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# DESIGN AS AN INTERDISCIPLINARY TOOL FOR ADDRESSING EVERYDAY HUMAN NEEDS: FROM HUMAN-CENTERED DESIGN TO INCLUSIVE AND ACCESSIBLE ENVIRONMENTS

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## ABSTRACT

Design has progressively evolved from a discipline primarily concerned with the form, function, and aesthetics of objects into a complex interdisciplinary field capable of addressing social, environmental, technological, health-related, and human challenges. Contemporary design increasingly operates at the intersection of architecture, engineering, medicine, rehabilitation, psychology, education, information technology, social sciences, and the humanities. In this context, design is not simply the production of objects or spaces, but a systematic process for identifying human needs, understanding contextual barriers, and developing solutions that improve everyday functioning, participation, safety, autonomy, and quality of life.

This article examines design as an interdisciplinary tool for addressing everyday human needs, with particular emphasis on Human-Centered Design (HCD), Universal Design, Inclusive Design, accessibility, assistive technology, and the design of physical and digital environments. Seven interrelated dimensions are proposed as a conceptual framework: (1) understanding human needs and lived experience; (2) interdisciplinary collaboration; (3) human-centered and participatory design; (4) universal and inclusive design; (5) accessible digital and technological environments; (6) accessible physical, social, and service environments; and (7) evaluation, sustainability, and continuous adaptation.

The article argues that contemporary design is most effective when it moves beyond disciplinary boundaries and incorporates knowledge from multiple scientific and professional fields. This approach is particularly important when designing for people with disabilities, older adults, people with cognitive impairments, and other populations whose participation may be restricted by environmental, technological, social, or attitudinal barriers. The World Health Organization estimates that approximately 1.3 billion people, or 16% of the global population, experience significant disability, highlighting the scale of the challenge and the importance of accessible environments and products. The article concludes that design should be regarded as a strategic interdisciplinary mechanism for translating scientific knowledge and human experience into practical solutions. Its contribution extends from individual products and assistive technologies to healthcare, education, transportation, tourism, cultural participation, smart cities, digital services, and public environments. Ultimately, design can contribute to more equitable societies when accessibility, inclusion, participation, sustainability, and human dignity are considered fundamental design requirements rather than secondary adaptations.

**Keywords:** Human-Centered Design; Inclusive Design; Universal Design; Accessibility; Disability; Assistive Technology; Interdisciplinary Design; Design Thinking; Built Environment; Digital Accessibility; Quality of Life; Sustainability

## 1 INTRODUCTION

Design is deeply embedded in everyday human experience. People interact continuously with designed objects, spaces, technologies, services, communication systems, buildings, transportation networks, and digital platforms. From the chair used at breakfast to the interface of a smartphone, from the design of a hospital to the organization of a classroom, design influences how individuals perform activities, communicate, move, learn, work, participate, and maintain independence [1].

For many decades, design was frequently understood primarily through the categories of aesthetics, functionality, manufacturing, and commercial value. Contemporary approaches, however, increasingly recognize that design is also concerned with human behavior, social participation, health, accessibility, sustainability, identity, and quality of life. This transformation has expanded the scope of design from the creation of individual products toward the development of systems, environments, services, experiences, and social infrastructures.

The expansion of this role is particularly important in the context of disability. The World Health Organization currently estimates that more than 1.3 billion people—approximately 16% of the world's population—experience significant disability. Disability is not determined solely by an individual's health condition or impairment; rather, it emerges through the interaction between health conditions and environmental and personal factors. Inaccessible buildings, transportation, information systems, technologies, and social structures can therefore create or intensify limitations in everyday participation [2].

This understanding corresponds closely with the biopsychosocial approach represented by the International Classification of Functioning, Disability and Health (ICF). The ICF conceptualizes functioning and disability through interactions among body functions and structures, activities, participation, and environmental factors [3]. Environmental factors may function either as barriers or facilitators. Consequently, design has a direct relationship with functioning because it can either increase the demands placed on individuals or reduce unnecessary barriers.

