Evaluation of the Effectiveness of Perceptible Principle of Universal Design in Shopping Malls in Southwest Nigeria

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Abstract. Universal Design (UD) is a concept that encompasses strategies in design that provides comfort, flexibility and adaptability in the built environment and improves the quality of life of all human beings. Perceptible information as a principle of UD that needs to be incorporated in the design of shopping malls in southwest Nigeria because it helps communicate sensorial information effectively to users notwithstanding the condition of the users or their sensory capacities. The aim of this study is to evaluate the use of perceptible information in shopping malls located in southwest Nigeria with a view to providing a standard for designing shopping malls that fulfill all requirements of UD. The quantitative method of data collection was used to obtain data. The data obtained was statistically analyzed and used to generate results related to the study. The Statistical Package of the Social Sciences (SPSS) was used for the statistical analysis and the results were presented using descriptive texts, figures, plates and tables. The study uncovered that the application of perceptible information as a UD principle in shopping malls in southwest Nigeria is insufficient. The study concluded by recommending various strategies through which perceptible information can be implemented in shopping malls in southwest Nigeria.

Keywords: Perceptible Principle, Shopping malls, Universal design

1. Introduction

Providing Universal Design (UD) for inclusivity which helps people use public facilities and environments in general is vital in the creation of a sustainable environment. According to Kadir & Jamaludin, the term sustainability can be split into three aspects that cover social, environment and economic requirements, it involves creating a synergy between these overlapping aspects[5]. Ortiz-rodriguez, Castells, and Sonnemann , also noted that in the scheme of sustainability, enhancing the quality of life of people which allows them live with improved economic, social and environmental conditions in a healthy environment is the main idea [8]. This paper dwells on the social aspect of sustainability. Social sustainability is a process of creating a successful and otherwise sustainable place that promotes the wellbeing of people by understanding what they need [5]. This can be seen as an ultimate goal of UD.

Baek and Jeong (2021), referred to UD as the design of environments and products that is to be used by all types of people to the largest extent that is possible without adaptation or the need for a specialized design [3]. There has been a paradigm shift however as UD has extended its concept of consideration to include all those that are socially vulnerable when looking at it from the human rights perspective. UD is achieved using various techniques and strategies and perceptible information is one of them.

Perceptible information refers to a design that effectively communicates important information to users of spaces, regardless of the environment or the user's physical capacities. This is accomplished through the use of various approaches such as pictorial, verbal, and tactile communication of important information, maximizing readability of important information, providing clear guidelines, and directing users. The design takes into account individual preferences and talents

A public building can be referred to as a building that is often visited by the general public and hence its name. These are buildings that ought to be designed to be accessible by the general public regardless of their physical, social and economic capacities. Buildings like libraries, banks, restaurants,

shopping malls et cetera are known as public buildings and hence it is important for them to be universally designed.

A shopping mall is a large public building that has a collection of retail stores or outlets and other business organizations where there is buying and selling of goods and services with the aim of making profit. Shopping malls also have different auxiliary facilities like outdoor parking spaces and sometimes a recreational area and more [2].

1.1 Problem statement

There is a need to evaluate public buildings in order to determine the sufficiency of UD in the overall building design. Shopping malls are a major part of the daily lives of people in southwest Nigeria and it is important to know whether these buildings are universally accessible or designed and can cater for the general public regardless of their capacities, size, age, social class, height etc.

Perceptible information has been chosen as the UD principle to be investigated as it is UD principle that deals with people's sensory nerves and is applicable to all types of persons. According to Burgstahler , it is a type of design that effectively communicates necessary information to the user regardless if their ambient conditions and making do with their sensory capacities [4].

Scholars like Sholanke, et al, have done studies to evaluate the compliance of UD at the main entrance of selected public school buildings and there has been literature evaluating different UD principles but not so much on perceptible information and its effectiveness in public buildings [11]. This paper aims to remedy that by evaluating the principle of perceptible information in selected shopping malls.

This study looks into evaluating the effectiveness of perceptible information as UD principle in shopping malls in south west Nigeria. This paper answers the following questions:

i. What are the different perceptible information used in shopping malls in south west Nigeria?
ii. How effective is perceptible information in shopping malls in southwest, Nigeria?

