Texture, Visual weight, Balance, Scale, Proximity and Movement. These elements will help us reach good visual aesthetics.

2.2.2 Hearing

Our ears have the potential to take in more data and assess aesthetically pleasing sounds and music. Some have developed the ability to identify a particular brand only with its sound and not by looking at it. The different notification sound helps us differentiate notifications of different applications. This is the ability of a sound that our brain is attracted to. Almost 100 per cent of all companies make use of sound and music as a medium to pass and carry information. Most productions have an audio identity to move hand in hand with their visual identity. To select the appropriate music on the sensory advertising and marketing approach, you may want to analyze thorough studies on the users and catch their likes and preferences. For example, the tone when Windows is logged in and shut down makes us understand that it is windows even without looking. Similar strategy made brands like Intel, Netflix (Fig 6) and PlayStation easily recognizable.

Fig. 6. Netflix

Visa, the brand illustrated in Fig. 7, has come up with a sound design solution to enhance its customer experience. They made a tinkling sound pop out, to make the customers realize that the transaction was successful without checking the phone. Visa made a study on how music and sound play a role in making customers purchase more. The Visa complete sound puts an emotion of trust and safety among the potential customers belonging to their brand. Similarly, Ola illustrated in Fig 7, uses the sound of a vehicle unlocking when the driver reaches the pickup point.

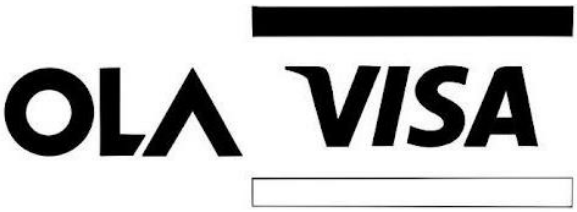

Fig. 7. Ola and Visa logos

The music and song played in the stores are cleverly picked and played at the right place according to the background of the setting. The songs list is so selective that they get from a head location directly and also, they run their radio station which is played at the stores. Every employee is trained to socialize and intermingle with the customers and they call out their name instead of the order number when the order is prepared. This makes them connect with customers' emotions. This makes the customer feel superior. The noise from the coffee machine is tweaked and the tone of voice from the staff is trained to give a pleasant experience for the customers.

Key elements of Sound: Loudness, Pitch, Beat, Repetition, Melody, Pattern, and Noise.

2.2.3 Touch

Skin is the largest and most sensitive sensory organ of the human body which helps us feel things physically. It also helps us feel the aesthetics through touch. Physical

aesthetics are especially important for products that we touch and experience.

We remember how velvet feels and how a hard rough surface feels physically and we tend to decide on which pleases us more. We, customers, make our decision on buying things based on the material of cloth as shown in Fig 8, or the touch feel while holding an iPhone. Such a leading sense is this material aesthetics. It improves users' interaction and connection with any brand's products.

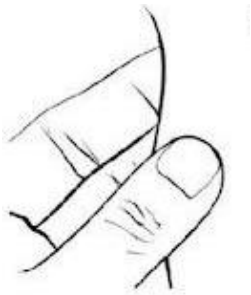

Fig. 8. Experiencing the texture

Research suggests that up to more than half a percent of customers say that they would prefer to feel a product before buying it. Like if they choose to buy products like furniture they would like to sit and feel the texture. An example Apple product stores use this marketing strategy to customers, making them prefer their products.

Key elements of Touch: Texture, Shape, Weight, Comfort, Temperature, Vibration and Sharpness. By learning them we can make our customers esteem our products.

2.2.4 Taste and Smell

For human beings, 1000s of taste buds work together to help in experiencing the difference between a rich and a dull taste. It is more closely related to us than any other sense.

Fig. 9. Starbuck store coffee bean pile

Starbucks ensures the aroma/smell of the coffee as shown in Fig. 9, is strong enough to interest customers and make people think it's the world's best coffee. Starting from grinding the coffee bean till it's made a drink it is performed in front of the customer. They even stopped serving breakfast because the smell of eggs was affected by the fresh smell of ground coffee. There is flexibility in customizing the customer's order. The worker asks for the customer's preference and prepares the order according to the customer's liking. If a customer is dissatisfied with the order, Starbucks remakes it to give the customer an enjoyable experience. Customers are given a trial taste of their order before paying for it (Chowdhury, 2021). This reduces the effect of regretting after purchasing. Starbucks succeeds in giving its customers a memorable experience every time they walk into the shop. Using such techniques Starbuck improved and enhanced its variety of customer experiences around the world.

Key elements of Taste and Smell: Strength, Sweetness, Sourness and Texture (for taste). Use these elements, when possible, to improve the complete picture, so our users can feel the aesthetics even deeper.

2.3 Branding Using Aesthetics

Today most industries and brands use sensory reacted aesthetics to build their values, increase trust and create a positive impression among the customers. This practice is termed Sensory marketing. Those were a few examples of how different sectors use this marketing technique to attract their customers.

2.3.1 Sensory Marketing

The idea and thinking of logic wouldn't work over the sensory emotional effect. Also, it has this magical way to reach the desired customer that a typical conventional marketing strategy cannot. The conventional marketing strategy is based on analyzing the previous choice of customers and showing them their related products or services. Such a marketing strategy is successful as it uses the user data and their emotions towards it. It assumes people will respond more to their emotional urges than objective reasoning. Sensory marketing increases their product success and makes it lasting by properly identifying, and studying the emotional deal of the customers, which ensures the building of the brand and its loyalty within the customer (Chowdhury, 2021).

Other examples of brands using sensory marketing.

Example 1: Apple

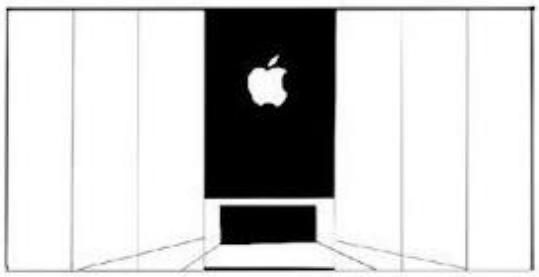

Fig. 10. Apple store

Apple was the first brand to establish stores as shown in Fig 10, where their customers can experience the in-store service and activity. The stores are designed minimally with pure colour to get the customers distracted from experiencing their products. It has this easy, simple, and active atmosphere to it. They have gone one step further, where we can open our purchased products and start using them straight away, whereas in other brands it says "charge the phone to 80 per cent before use".

Example 2: Singapore Airlines

Fig. 11. Uniforms for flight attendants

Singapore Airlines aims at multiple senses – especially smell and vision. They have these unique and refreshing rose, lavender and citrus scents used by all the flight attendants, sprayed onto their clothes and other service equipment like towels and socks. They have a unique uniform for their flight attendants as illustrated in Fig 11, which has different designs that match their designation in cultural and traditional means.

Today many airlines have started following this strategy to provide a home-like experience for their customers.

3. Why Does Aesthetic Design Matter?

Till some point in time, we were purchasing or even we had products and services that were only made out of practicality and reliability. For example, people were using a phone that had a

keypad and thought it was reliable but now the touch screens have become more reliable and look good. Hence today we expect usability by default and are searching for products and services that are more than just functional and usable. People are ready to spend their time and money on experiencing such aesthetics. We want a product that represents us. A person would love to get out and walk from a basic model Mercedes Benz than from a top model Toyota. Users are emotionally connected to such designs.