This perspective represents a significant conceptual shift. Instead of asking only, “What is wrong with the individual?”, design-oriented approaches encourage the question, “What can be changed in the environment, product, technology, or service so that the individual can participate more effectively?”

The distinction is particularly important for people with disabilities, older adults, people with dementia, individuals with motor or sensory impairments, and people with cognitive or communication difficulties. For these populations, apparently minor design decisions may significantly affect independence and safety. The height of a seat, the weight of a door, the contrast between text and background, the position of a handrail, the clarity of a sign, the organization of a hospital corridor, or the number of steps required to complete a digital task can determine whether an activity is accessible or inaccessible.

The purpose of this article is therefore to examine design as an interdisciplinary tool for addressing everyday human needs. The article does not conceptualize design as a single professional activity but as a methodological and strategic process connecting different forms of knowledge [ 4].

Seven interconnected dimensions are proposed:

1. Understanding human needs and lived experience, 2. Interdisciplinary collaboration, 3. Human-Centered and participatory design, 4. Universal Design and Inclusive Design, 5. Digital accessibility, assistive technology, and emerging technologies, 6. Accessible physical, social, and service environments, 7. Evaluation, sustainability, and continuous adaptation.

Together, these dimensions provide a framework for understanding how design can contribute to solving complex human problems.

## 2 FROM OBJECT DESIGN TO HUMAN-CENTERED DESIGN

One of the most important transformations in contemporary design is the transition from object-centered approaches toward human-centered approaches.

Traditional product development frequently began with a technical specification or manufacturing opportunity. Human-centered approaches instead begin with an understanding of people, their activities, their contexts, their capabilities, and their expectations. Research examining the evolution of the ISO framework has highlighted the growing relationship between human-centered design, human factors, usability, user experience, and universal design [3,5].

Human-centered design does not mean simply asking people what product they want. It involves understanding what they actually do, what difficulties they experience, what environmental conditions affect their behavior, and what latent needs may not be immediately articulated.

Norman (2013) emphasized that good design should communicate its possible uses clearly to users. The relationship between affordances, signifiers, feedback, and conceptual models is particularly relevant when designing for individuals whose cognitive, sensory, or motor abilities may differ from those assumed by conventional design [6,7].

A digital interface may contain all required information but remain inaccessible if navigation is unnecessarily complicated. A public building may contain an elevator but still be difficult to use if its location is poorly signposted. Functionality should not be evaluated only in technical terms. It should be evaluated in relation to the capabilities, expectations, and context of the person using the design [8,9]. Clarkson and Keates (2003) similarly conceptualized inclusive design as a balance between product demands and user capabilities. When the demands imposed by a product exceed the capabilities of a user, design exclusion occurs [10].

This principle can be expressed conceptually as: Accessibility is the reduction of unnecessary demands with the support of human capabilities.

The objective is not to make people adapt unnecessarily to poorly designed environments but to design environments that accommodate human diversity [11].

## 3 UNDERSTANDING HUMAN NEEDS AND LIVED EXPERIENCE

The first dimension of interdisciplinary design is the systematic understanding of human needs.

Human needs are multidimensional. They may include: physical needs, cognitive needs, sensory needs, emotional needs, social needs, communication needs, cultural needs, environmental needs, technological needs, educational needs, healthcare needs, and needs associated with independence and participation.

A major limitation of conventional design is the tendency to simplify users into demographic categories. Age, disability, gender, or diagnosis alone cannot adequately describe how a person interacts with the environment [12].

Two individuals with the same diagnosis may have significantly different abilities, preferences, routines, family circumstances, cultural backgrounds, and environmental contexts. Consequently, design research should examine the relationship between the person and the activity.

A useful analytical model could be based on the idea that the individual's characteristics and abilities influence how an activity is performed within a specific environment. The interaction between the person, the activity, and the environment can either facilitate or create barriers to participation, ultimately affecting the outcome in terms of independence, safety, accessibility, performance, well-being, and quality of life [13].