2. Universal Design

UD is a design approach that is built around people and helps answer the questions about inclusion in the physical environment. It is a concept that is based on creating user-friendly products or services to different classes of people or users without discrimination. Such an environment provides flexibility, adaptability and comfort that can reduce the human life cycle impact and will encourage the participation of the residents in such a community [5]. At a broader scale, UD is a concept in design or a design approach with the intention of accommodating a wider range of users, their capacities and backgrounds notwithstanding [1]. It is an approach that has evolved from just designing for or catering to the disability rights movement to catering for an aging population, social population and the general health and wellbeing of users. This has helped in considering a wider range of people and their different capacities.

According to the United Nations Convention on the Rights of Persons with Disabilities (CRPD), and Sampson and Gifford, universal design is a concept of rehabilitation which facilitates the planning of programs, products, environments, and services that are sensitive to a large expanse of people's capacities and that accommodate them [10]. Therefore, Universal design is an approach that has the ability to promoting equal participation and allow people to dismantle barricades in public buildings. It can be seen as a process of designing spaces that are all inclusive which provides a means of accommodating different types of people within the built environment efficiently, their experience, age, mobility, size, age et cetera notwithstanding [2]

UD is a process that has to be followed in a chronological manner. According to Burgstahler , the process of UD starts with identification of application that is identifying the spaces where it should be applied then definition of the universe which means defining the population that it would be employed for [4]. The process includes; involving identified population, adopting guidelines and standards, applying selected standards or guidelines, training and supporting instructors or volunteers, planning for

accommodation of other design strategies whose population was not designed for, and evaluating the overall design.

At the Center of Universal Design (CUD), a collaboration of architects, product designers, engineers, and environmental design researchers developed seven universal design principles for products and environments [4].. These principles have been in place and have remain relevant till today. They are:

1. Equitable use: This is making sure the design is marketable and ultimately useful to people that have diverse capabilities [4].
2. Flexibility in use: This implies that the design has room for a large range of individual capacities and preferences. Basically, people should be able to use the building's design characteristics in more than one prescribed way [4].
3. Simple and intuitive use: This means the design can be understood easily without the user's knowledge, concentration level, language skill and experience [4].
4. Perceptible information: Regardless of ambient conditions or the user's sensory capacities, the design should efficiently communicate important information to the user [4].
5. Tolerance for error: The design should be able to minimize hazards as well as the adverse repercussions of accidents, mishaps or unintended actions [4].
6. Low physical effort: This entails that the design should be efficiently utilized or used with a lot of comfort and without fatigue [4].
7. Size and space approach and use: this means that appropriate space and sizes should be applied and provided for teach manipulation and use regardless of their physical, economic or social characteristics [4].

2.1. Perceptible information principle

According to the National Disability Authority, perceptible information denotes a design that transfers important information excellently to the user of spaces, regardless of ambient settings or the user's bodily capacities [7]. This is achieved by employing various approaches such as pictorial, verbal, and tactile for superfluous communication of important information, maximizing readability of important information, providing clear guidelines, and directing users. Individual tastes and capacities are accommodated by the design. For example, a captioned video gives viewers the option of listening or reading to comprehend the material. This not only allows people with hearing difficulties access, but it also allows people who prefer not to utilize sound or who learn better by reading.

According to National Disability Authority , perceptible information has four guidelines which are:

1. Using different methods like verbal, pictorial or tactile for redundantly presenting essential information [7].
2. Providing sufficient disparity between important information and its environment [7].
3. Maximizing the legibility of important information [7].
4. Differentiating elements in a way that makes easy for description that it to make it easy to give directions and instructions [7].
5. Ensure that there is compatibility with a range of devices or techniques utilized by people that have sensory limitations [7].

2.2. Universal design and sustainability

The term "sustainability" was coined to describe a resourcefulness-based strategy for preserving and continuing things for future generations [9]. Sustainability stresses a positive transformation trajectory based largely on social, economic, and environmental issues as a visionary and forward-thinking development model [11]. According to Maywald & Riesser, in recent years, the term "sustainability" has been applied to a wide range of products and activities [6]. Economic growth, environmental protection, and social equality are the three pillars of sustainability [3].

In the built environment according to Kadir and Jamaludin, social sustainability is the process of creating long-term, successful places that promote well-being by understanding what people require from the places they live and work [5]. Social sustainability combines physical realm design with social world and infrastructure design to support social and cultural life, social amenities, citizen engagement systems, and space for people and places to evolve. In addition to social development within a community, the life cycle and growth of individuals within their private living spaces are important as underlying elements of social sustainability.