There is a phenomenon called “Aesthetic Usability”. Beautiful looking things work beautifully. It can be simply put like, judging the content quality of a book by the way its cover page looks. They naturally become more valuable even if they are not. This is much more seen in products that have the same functionality but differ in look. A product of Kia and Hyundai might be the same in engine performance and the decision goes by the value that it holds in exterior and interior design that attracts the customer. Through which we become loyal to that brand and we go to the extent that even if any product from that brand fails to impress, we still like it. For example, imagine the Apple fans.

The aesthetic impression that a brand creates, marks the long-term impression and trust between customers and the brand.

3.1 Design for Aesthetic Pleasure

So now how do we know what should be designed and aesthetically pleasing? The design has to have a need and value within the market. Designing without a need for it will become a failure, however aesthetic ever it might be.

A design has been in such a manner that it does not overreact to the human senses. Products that are designed with the notion of physical pleasure like a chair, which has to be ergonomic, feel simple. Products or services that are designed based on social pleasures such as interactive design (AI voices, home-based assistance devices). Such devices on evolving have a much threat to removing social interaction, and connection between real peoples. Coffee machines as shown in Fig 12, are not meant to work silently and not too loud. It operates with a certain level of noise which is satisfying and enables the interaction with customer and seller without any disturbance. Psychological pleasure is another part that decides whether a product feels right even before being experienced. For example, a Ferrari car which is fast and sporty has to look the same. Another example is the DC Avanti which looks like a sports car but doesn't perform like a sports vehicle.

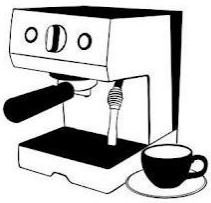

Fig. 12. Coffee maker machine

3.2 Balancing Aesthetics (Form) and Usability (Function)

There are certain cases where the aesthetics have to be compensated over bringing in more practicality. It is always said that form follows the function.

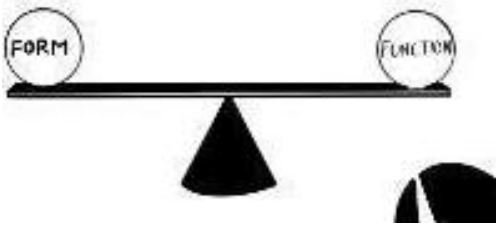

Fig. 13. Form and Function balanced

3.2.1 Function and Form Balanced

This is the area that decides the success of a design and its designer. Most designers try to achieve this point in their designs. Balancing these two factors are important and hard to achieve (Nikolov, 2019). Many designers have achieved it. For example, a smartphone and gadgets as shown in Fig 14, trolley bags, ergonomic chairs etc.

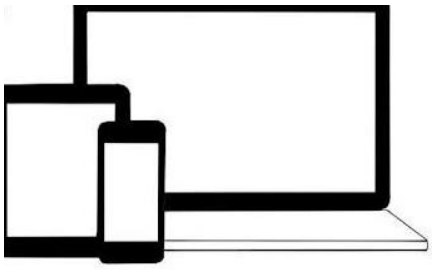

Fig. 14. Smartphone, tablet, laptop

3.2.2 Form Over Function

Some products in the market are more valued toward the design of aesthetics than their functionality. For example, fashion costumes made out of paper would not handle water

and fire and heels that are in flame as illustrated in Fig 15, feel more attractive but do not serve their ultimate purpose. People fall crazy for such designs and have them in showcases (Nikolov, 2019).

Fig. 15. flame fashion heels

Another example is Philippe Starck's lemon squeezer as illustrated in Fig 16, by Alessi. Don Norman says, “It's just neat, it's fun. It's so much fun. I have it in my house but I have it in my entryway, I don't use it to make juice. I bought the gold-plated special edition and it comes with a little slip of paper that says,” don't use the juicer to make juice”. The acid will ruin the gold plating” (Don Norman, 2009).

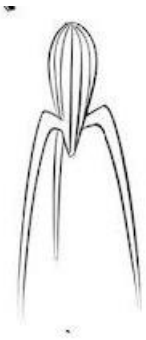

Fig. 16. lemon squeezer

3.2.3 Function Over Form

Remember when we enter into a clothing store with many possible choices and end up not buying anything and at the same time entering into a store with less yet attractive choices and end up finishing the shopping. Too many possibilities or options will take a lot of time and confusion in deciding a design and often lead to frustration and depression. To overcome such confusion there is a phenomenon referred to as Hick's law. Which when applied to a design will help make clever and better design choices (William Edmund Hick, 1952). A remote would be a fine example of this. Having too many buttons, as shown in Fig 17 (left), to click on a remote will make the task time consuming and irritating during emergencies. A remote with a minimum button as shown in Fig 17(right) has better experience in such emergency cases (Nikolov, 2019).

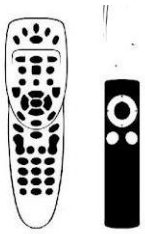

Fig. 17. TV remotes with more buttons(left) and less buttons(right

4. Aesthetics as Qualitative Assessment

The sensory experiences (visceral and others) play a huge role in affecting a person's perception, impression and reaction while interacting with a designed artifact. Therefore, every design should be subjected to both qualitative and quantitative evaluation and validation. Quantitative assessments are based on governable data and standardized specifications. Qualitative assessments are based on emotive responses generated by sensory experiences. Validation of functional achievements and usability are usually done through qualitative assessments. However, the emotive experiences that are gauged through qualitative assessments provide a deeper insight into the minds of the users and stakeholders. Aesthetically pleasing designs that are easier to use and therefore highly usable should ideally perform equally well in both quantitative as well as qualitative assessments.

5. Conclusion

The seven primary principles of universal design do not include aesthetics. Their focus is on practical requirements rather than sensory experiences. However, this study suggests that a design should also adhere to the guidelines and standards, its situatedness in context and consider the value of aesthetics in it. A design that is done only with the idea of functionality cannot be termed as a designed entity at all if it is devoid of emotive experiences. The key to designing effective built environments for everyone is to draw together aesthetics and universal design. Universal Design tries to increase flexibility and adaptability, to which functionality is very important. But it should not be intended to be based on the factor of usability alone. Emotional and sensory experiences provided by good aesthetics strengthen purely functional provisions to become wholesome universal design experiences.

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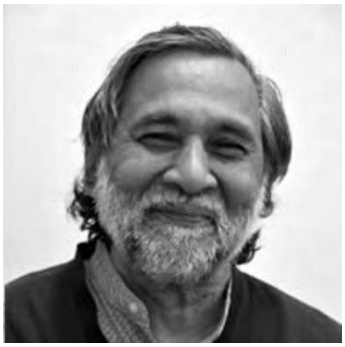
CONTRIBUTORS



Lalit Kumar Das
Ex-Head, Design Program, IDDC, IIT Delhi
Distinguished Visiting professor, IIT Bombay

Professor Lalit K. Das graduated in Civil Engineering from IIT Kanpur. Thereafter he did his Masters of Technology in Design Engineering from IIT Delhi and then Master of Art in Industrial Design from the Royal College of Art, London. He has widely travelled and has worked at the Industrial Design Center, IIT Bombay and at the Department of Fine Art, University of Manitoba, Canada and at Delhi Technological University.