For example, difficulty preparing a meal may not result exclusively from a person's motor impairment. The problem may arise from the height of the work surface, the weight of kitchen equipment, storage organization, inadequate lighting, or the absence of an appropriate assistive device. Similarly, difficulty navigating a public building may result not from visual impairment alone but from poor signage, inadequate contrast, complex spatial organization, or inconsistent information. The ICF framework reinforces this understanding by identifying environmental factors as an essential component of functioning and disability [14].

Observation is particularly valuable because people do not always consciously recognize or communicate all the difficulties they experience. Understanding human needs must also include emotional and psychological dimensions.

A product designed for a person with a disability should not necessarily look like a medical device. Medicalized aesthetics can reinforce stigma and dependency. Inclusive design therefore increasingly seeks to combine accessibility with desirable aesthetics, familiarity, dignity, and personalization [15].

## 4 INTERDISCIPLINARY COLLABORATION

Complex human problems rarely belong to a single discipline.

A hospital environment, for example, involves architecture, medicine, nursing, engineering, psychology, ergonomics, infection control, information technology, and facility management. Designing an accessible city involves urban planning, architecture, transportation engineering, public administration, disability studies, environmental psychology, digital technology, and social policy [16]. The interdisciplinary character of design is therefore not an optional addition. It is increasingly a requirement for addressing complex problems.

Sanders and Stappers (2008) argued that contemporary design increasingly involves diverse stakeholders and multidisciplinary teams. Co-design environments require communication across disciplinary and cultural boundaries, particularly when complex systems such as healthcare, education, and public environments are involved [17].

Healthcare is a particularly strong example of interdisciplinary design.

Healthcare professionals understand: diagnosis; treatment; rehabilitation; patient behavior; clinical risks; care processes.

Designers contribute knowledge of: ergonomics; spatial organization; interaction; materials; visual communication; product development; user experience [18].

Engineers contribute: structural safety; mechanics; electronics; materials; technological systems.

Psychologists contribute: cognition; behavior; stress; perception; human interaction.

The combination of these perspectives can produce solutions that no single discipline could develop independently. Inclusive educational environments require collaboration among teachers, special educators, psychologists, occupational therapists, architects, designers, technologists, students, and families [19]. Design also benefits from sociology, anthropology, disability studies, and psychology because products and environments operate within social systems.

A technically accessible building may still exclude people if social attitudes remain discriminatory. Therefore, accessibility must be understood not only as a technical characteristic but also as a social and cultural condition [20].

## 5 HUMAN-CENTERED AND PARTICIPATORY DESIGN

Human-centered design becomes particularly powerful when it incorporates users as active participants in the design process. Participatory design moves beyond designing for people toward designing with people. This is particularly important in disability-related design because professionals may unintentionally make assumptions about what people with disabilities need [21].

Users, caregivers, healthcare professionals, teachers, and community members possess forms of experiential knowledge that cannot be completely replaced by professional expertise. The design process can be conceptualized as an iterative sequence of exploration, understanding, problem definition, co-creation, prototyping, testing, and refinement, through which designers progressively develop and improve solutions in response to users' needs, experiences, and feedback [22].

Design Thinking similarly emphasizes observation, experimentation, iteration, and learning from users rather than relying exclusively on predetermined solutions [23].

However, design thinking should not be treated as a universal solution to every social problem. Its value depends on the quality of research, stakeholder participation, implementation resources, and evaluation.

In disability-related projects, participation must also be accessible. A person with a communication disability may require alternative communication methods. A person with cognitive impairment may need simplified information and additional time. A person with visual impairment may require tactile or audio materials. Designing an accessible product through an inaccessible process is insufficient [24].

The concept of the user can therefore be expanded beyond the traditional linear relationship of designer, product, user toward a more collaborative and interconnected model in which designer, user, professional, caregiver, and community interact throughout the design process. This approach recognizes that effective design solutions emerge through the exchange of knowledge, experiences, expertise, and perspectives among all relevant stakeholders. Rather than positioning the user as a passive recipient of a predetermined solution, the model places users, professionals, caregivers, designers, and community members within a shared knowledge network, enabling more inclusive, context-sensitive, and meaningful design outcomes [25]

## 6 UNIVERSAL DESIGN AND INCLUSIVE DESIGN

Universal Design represents one of the most important conceptual foundations for contemporary accessible design.