The applicability of UD extends from planners and designers to facility managers and facilities, with a focus on buildings, retail malls, public facilities, the health sector, rehabilitation, and organizations that work with people with disabilities. That is, UD is dedicated to improving people's lives through design for all in order to build a better society for all people, regardless of age, gender, culture, skills, or impairments. This is a function of social sustainability.

3. Methodology

This research adopted a quantitative method of data collection. The former is a method that is used for testing objective theories by examining the relationship among variables. This method of data collection helps answer the research questions which is to determine the types of perceptible information techniques are employed in the shopping malls and how effective perceptible information as UD principle is.

3.1. Summary of research design

Table 1. showing summary of research design

S/N	Objectives	Data characteristics	Data source	Data collection instruments	Data analysis
1	Objective 1: To identify the different perceptible information used in shopping malls in south west Nigeria.	Qualitative data	Literature review and Case study	Existing literature and Observation.	Content analysis
4	Objective 4: To evaluate the effectiveness of perceptible principle of universal design (UD) in shopping malls in southwest Nigeria	Qualitative data	Users of shopping malls	Questionnaires	Statistical Package for Social Sciences

3.2. Operational definition of variables

In statistics, operationalization of variables describes categorizing variables into elements that can be quantified. The variables in this study can be measured in both an empirical and quantitative manner. The variables were both classified and observable. Dependent variables, independent variables, and control variables are the three types of variables. The variables that are dependent on the independent variables are known as dependent variables. The variables are representations of the various elements seen by the researcher.

Table 2. showing the different variables, their descriptions and range of value

Variable Number	Code	Description	Scale	Range of Value
V1	PCMDREREDI	Pictorial mode for representing redundant information	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.
V2	VBMDREREDI	Verbal mode for representing redundant information	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.
V3	TCMDREREDI	Tactile mode for representing redundant information	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.
V4	BRMDREREDI	Braille mode for representing redundant information	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.
V5	IDMDREREDI	Interactive device as a mode for representing redundant information	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.
V6	PRACFPINIM	Presence of adequate contrast for proper identification of important information	Nominal	Yes, No
V7	EFACFPINIM	Effectiveness of provided contrast for the effective identification of important information.	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.
V8	PRIMINFQN	Pronouncement and emphasis of important information for quick notice.	Ordinal	Very pronounced, Pronounced, undecided, Not pronounced, Not pronounced at all.
V9	EFSDEFECO	Effectiveness of simple description of elements for easy comprehension.	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.

V10	EFWAFD	Effectiveness of way finding	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.
V11	EFLEGLET	Effectiveness of legibility of letters	Ordinal	Very effective, Effective, undecided, Not effective, Not effective at all.

3.3 Research population

The research population selected using the purposive sampling method where the researcher picks his or her samples based on their intuition and judgment. The questionnaires were distributed to people met at the case study areas on peak days. This led to a total of one hundred and twenty (120) copies of questionnaires administered among the users of the selected case studies. The questionnaires were administered to people at the selected case study area on peak days when and where human traffic is high.

This survey was conducted between June 18, 2021 and June 20, 2021 with the help of a trained field research assistant. Table 3 shows the response rate across these shopping malls at the end of the survey. This table shows the number of questionnaires administered and the number of questionnaires retrieved.

Table 3. shows the response rate across the selected shopping malls.

S/N	Shopping Mall	No. of Questionnaires administered	No. of Questionnaires retrieved	Response Rate
1	Palms Shopping Mall, Ota, Ogun state	40	35	87.5%
2	Ikeja City Mall, Ikeja, Lagos	40	38	95%
3	Ventura Mall, Samonda, Ibadan	40	40	100%
	Total	120	114	94.1%

From the table above it can be seen that a total of one hundred and twenty (120) questionnaires were shared and one hundred and fourteen (114) were retrieved

Out of the one hundred and twenty (120) questionnaires distributed across the three shopping malls for the study, a total of one hundred and fourteen (114) was retrieved.

Ventura Shopping Mall, Samonda, Ibadan, had the most respondents (40), resulting in a 100(%) success rate, followed by Ikeja City Mall, Ikeja, Lagos, with (85) respondents, resulting in a 95% response rate, and Palms Shopping Mall, with the fewest (35) respondents, resulting in an 87.5% response rate.

4. Results

According to Table 4, the pictorial mode of representing redundant information is present in the shopping malls. It also shows that 38.6% of respondents assessed the effectiveness of the graphic style of showing redundant information as very effective, and 61.4% rated the effectiveness of the pictorial mode of representing redundant information as effective. This means that most of the users found this method effective. Hence, it is an effective method of perceptible information for the users of the shopping malls.