Professor Das pioneered Industrial Design education at IIT Delhi. He developed a programme that is an excellent blend of design sensitivities and industrial propensities.

He is deeply interested in a sustainable approach to design, universal design and a non-parochial non-partisan framework for study of design. He was engaged in the development of the National Design Policy and a member of the National Committee on Design and Artisan development. He has worked with artisans and has conceptualized distant education for artisans under the banner of IGNOU. He has led sponsored projects for the differently enabled like children with cerebral palsy and others who are orthopedically handicapped. He is the founding editor of Design for All India newsletter.

He has successfully supervised PhD in diverse areas of Design & Emotion; Values in decision making for Sustainable Product Design; Forecasting Future Design Possibilities; Citizen-Centric E-governance, Control system Quadcopters and Automated Detection of Pot Holes & Cracks.

He has been a faculty and teaching courses at IIT Bombay, IIIT Jabalpur, School of Planning & Architecture and Lady Irwin and is an external expert on the senate of NID Ahmedabad.

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Dr. Sugandh Malhotra has over twenty years of professional experience in industrial design and automotive design industry. He worked on design projects for marquees in the industry that include Honda R&D, Hero Global Design, Hi-Tech Robotic Systemz Ltd., SETI Labs Berkley, Aprilia Motors Italy, Bombardier Canada and most of the leading automotive and consumer brands of India. He has worked on over 75 projects and has been instrumental in design of over 23 techno-commercially successful launched products at a pan India level. He has won many International and National level design awards. Dr. Malhotra takes keen interest in teaching design and had been mentoring students from many leading institutions such as TU Braunschweig (Germany), TU Darmstadt (Germany), IIT Delhi, SPA Delhi, Lady Irving College, IILM, Pearl Academy among others. Since 2016, Dr. Malhotra has been actively teaching courses related to Industrial Design and Mobility & Vehicle Design at IDC, IIT Bombay.

His research interest areas include design research methods, future design possibilities, design forecasting and sustainable design.

Dr. Malhotra has been a recipient of several national and international awards. Most recently, he was awarded the prestigious Joseph Jaworski's Next gen Foresight Practitioner's Award in the Annual Convention that happened in October 2019 at Brussels, Belgium.

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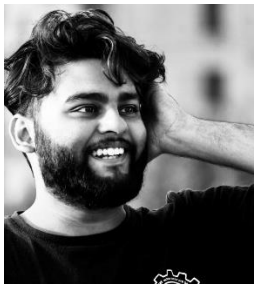

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FORTHCOMING ISSUES

April 2022 Vol-17 No-4

Dr. Shatarupa Thakurta Roy

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BFA Kala Bhavana, Visva Bharati University 1997 MFA Kala Bhavana, Visva Bharati University 1999 PhD Department of Design, IIT Guwahati 2014

Research Areas

Graphic Art, Art History, Art Criticism, Design Theory, Design History, Methodology of Visual Research, Visual Culture, Visual Communication, New Materialism in Visual Art, User Interface Design, Graphic Novel and Graphic Medicines.

May 2022 Vol-17 No-5

Dr. Christopher Lee

I have a Ph.D. in Education with a specialization in Instructional Design, a Masters of Fine Arts in Writing and Poetics (MFA) and a Masters in Education (M.Ed). My research interests center on Universal Design for Learning. I love to write and teach. Whenever teaching I learn a little more about what Universal Design for Learning means and how much students enthusiastically embrace its principles. My philosophy of education centers around the learner. As an instructor, I am much like a coach and so, strive to listen to what students are saying and then facilitate their learning as much as possible. As an administrator, I listen to students, staff and everyone I work with to learn more about Universal Design and how I can be a part of helping to make life better for all. I love technology and the doors it opens for everyone. I love hiking, reading, writing, weight lifting, and most of all, being with my family

June 2022 Vol-17 No-6

Mark Watson MDIA

M Des. (Industrial–By Research) RMIT–Design Providence / DesignThinkers Group

Founded in 1990, Design Providence is a multi disciplinary practice in the field of Interior Architecture and Product Design. Working in Service Design and Design Thinking since 2010 becoming a Partner with Amsterdam based DesignThinkers Group & Academy in 2013 facilitating rapid prototyping workshops, including the Global Goals Jam with Amsterdam University of Applied Sciences and the UNDP.

Mark held office as Vice President with the Victorian Chapter of the Design Institute of Australia, also as Director with Arts & Recreation Training Victoria, and Artists & Industry.

Mark has presented on Design in India since 2003 at Design Sutra Conference Mumbai, participated in the International Council of Societies of Industrial (ICSID) [now World Design Organisation] Interdesign Workshop "Humanising the Metropolis" Mumbai, also presented at IIT Delhi, IIT IDC, Mumbai, NID Ahmedabad and DYPDC Center for Automotive Research & Studies, Pune as well as the NatCon InDesia in Kolhapur in 2014 for the IIID.

He is advisor to the India Design Festival, the Delhi Design Festival and Odisha Design Council as well as judge of the India's Best Design Studio / Project Awards 2017, Guest Editor of the 'Design for All of India' Journal July 2017 Vol-12 No-7 and keynote speaker at the 17th CII NID Design Summit 2017 in Hyderabad.

In 2017 participated with the Australia India Institute as Incoming Leaders Fellow researching Air Quality in Delhi

incorporating World University of Design and CSIR – NEERI.

Mr. Mark Watson

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July 2022 Vol-17 No-7

Lourdes Arreola Prado

Built Enviorment Program Manager
International Association of Accessibility Professionals (IAAP)
G3ict : The global Initiative for Inclusive ICT's , USA

August 2022 Vol-17 No-8

Prof. Dr. Jurgen Faust, PhD

Professional Experience

2021 – current Professor SRH Mobile University, Germany
2013 – 2020 President Macromedia University Munich, Germany
2010 – 2013 VP for Academic Affairs and Research, MHMK Munich, Germany
2008 – 2013 Dean, MHMK, Munich, Germany
2007 – 2021 Full Professor Media Design and Communication, Macromedia University Munich, Germany
2009 - 2012 International Strategic Advisor, Istituto Europeo di Design (IED) Group, Milan, Italy
2007 - 2009 Chief Academic Officer, IED group, Milan, Italy
2007 – 2009 Professor Monterrey Tecnologico, Monterrey,

Design and Theory, Mexico

PhD, University of Plymouth, Planetary Collegium, England

Thesis title: *Discursive Designing Theory, Towards a Comprehensive Theory of Design*

Supervisors: Prof. Dr. Derrick De Kerkhoeve, Prof. Roy Ascott, Prof. Antonio Caronia, Prof. Mike Phillips

1982 - 1984

Postgraduate Studies, Free Academy in Nuertingen, Germany (painting/graphic and sculpture), Fine Arts degree

1979 - 1982

Undergraduate Studies, University of Applied Sciences, Reutlingen in Cooperation with University of Bremen, Germany, Diploma in Chemistry (Dipl. Ing.)

Jurgen Faust (born 1955 in Germany) is a design professor, researcher who has worked in four different countries, US, Mexico, Italy and Germany as a Professor for Design, Theory and Media as well as an administrative Dean in four countries. He is a co-founder of a private university in Germany, as well as a developer of many undergraduate and graduate programs in a variety of fields in design. His PhD research was about designing design through discourse within the design community. His research work let him to create a comprehensive theory describing design processes and models.