The seven classical Principles of Universal Design include equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and appropriate size and space for approach and use.

Universal Design aims to make products and environments usable by the widest possible range of people without requiring specialized adaptation.

Inclusive Design is closely related but places particular emphasis on recognizing diversity and reducing exclusion. Clarkson et al. (2003) described inclusive design as an approach that responds to a broad range of human capabilities [26].

Persson et al. (2015) demonstrated that concepts such as Universal Design, Inclusive Design, Accessible Design, and Design for All have developed through different traditions but share the broader objective of reducing barriers and improving accessibility [27].

A critical distinction therefore exists between compliance and inclusion, as compliance focuses on whether an environment meets minimum technical and regulatory requirements, whereas inclusive design goes further by asking whether people can actually use that environment effectively, safely, comfortably, independently, and with dignity. An accessible ramp may satisfy dimensional requirements but still be uncomfortable or difficult to navigate if poorly positioned. A website may technically satisfy some accessibility requirements while remaining confusing for people with cognitive impairments. A building may provide wheelchair access while offering poor orientation for people with visual or cognitive disabilities. Consequently, accessibility should be understood as a multidimensional quality [28].

The United Nations Convention on the Rights of Persons with Disabilities explicitly recognizes accessibility as a prerequisite for independent living and full participation. Article 9 addresses access to the physical environment, transportation, information and communication technologies, and public services [29].

The Convention therefore places accessibility within a human-rights framework rather than treating it merely as a design preference. The European Union has similarly promoted accessibility standards and Design for All approaches across the built environment and ICT. European accessibility work includes EN 301 549 for ICT and EN 17210 for accessibility and usability of the built environment **[30].**

## 7 DIGITAL ACCESSIBILITY, ASSISTIVE TECHNOLOGY, AND EMERGING TECHNOLOGIES

The contemporary human environment is simultaneously physical and digital.

People increasingly rely on: smartphones; websites; mobile applications; electronic health services; digital banking; online education; smart-home systems; navigation systems; artificial intelligence; communication technologies; and digital public services.

Consequently, digital accessibility is now an essential component of inclusive design.

WCAG 2.2 provides recommendations for making web content accessible to people with visual, auditory, motor, speech, learning, and cognitive disabilities. [31].

Assistive technology provides another major intersection between design, medicine, engineering, rehabilitation, and information technology.

The WHO and UNICEF Global Report on Assistive Technology estimates that more than 2.5 billion people need one or more assistive products, with this number expected to exceed 3.5 billion by 2050 [32].

Assistive technologies include: wheelchairs; hearing aids; spectacles; communication devices; mobility aids; prosthetic devices; adapted computer interfaces; smart-home technologies; environmental control systems. The design challenge is increasingly to integrate assistive functions into everyday products rather than isolate them as visibly medical devices. For example, a smartphone can simultaneously function as a communication device, navigation tool, health monitor, reminder system, and accessibility interface.

Artificial intelligence introduces new possibilities for personalization. However, AI also creates new ethical and accessibility challenges, including bias, privacy, transparency, data security, and exclusion of populations whose data are insufficiently represented [33]. Therefore, technological innovation must remain human-centered.

## 8 ACCESSIBLE PHYSICAL, SOCIAL, AND SERVICE ENVIRONMENTS

The built environment is one of the most visible areas in which design influences participation.

Accessibility applies to: homes; hospitals; schools; universities; workplaces; public buildings; streets; parks; transportation; cultural institutions; hotels; restaurants; healthcare facilities.

The European standard EN 17210:2021 establishes common functional requirements and recommendations for accessible and usable built environments and explicitly connects them with Universal Design and Design for All principles [34].

An accessible city requires more than accessible individual buildings. Accessibility should be understood as a continuous journey rather than a series of isolated accessible elements. [35]. Therefore, accessibility should be understood as a continuum rather than a collection of isolated features. Transportation is particularly important because mobility determines access to employment, education, healthcare, culture, and social relationships.