This demonstrates how successful this method of information representation is in a shopping mall.

Table 4. Effectiveness of Pictorial Mode of Representation of Redundant Information

Pictorial Mode	Frequency	Percent(%)
Very Effective	44	38.6
Effective	70	61.4
Total	114	100.0

Table 5 shows that the verbal move of representing redundant information is present in the shopping malls. It also shows that 78.9% of respondents rated the effectiveness of the verbal mode of representing redundant information as non-effective, and 21.1% rated the effectiveness of the verbal mode of representing redundant information as non-effective at all, based on the analyzed data. This means that majority of the users found this method not effective. Hence, it is an ineffective method of perceptible information for the users of the shopping malls.

This demonstrates how inefficient this kind of information representation in a shopping mall is.

Table 5. Effectiveness of Verbal Mode of Representing Redundant Information

Verbal Mode	Frequency	Percent(%)
Not Effective	90	78.9
Not Effective at all	24	21.1
Total	114	100.0

Table 6 reveals that the tactile mode of representing redundant information is present in the shopping malls. It also shows that 7.9% of respondents assessed the effectiveness of tactile mode of showing redundant information as non-effective, and 92.1% rated the effectiveness of tactile mode of representing redundant information as non-effective at all, based on the data analyzed. This means that majority of the users found this method not effective at all. Hence, it is an ineffective method of perceptible information for the users of the shopping malls.

This demonstrates how inefficient this kind of information representation in a retail mall was.

Table 6. Effectiveness of Tactile Mode of Representing Redundant Information

Tactile Mode	Frequency	Percent (%)
Not Effective	9	7.9
Not Effective at all	105	92.1
Total	114	100.0

Table 7 shows that the braille mode of representing redundant information is present in shopping mall. It also shows that 7.9% of respondents assessed the effectiveness of braille mode of representing redundant information as non-effective, and 92.1% rated the effectiveness of braille mode of representing redundant information as non-effective at all, based on the data analyzed. This means that majority of the users found this method not effective at all. Hence, it is an ineffective method of perceptible information for the users of the shopping malls.

This demonstrates how inefficient this kind of information representation in a retail mall was.

Table 7. Effectiveness of Braille Mode of Representing Redundant Information

Braille Mode	Frequency	Percent(%)
Not Effective	9	7.9
Not Effective at all	105	92.1
Total	114	100.0

Table 8 shows that the interactive mode of representing redundant information is present in the shopping malls. It also shows that 37.7% of respondents assessed the effectiveness of interactive method of showing redundant information as non-effective, and 62.3%(%) rated the effectiveness of interactive mode of representing redundant information as non-effective at all, based on the data analyzed. This means that majority of the users found this method not effective at all. Hence, it is an ineffective method of perceptible information for the users of the shopping malls.

This demonstrates how inefficient this kind of information representation in a retail mall was.

Table 8. Effectiveness of Interactive Mode of Representing Redundant Information.

Interactive Mode	Frequency	Percent (%)
Not Effective	43	37.7
Not Effective at all	71	62.3
Total	114	100.0

According to Table 9 there is the presence of contrast for the effective identification of important information in the shopping malls. It also shows that 14% of respondents rated the effectiveness of contrast provided for the effective identification of important information in the shopping mall as very effective, while 77.2%(%) rated the effectiveness of contrast provided for the effective identification of important information in the shopping mall as effectively. This means that majority of the users found this method not effective. Hence, it is an ineffective method of perceptible information for the users of the shopping malls.

This demonstrates the power of contrast in identifying vital information in a retail mall.

Table 9. Effectiveness of the Contrast Provided for the Effective Identification of Important Information in the Shopping Mall

Contrast	Frequency	Percent (%)
Very Effective	16	14.0
Not Effective	88	77.2
Not Effective at all	10	8.8
Total	114	100.0

According to Table 10 important information is well pronounced and emphasized for quick notice by the users of these shopping malls. It also shows that 2.6% of respondents agreed that important information is very pronounced and emphasized for quick notice by shopping mall users, 88.6% agreed that it is just pronounced and emphasized for quick notice by shopping mall users, and 8.8% agreed that it is not pronounced and emphasized. This demonstrates that crucial information is well-pronounced and emphasized in shopping malls so that users may notice it quickly. This shows that important information was well pronounced in these shopping malls hence is an effective means of perceptible information for users of the shopping malls.