Over the past decades he has specialized in managing through designing and published about the idea of transferring design methods and processes into the management field.

He was as well teaching design and design theory. He contributed to a variety of books and publications. In addition, he is a practicing researcher, designer, and artist, who showed in many places, including museums and galleries in Europe,

Germany, France, England, Italy, Poland and Slovakia as well as the United States.

Jurgen Faust was the President Macromedia University of Applied Sciences in Munich for 8 years and since March 2021 he is a professor at SRH Mobile University Germany where he currently develops a new Design School Design focused on distance education with the master programs in Design Management and UX & Service Design.

NEW BOOKS

it is available on **www.morebooks.de** one of the largest online bookstores. Here's the link to it:

https://www.morebooks.de/store/gb/book/design-for-all/isbn/978-613-9-83306-1

The Ultimate Resource for Aging in Place With Dignity and Grace!

Are you looking for housing options that are safer and more accommodating for independently aging in place? Do you want to enjoy comfort, accessibility, safety and peace of mind – despite your disabilities, limitations and health challenges? The help you need is available in the Universal Design Toolkit: Time-saving ideas, resources, solutions, and guidance for making homes accessible.

This is the ultimate resource for individuals and professionals who want to save time, money and energy when designing, building, remodeling or downsizing a home. The Universal Design Toolkit will help you take the steps to design homes for your clients or yourself while eliminating the costly trial and error challenges you'd inevitably encounter if faced with this learning curve on your own.

Rosemarie Rossetti, Ph.D., teamed with her husband Mark Leder in creating this unique Toolkit. They bring ten years of research, design and building expertise by serving as the general contractors for their home, the Universal Design Living Laboratory– which is the highest rated universal design home in North America.

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Home features you need to look for. Nothing is assumed or left out.

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Interview questions to help you hire industry professionals with knowledge and experience.

Photographs that provide a frame of reference to inspire, clarify and illuminate features and benefits.

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Space planning dimensions for access using assistive devices such as wheelchairs and walkers.

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If you want useful, dependable advice and easy to implement ideas from respected experts who know the ropes, you'll love Rossetti and Leder's perspective. As a speaker, author and consultant who uses a wheelchair, Rossetti has helped hundreds of people design their ideal homes. Now her comprehensive Toolkit is available to help and support you!

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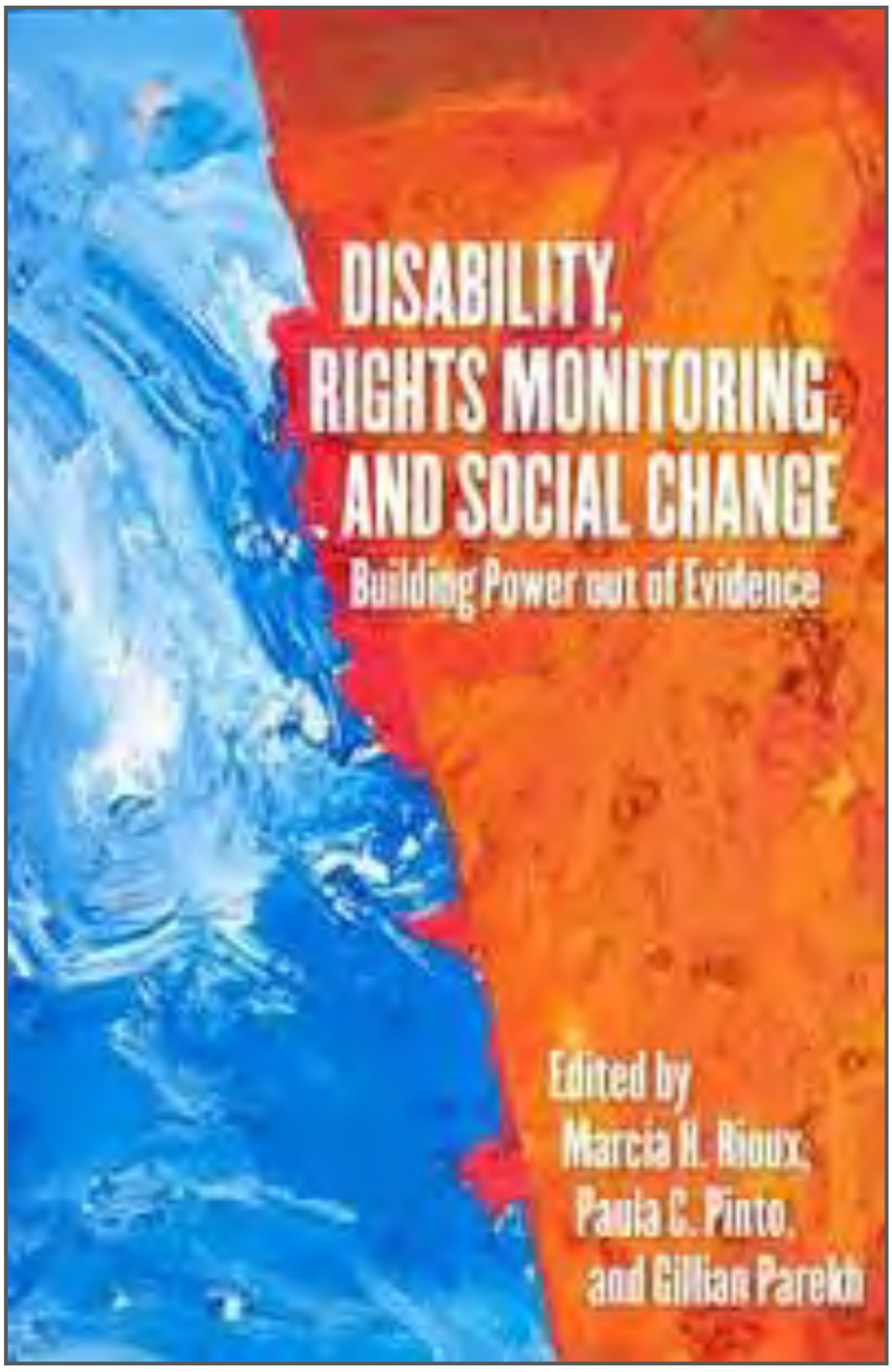
Disability, Rights Monitoring and Social Change



New Update: ELIVIO BONOLLO (2015/16) PRODUCT DESIGN: A COURSE IN FIRST PRINCIPLES

Available as a paperback (320 pages), in black and white and full colour versions (book reviewed in Design and Technology Education: An International Journal 17.3, and on amazon.com).