The WHO reports that persons with disabilities can experience inaccessible and unaffordable transportation as substantially more limiting than people without disabilities [36].

Accessible transportation therefore contributes directly to social participation.

Healthcare environments require special consideration because users may experience pain, stress, fatigue, sensory difficulties, cognitive impairment, or reduced mobility.

Design can support: orientation; privacy; safety; infection control; reduced stress; communication; waiting comfort; staff efficiency; accessibility [37].

The design of healthcare environments therefore requires cooperation between architecture, medicine, nursing, ergonomics, psychology, engineering, and patient experience [8, 38].

The goal should not be to create a clinical environment but a familiar, supportive, and dignified one.

The interdisciplinary value of design becomes especially visible when examining the range of fields in which design contributes to problem-solving [39]. Design contributes to many scientific fields such as medicine and healthcare, psychology, rehabilitation, education, engineering. computer science, urban planning, tourism, culture, and Social policy [40].

Design operates as a translation mechanism between policy, scientific knowledge, technology, and everyday human experience [41].

## 9 EVALUATION, SUSTAINABILITY, AND CONTINUOUS ADAPTATION

A design solution cannot be considered successful simply because it has been produced.

It must be evaluated. Evaluation may examine: usability; accessibility; safety; comfort; independence; user satisfaction; physical effort; cognitive effort; environmental impact; durability; cost; maintenance; social acceptance [41,42].

This is particularly important in healthcare and disability-related design because intuitive solutions are not always effective [42, 43].

Sustainability extends the responsibility of design beyond immediate usability. A sustainable design considers: material selection; energy consumption; durability; repairability; recyclability; modularity; manufacturing processes; transportation; end-of-life disposal [44].

Human needs change. Ageing, disease progression, injury, rehabilitation, technological development, and changing social circumstances can alter the relationship between people and their environments [44,45]. Independence does not necessarily mean performing every activity without assistance. Rather, it means having meaningful control and choice over one's life.

A well-designed environment can: reduce unnecessary assistance; facilitate decision-making; improve safety; reduce fatigue; support communication; enable participation; increase confidence.

This is particularly relevant for older adults and people with disabilities. Clear environmental cues can support orientation for a person with cognitive impairment. The design intervention therefore becomes a facilitator of human agency [46]. Historically, accessibility solutions were often developed as specialized products for specific populations.

Although assistive products remain essential, contemporary design increasingly seeks to integrate accessibility into mainstream products. The distinction can be expressed as:

- Specialized design: Designed specifically for a particular impairment or population.
- Universal design: Designed from the beginning to accommodate broad human diversity.
- Inclusive design: Designed through continuous attention to diversity, exclusion, and individual differences.

These approaches should not be regarded as mutually exclusive. Universal Design cannot eliminate the need for all assistive technologies. Some individuals require highly specialized solutions. The European accessibility framework explicitly recognizes that Universal Design does not exclude assistive devices where they are required [47].

### 9.1 Research Methodology

This study employs an **interdisciplinary conceptual research methodology** based on a structured review and synthesis of scientific literature, international standards, policy frameworks, and established design approaches related to human-centered design, Universal Design, Inclusive Design, accessibility, disability, assistive technology, and the built and digital environment. The methodological approach was selected to examine how design can function as an interdisciplinary tool for addressing everyday human needs across different contexts and populations [48]. The study follows a **qualitative, exploratory, and analytical approach**. Relevant literature was examined to identify recurring concepts, principles, challenges, and design strategies associated with human needs, accessibility, participation, independence, safety, and quality of life.

## 10 DISCUSSION

The analysis presented in this article demonstrates that contemporary design increasingly operates as an interdisciplinary problem-solving methodology.

The central argument is that design should not be understood merely as the final stage of producing an object. Instead, it should be understood as a process that begins with understanding human needs and continues through research, collaboration, ideation, prototyping, implementation, evaluation, and adaptation.