Table 10. Effectiveness of Important Information Well Pronounced and Emphasized for Quick Notice by the users in the Shopping Mall

Important Information	Frequency	Percent (%)
Very Pronounced	3	2.6
Pronounced	101	88.6
Not Pronounced	10	8.8
Total	114	100.0

Table 11 reveals that the elements in the shopping malls are described in the simplest ways for easy comprehension by users of the shopping malls. It also shows that 50% of respondents judged the efficiency of features in the shopping mall to be described in simple ways for easy comprehension by users as very successful and effective, based on the data analyzed. This demonstrates how the mall's most effective elements are described in the simplest terms possible for users to understand. This means that majority of the users found this method effective. Hence, it is an effective method of perceptible information for the users of the shopping malls.

Table 11. Effectiveness of Elements in the Shopping Mall Described in the Simplest Ways for Easy Comprehension by the Users.

Elements	Frequency	Percent (%)
Very effective	57	50.0
effective	57	50.0
Total	114	100.0

Table 12 shows that wayfinding methods are present in the shopping malls. It also shows that 43.9% of respondents assessed the efficacy of navigation around the retail mall as very successful, and 56.1% rated the effectiveness as effective, based on the data analyzed. This means that majority of the users found this method effective. Hence, it is an effective method of perceptible information for the users of the shopping malls.

This demonstrates that navigation in a shopping mall is effective.

Table 12. Effectiveness of Wayfinding in the Shopping Mall.

Wayfinding	Frequency	Percent (%)
Very Effective	50	43.9
Effective	64	56.1
Total	114	100.0

Table 13 shows that legibility of letters is present in these shopping mall. It also shows that 23.7% of respondents assessed the effectiveness of legible letters as very successful, while 76.3% rated it as simply effective, based on the data analyzed. This means that majority of the users found this method effective. Hence, it is an effective method of perceptible information for the users of the shopping malls.

This demonstrates the importance of legible letters in retail centers.

Table 13. Effectiveness of The Legibility of Letters in The Shopping Malls

Elements	Frequency	Percent (%)
Very Effective	27	23.7
Effective	87	76.3
Total	114	100.0

4.1 Discussion

This analysis helped to determine if there were perceptible information techniques used in the shopping malls. It has also helped to the effectiveness of the selected perceptible information elements in shopping malls. Legible letters, information descriptions, wayfinding, highlighting key information for quick notice, contrast of important information, braille, tactile, interactive mode, vocal mode, and pictorial mode are all examples of elements.

From the survey carried out, it can be noted that specific strategies were identified in the selected shopping malls. The respondents were able to rate these strategies using the Likert scale on their level of effectiveness. Some were deemed effective while some were deemed not effective at all. Special methods and strategies like braille, tactile and pictorial were not effective at all as all of the respondents agreed that text and diagrams were the most common ways of communicating information to them in shopping malls; this indicates that shopping malls in the study area do not take other ways of representing information into account, which can be traced back to a lack of inclusivity.

5. Conclusion and Recommendations

In conclusion, this fieldwork revealed the various forms of perceptible information strategies applied in shopping malls found in south west Nigeria. It also revealed that shopping malls lack accessibility and usability for individuals with particular disabilities, making them inaccessible. As a result, shopping malls are not inclusive. The findings of this study correspond with those of Sholanke et al., (2019), who found that many buildings fail to meet the accessibility and usability needs of their users.

The findings of the study corroborate previous research in this field, which found that many public buildings in Nigeria are inaccessible and unusable by PWDs, despite adequate provisions for capable individuals to design shopping centers, which are particularly important for the development and implementation of UD strategies. To close the gap and promote social inclusion, steps must be made.

This study recommended that management of shopping centers, in accordance with UD should undertake renovation of their facilities in order to ensure that they are adequately provided in accordance with UD principles. This refurbishment will help shopping centers.

In order to ensure that these UD concepts are understood and carried out accordingly, the design professions and other allied professions should also be trained in UD design and its strategy. Governmental institutions like the Architects Council of Nigeria (ARCON) should organize seminars and training for professionals on the use of UD design strategies and social inclusiveness in organizations such as the Nigerian Institute of Architects (NIA). Also, Universal design can be incorporated into the curricular of built environment disciplines. This should be done to promote the practice of UD in the construction industry from the very early stages.

Every person has rights to the use of public buildings regardless of age, gender, ability or disability and public awareness of these rights and UD is important. Therefore, sensitizing people about UD would give people a better understanding of its need, uses and utilization.

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