The 2018, eBook edition is available in mobi (Kindle) and ePub (iBook) file versions on the amazon and other worldwide networks; including on the following websites:

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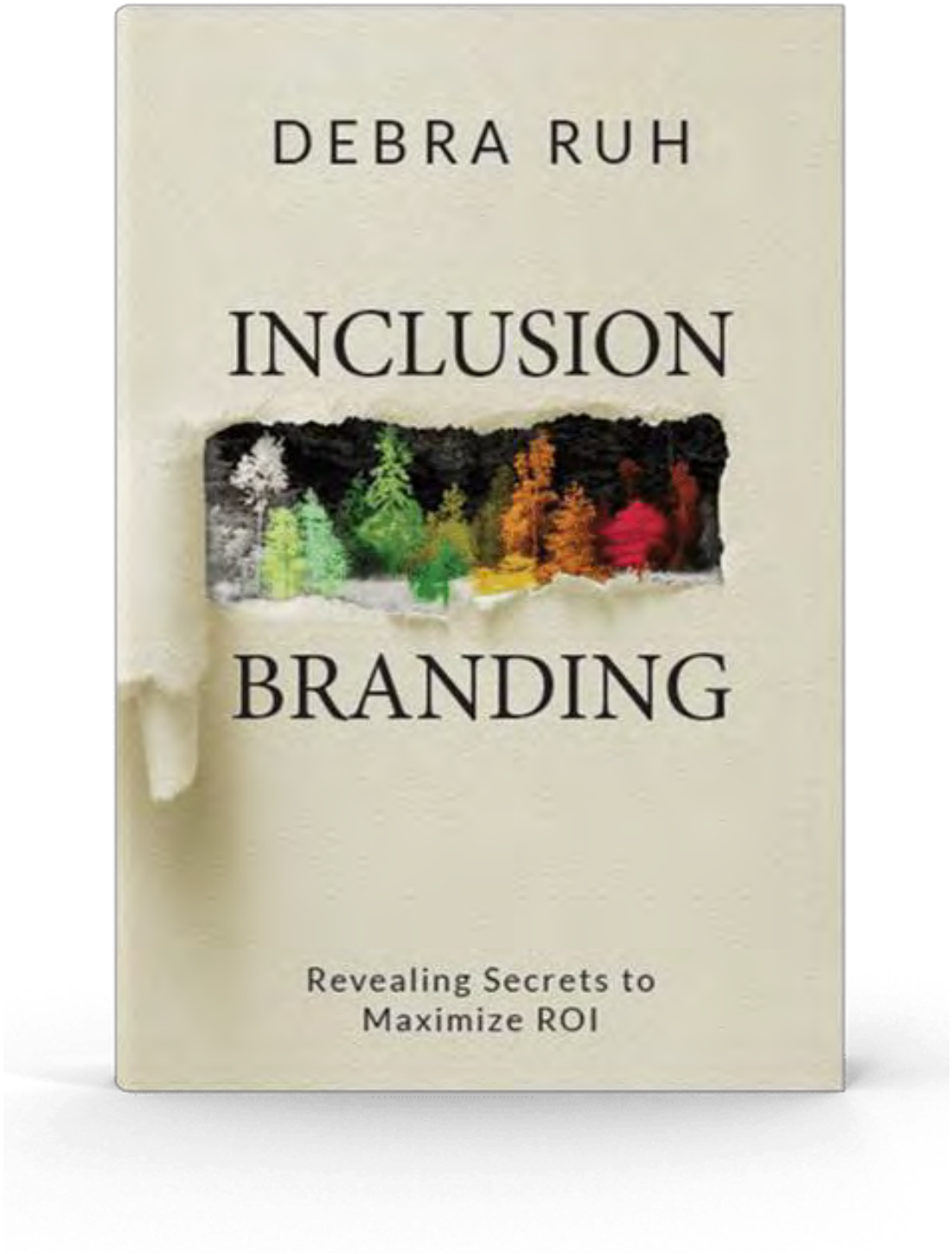
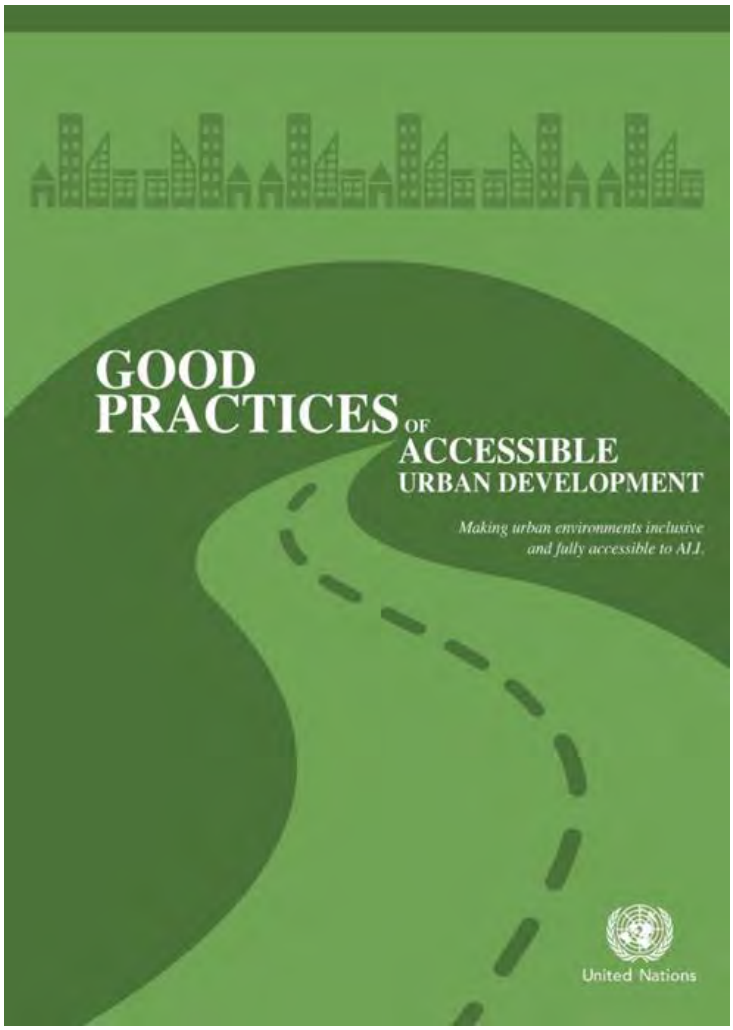
READING HINTS: ePub files can be read with the iBook app on Apple MacBook/iPad devices; ePub files can also be read on Desktops PCs, Laptops and Surface devices using readers such as the Microsoft *freda*ePub reader. The Kindle (mobi file) reader isflexible and suitable for reading the eBook on PCs; Kobo readers can also be used to read ePub files on MacBook and iPad. All formats are very interactive with very good navigation.