The seven dimensions form are consistent with the WHO's recognition that disability is strongly influenced by environmental factors and with the UN Convention's emphasis on access to physical environments, transportation, information, communication technologies, and services [49].

This approach also transforms the role of the designer. The designer becomes: researcher; facilitator; communicator; problem-framer; collaborator; translator of scientific knowledge; evaluator; mediator between stakeholders. The designer does not replace the doctor, engineer, psychologist, occupational therapist, educator, architect, or user. Instead, the designer creates connections among these areas of expertise [48].

Accessibility is sometimes incorrectly perceived as a limitation on creativity. In reality, accessibility can become a driver of innovation. Inclusive design must therefore be measured through actual use rather than intentions [50]. The interdisciplinary design process can be summarized as a continuous and iterative sequence of understanding human needs, collaborating with relevant stakeholders, co-designing solutions, integrating multidisciplinary knowledge, developing prototypes, evaluating their effectiveness, and adapting the final solution according to user feedback and emerging needs [49,51]. This type of educational structure would reflect the real interdisciplinary nature of accessibility challenges [52].

The interdisciplinary design approach also has implications beyond individual projects. Implementation can therefore be understood as a continuous process through which human rights are translated into policies and standards, which are subsequently transformed through design into accessible environments and services that ultimately enable meaningful participation and inclusion in everyday life [53, 54].

The importance of this chain is particularly clear in accessibility policy. The UN Convention establishes accessibility as a human-rights issue, while European standards provide more specific technical frameworks for implementation.

The useful and constructive role that digital technologies play in the realm of education for accessibility must now be emphasized. To strengthen the field of inclusiveness and accessibility education, we must encourage the use of digital technology across all educational areas. We have to be inspired and adopt paradigms like Mobile devices (60), a range of ICTs (61-64), AI & STEM ROBOTICS (65-70), and other technologies and paradigms that enable and enhance educational processes like evaluation, intervention, and instruction, which could be embraced and used in inclusive and accessible education. Additionally, the use of ICTs in connection with theories and models of metacognition, mindfulness, and emotional intelligence development [71-76] speeds up and improves educational practices and results, especially in accessibility design.

## 11 CONCLUSIONS

This article is conceptual and interdisciplinary rather than an empirical intervention study. It synthesizes established theoretical approaches but does not present primary experimental data. Future research can develop a framework through several directions. Future empirical research should therefore examine specific applications of the proposed seven-dimensional framework through comparative case studies and user-based evaluation.

Design has become increasingly important as a means of addressing complex human and societal challenges. Its contribution extends well beyond the creation of attractive or functional products. Contemporary design can influence independence, participation, health, safety, communication, education, mobility, social interaction, and quality of life.

The central argument of this article is that design is most effective when understood as an interdisciplinary tool for translating human needs and scientific knowledge into practical solutions.

The seven dimensions proposed in this article provide a framework for this transformation. Understanding human needs without interdisciplinary knowledge can produce incomplete solutions. Interdisciplinary collaboration without user participation can reproduce professional assumptions. Universal Design without evaluation can result in theoretical rather than practical accessibility. Technology without inclusion can create new forms of digital exclusion. Sustainability without adaptability can fail to respond to changing human needs.

The future of design therefore requires a movement from designing objects to designing relationships, systems, environments, and opportunities for participation.

For people with disabilities, this shift is particularly significant. The environment can act as either a barrier or a facilitator of functioning. Accessible design can reduce unnecessary demands, increase independence, and enable participation. This is consistent with the WHO's understanding of disability as an interaction between individuals and environmental factors, and with the international human-rights framework established by the UN Convention on the Rights of Persons with Disabilities. The importance of this approach is likely to increase as populations age, technology becomes more deeply integrated into everyday life, and societies become increasingly aware of diversity in human abilities. Ultimately, the most successful design is not necessarily the most technologically sophisticated or visually spectacular. It is the design that enables people to live, communicate, move, learn, work, participate, and belong.

In conclusion, design is not simply about creating things. It is about creating possibilities for human participation.

## COMPLIANCE WITH ETHICAL STANDARDS


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The Authors proclaim no conflict of interest.


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