DEBRA RUH
INCLUSION
BRANDING
Revealing Secrets to
Maximize ROI

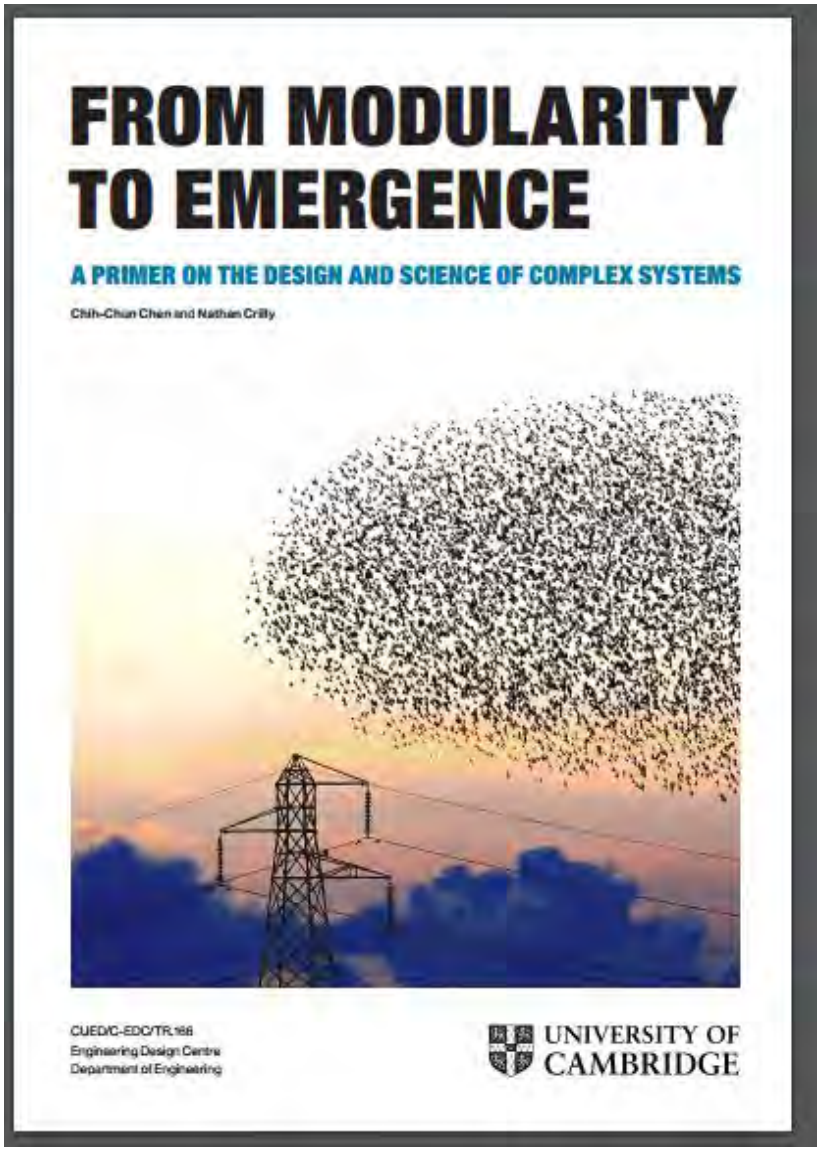


In light of the forthcoming United Nations Conference on Housing and Sustainable Urban Development (HABITAT III) and the imminent launch of the New Urban Agenda, DESA in collaboration with the Essl Foundation (Zero Project) and others have prepared a new publication entitled: "Good practices of accessible urban development".

The publication provides case studies of innovative practices and policies in housing and built environments, as well as transportation, public spaces and public services, including information and communication technology (ICT) based services.

The publication concludes with strategies and innovations for promoting accessible urban development.

The advance unedited text is available at:http://www.un.org/disabilities/documents/desa/good_practices_urban_dev.pdf



Dr Chih-Chun Chen and Dr Nathan Crilly of the Cambridge University Engineering Design Centre Design Practice Group have released a free, downloadable book, _A Primer on the Design and Science of Complex Systems_.

This project is funded by the UK Engineering and Physical Sciences Research Council (EP/K008196/1).

The book is available at URL: http://complexityprimer.eng.cam.ac.uk


Changing Paradigms:
Designing for a Sustainable
Future
Editors:
Peter Stebbing
Ursula Tischler
CUMULUS THINK TANK
Publication No 1 of the Think
Tank Series from the Cumulus
International Association of
Universities and Colleges of
Art, Design and Media
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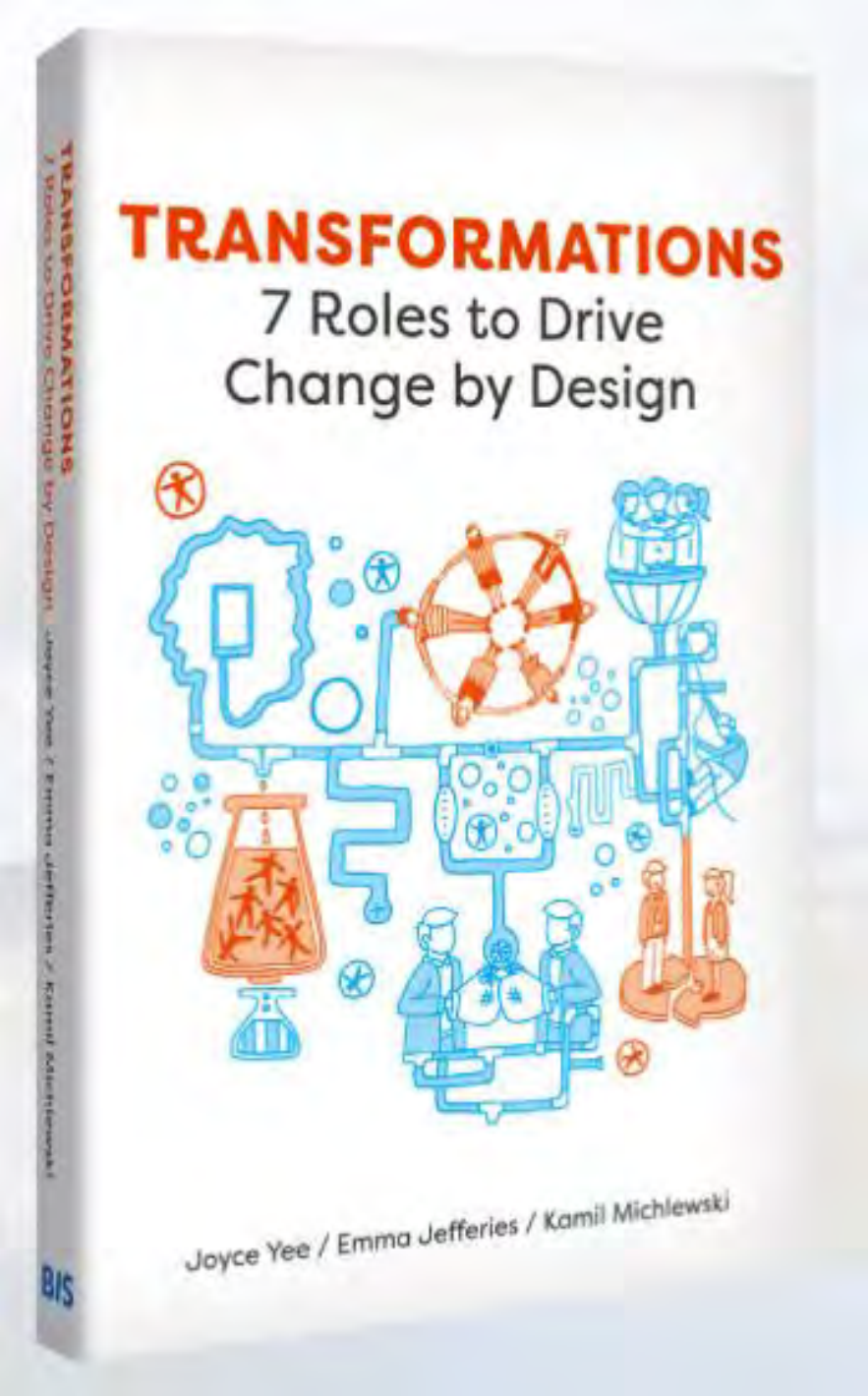
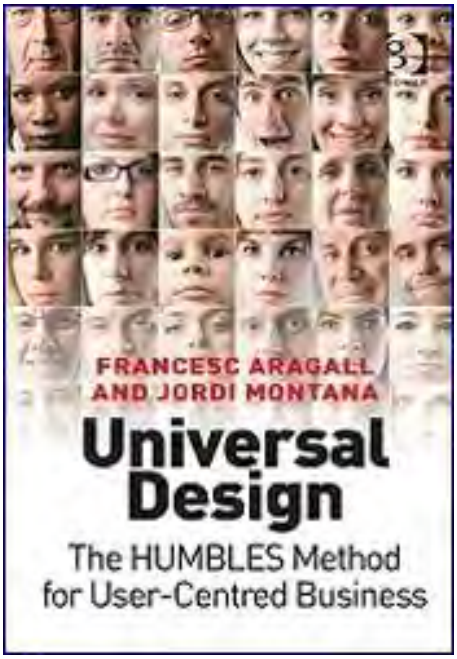
CLAY
Changing
Paradigms:
Designing for a
Sustainable
Future

Practical Guide for Ecodesign – Including a Toolbox
Author: Ursula Tischner


TRANSFORMATIONS
7 Roles to Drive
Change by Design
Joyce Yee / Emma Jefferies / Kamil Michlewski
BIS


Arnar Árnason and Sigurjon Baldur Hafsteinsson
DEATH AND GOVERNMENTALITY
Neo-liberalism, grief and the nation form

Universal Design: The HUMBLES Method for User-Centred Business



"Universal Design: The HUMBLES Method for User-Centered Business", written by Francesc Aragall and Jordi Montaña and published by Gower, provides an innovative method to support businesses wishing to increase the number of satisfied users and clients and enhance their reputation by adapting their products and services to the diversity of their actual and potential customers, taking into account their needs, wishes and expectations.

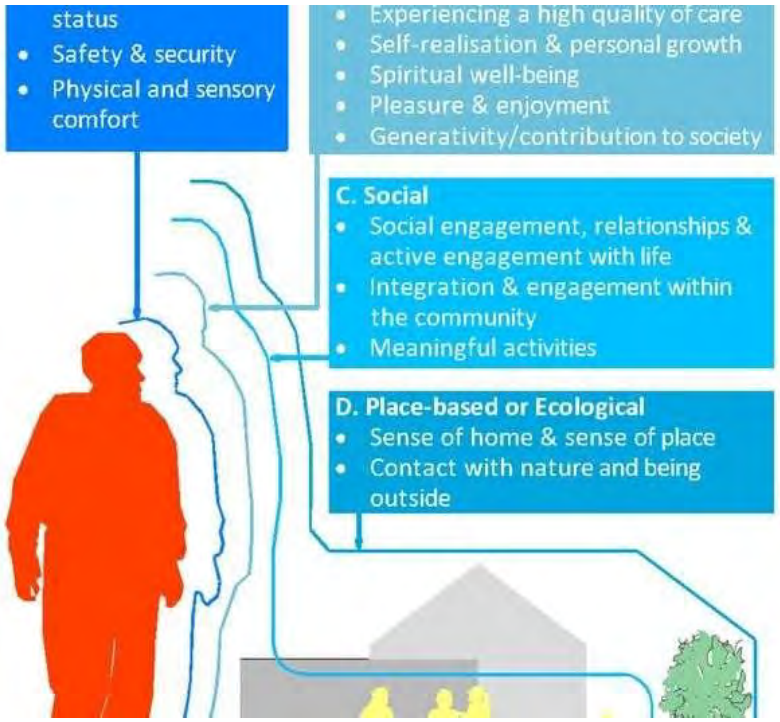
The HUMBLES method (© Aragall) consists of a progressive, seven-phase approach for implementing Design for All within a business. By incorporating the user's point of view, it enables companies to evaluate their business strategies in order to improve provide an improved, more customer-oriented experience, and thereby gain a competitive advantage in the marketplace. As well as a comprehensive guide to the method, the book provides case studies of multinational business which have successfully incorporated Design for All into their working practices.

According to Sandro Rossell, President of FC Barcelona, who in company with other leading business professionals endorsed the publication, it is "required reading for those who wish to understand how universal design is the only way to connect a brand to the widest possible public, increasing client loyalty and enhancing company prestige". To purchase the book, visit either the Design for All Foundation website

APPEAL

NEWS

1. Universal design guidelines for improving quality of life and COVID-19 infection control in residential care



Credit: Trinity College Dublin

Researchers from TrinityHaus, a research center in the School of Engineering in Trinity, today launched the world's first set of Universal Design Guidelines for improving quality of life and enhancing COVID-19 infection control in existing residential care settings for older people. There are 581 such residential care settings in Ireland.

The guidelines take into account many aspects of the physical environment across all parts of a setting and therefore, take a holistic and integrated approach across all spatial scales, from the location, access, and overall site layout, down to building layout, building components or specific applications of technology.

Dimitra Xidous, Co-Applicant and Research Fellow at TrinityHaus, said:

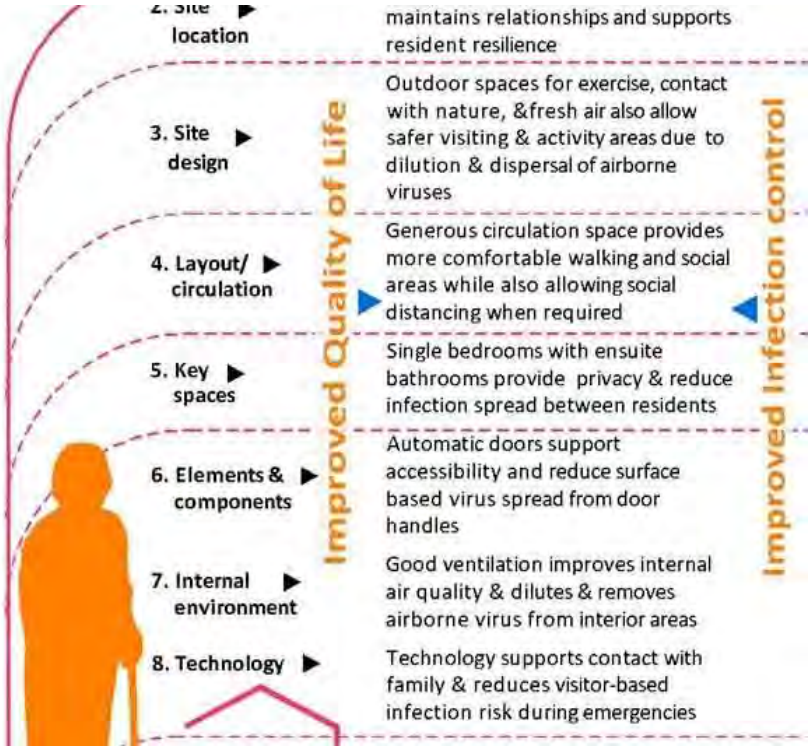
"The COVID-19 pandemic highlighted that Residential Long-Term Care (RLTC) is vulnerable to infectious diseases and recent research shows that RLTC settings have been disproportionately affected by COVID-19, with serious impacts on residents, staff, and family members."

"Like many other airborne infectious diseases, COVID-19 has serious implications for spatial practices and the design of the built environment, which is why this project was such an important one. The new

guidelines we are launching today outline how the built environment in RLTC settings can be adapted and retrofitted to enhance the quality of life for residents; improve the visitor experience for friends and family members; and improve COVID-19 infection control, pandemic preparedness and resilience while still protecting the psychosocial health and well-being of residents."

Adopting a universal design approach ensured that the research and resulting guidelines have been created in collaboration with key stakeholders, are people-centered, and address the diverse needs of residents, staff, and visitors regardless of their age, size, ability, or disability.

This research examined the key spatial scales, from site layout to individual internal spaces, space management (i.e., function, use, and circulation), and the elements and systems (i.e., materials and finishes); fit-out; internal environment; and technology, of existing settings.



Credit: Trinity College Dublin

Furthermore, the research and guidelines prioritize design for quality of life in RLTC and emphasize the importance of universal design, including dementia-friendly design. COVID-19 and infection control issues were carefully examined, but at all times through a quality of life lens.

Tom Grey, Co-Principal Investigator and Research Fellow at Trinity Haus, said:

"Throughout this research a set of quality of life domains was used to provide indicators for an environment where residents have the support and freedom to live full and meaningful lives.

"It is vital that we learn from this pandemic and identify how the design, layout, management, and

modification of the built environment can support quality of life for residents and improve pandemic resilience. This knowledge will help inform adaptation and retrofit of the 581 public, private, and voluntary RLTC settings in Ireland to protect the people who live and work in RLTC settings from the current pandemic situation and the possibility of future waves of COVID-19."

"Additionally, at a policy level, research in this area will support the 'Our Shared Future' program for Government with its commitment to protecting those living in RLTC, while also supporting the work of the COVID-19 Nursing Homes Expert Panel tasked with providing learnings from the crisis and recommendations for the RLTC sector."

In terms of COVID-19 and infection control, the research highlights how respiratory viruses are transmitted through contact, droplets, and airborne routes and that infection control strategies should take account of all transmission routes. However, there is now good evidence that COVID-19-related contact transmission is generally lower risk and that the principal modes of transmission involve respiratory droplets and airborne transmission.

Furthermore, research shows that risk of transmission is reduced outdoors due to air movement removing and diluting COVID-19 virus particles, and environmental conditions such as sunlight damaging the virus particles and decreasing transmission.

Professor Desmond O'Neill, Co-Principal Investigator and Geriatrician at Tallaght University Hospital, said, *"Architecture and the design of the built environment has hitherto been a much-neglected issue in terms of nursing homes, yet it is clearly critical to quality of life and the support of long-term care of older people and staff in residential long-term care facilities."*

(Courtesy: Medical Express)

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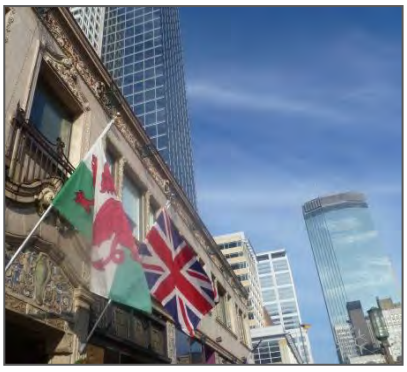
PROGRAMME AND EVENTS



berkeley prize

BERKELEY PRIZE 2022 LAUNCHES IN ONE MONTH

This year's topic:

DESIGN GUIDED BY CLIENTS' NEEDS:

Applying Social Factors Research to Architecture

A NEW QUESTION ON THE SOCIAL ART OF ARCHITECTURE AND A NEW OPPORTUNITY TO CONSIDER THE WHY OF DESIGN

AS ALWAYS, THE POTENTIAL FOR UNDERGRADUATE STUDENTS TO WIN CASH PRIZES IN THE ANNUAL ESSAY COMPETITION

AND, FOR THE SECOND YEAR, A CHANCE FOR PRIZE SEMIFINALISTS TO RAISE MONEY AND RECEIVE A STIPEND TO PARTICIPATE IN A LOCAL COMMUNITY SERVICE PROJECT RELATED TO THE TOPIC

IT ALL STARTS ON SEPTEMBER 15

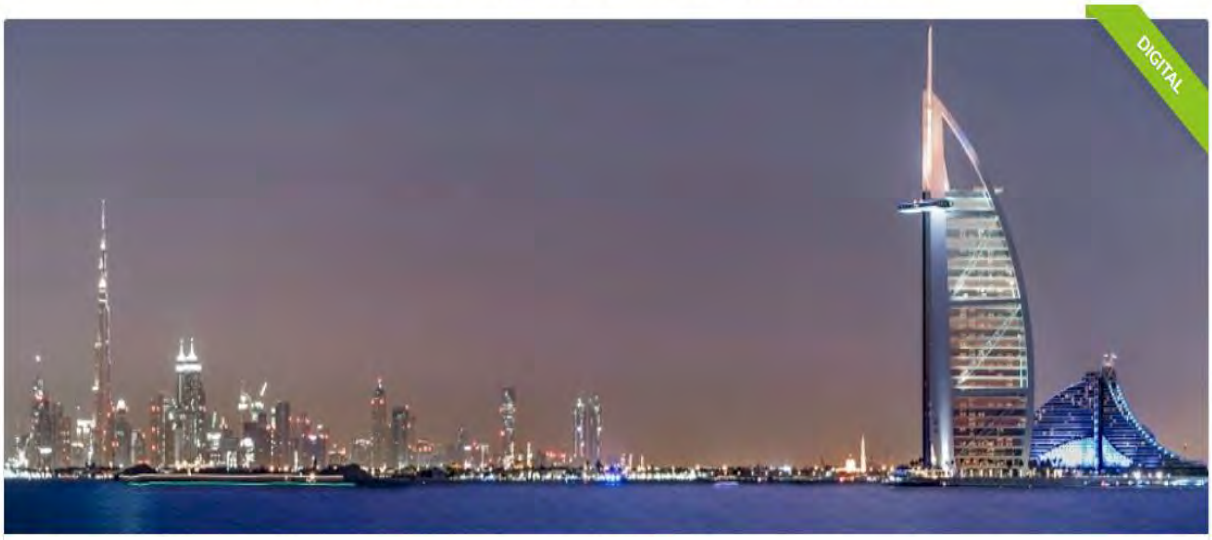
TELL FRIENDS, STUDENTS AND FACULTY - FORWARD WIDELY

ICPDPD 2022: 16. International Conference on Product Development and Product Design

March 03-04, 2022 in Rio de Janeiro, Brazil

ICPID 2022: 16. International Conference on Product and Industrial Design

April 07-08, 2022 in Dubai, United Arab Emirates



The Lulu Awards | RICHMOND URBAN DESIGN AWARDS 2022

uia INTERNATIONAL UNION OF ARCHITECTS

UIA COMPETITIONS
18 JANUARY 2022

INTERNATIONAL ACCESSIBILITY SYMBOL DESIGN COMPETITION

The International Union of Architects (UIA) and Rehabilitation International (RI) are jointly inviting submissions for a **twenty-first century symbol of accessibility** to represent their core values of rights and inclusion, independence, physical and virtual accessibility for all, including people with disabilities.

The challenge is therefore to develop a new symbol of accessibility that better represents the variety of people who use buildings and other types of built environments. The competition invites **professional architects** and **graphic designers** as well as **architectural and graphic design students** to design a new graphic symbol of accessibility, to be proposed to the **International Organization for Standardization (ISO)** for adoption as the new international symbol of accessibility.

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JOB OPENINGS

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