

Investigating the Application of Artificial Intelligence in Biology and the Human Need for Colour in Space

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Abstract

Colour has a special physical and mental effect on people, and people have different reactions to different colours. Residential architecture, which tries to optimize the quality of spaces with elements such as form, colour, texture, and such things and to achieve proper efficiency and performance along with beauty, can use artificial intelligence technology in design for an innovative approach and respond to the needs and use environmental functions. Since the residential space is an important space for human comfort and the family spends the best time together in it, it should be designed in such a way as to provide a sense of peace and motivation for its residents. The bright colours are one factor to achieve this. The current research method is based on previous studies and quantitative (using analysis software) and qualitative methods for the development of desirable residential spaces based on human needs for physiological and psychological comfort. This article investigates human needs and the impact of colour science in biological design using artificial intelligence to create comfortable spaces and understand human needs, and the results show that colour is one of the important psychological issues that have a significant impact on it.

Key words; Human needs, AI, Colour science, Residential spaces, Biology

Introduction

In today's modern world, designers and architects of human spaces need to know what human needs in technological advancement and sustainable systems are seeking, and what criteria are they seeking to design sustainable spaces. The need to focus on artificial intelligence and intelligentization can be one factor in reaching spaces with human criteria and environmental psychology. But how can artificial intelligence meet the needs of future humans? How can artificial intelligence be used to achieve utopia and comfort in residential spaces? The human need for comfort in the two areas of visual vision (space perception) and thermal comfort can express the fact that by using artificial intelligence and combining digital designs with special extensions, it is possible to answer the two challenges of mental and physical comfort. Human achieve the great revolution in the machine and human intelligence can be a step beyond human mentality and needs for the future generation, because there are numerous obstacles to achieving artificial intelligence equal to the human mind, such as communication with sensors and the Internet, or the advancement of intelligence. Artificial and advanced from the human mind. Therefore, with practical ideas, the advancement of technology can be taken to improve services in the lives of people in service. Therefore, with practical ideas, the advancement of technology can be taken to improve services in the lives of people in service.

According to Schilirò (2020), artificial intelligence can be divided into 5 broad classes: (1) computer vision, (2) natural language, (3) digital assistants, (4) robotic process automation, and (5) advanced device-acquire knowledge. Digitization has a significant impact on global trade and investment. Other work being done on this is leading to improved solutions to global problems.

At the global level, this information has contributed significantly to the increase in global GDP over the past decades, and digital and artificial intelligence-based technologies show a large growth rate of

impact than world trade in goods (Schilirò, D., 2020).

Artificial intelligence today is undoubtedly an interactive and disruptive technology, with countless applications and more prospects for every industry and background, from healthcare to agriculture, engineering to finance, sports transport, and more (Cugurullo F., 2020, pp. 1-14) In addition, artificial intelligence is one of the main drivers of the world's smart city movement (Singh, et al., 2020)

One of today's challenges for the future of human life on the planet is to reach a utopia and transform subjectivity into objectivity. According to the preliminary studies, it can be assumed that by applying artificial intelligence in responding to human needs in residential spaces, including space colourology, dystopian and futuristic liveable spaces can be achieved.

Therefore, the use of up-to-date technology in the design of architectural and urban spaces, such as making the spaces smart and building smart cities, can establish the ideal cities in the future.

Smart towns are broadly visible as places in whereat virtual era and information is broadly applied to generate efficiencies for financial increase, great lifestyles, and sustainability. (Mora, Deakin, & Reid, 2019, pp. 70–97)

Overall, the world of the future will be developed using intelligence that can meet the needs of people using technology. One of the important situations in this field is the use of new technologies and continuous development. (Grassl & Groß, 2019, p. 27)

For example, the beauty and well-being of the environment can be demonstrated through creative use and creative thinking. Even developed cities can use artificial intelligence to stop population growth and environmental degradation and climate change. For this reason, this period in which urban services are maintained and the needs of urban people are met with the use of robots and modern technologies can be called the smart age. (Boenig-Liptsin, 2018, pp. 16-21) The vision of future residential spaces can be presented using artificial intelligence based on human needs.

Therefore, the objectives of this research are:

- Application of artificial intelligence in spaces
- Investigating the colour since of residential spaces based on human needs for the psychology and physiology of the colour sense of the space

Research hypothesis

It seems that by using artificial intelligence in the design of human spaces, we can answer the human need for colour science and the proper use of colour in architecture.

Sustainability and human needs, as reviewed by the literature, concentrating on human's full capacity over the process. Balancing the environmental vitality in urban areas will have positive impacts on the urban development based on sustainability and meet the needs and demands. However, without reducing production resources (Ben-Eli, 2018, pp. 1337–1343), the human and environmental context seems to experience growth (Ehrenfeld, 2021). So, implementing a framework requires sufficient knowledge about artificial intelligence, the model of human needs, the perspective of forward-looking communities, and urban infrastructure. Finally, using the qualitative method in the first stage of research, we can indicate the limitations and theoretical foundations, by looking at examples such as examples of smart and historic cities, one can understand the creation of a sustainable future for humanity.

Then, with the quantitative research method, the impact can be measured using numerical analysis with SPSS software, and optimal and practical results can be obtained in this field.

Research Background

(Collins, 2021) provides a state of the artwork of AI studies in data structures between 2005 and 2020, identifies the evolution of the way AI is defined over a 50 period, Synthesises and categorizes the mentioned commercial enterprise value of AI, and analysis and categorizes the contributions of 55 primary papers.

(Baduge, 2022) in this article :by using artificial intelligence techniques, can be used in the entire life cycle of the building, and with machine learning analysis and neural network algorithms, a logical analysis of the resistant design of buildings and structures in residential homes can be reached.

(Ekici, 2021, pp. 373-389): Previous studies have shown that optimizing high-performance infrastructure can focus on multiple performance processes that may require different digital platforms, learn how to connect different software and use MUZO method, Machine learning, and High-quality design in a dynamic urban environment driven by artificial intelligence.

(Kumar.P, 2021). With the development of sensing generation and the proliferation of low-electricity circuits, the Internet of Things (IoT) is rising as a promising generation to realize clever towns. However, concerns such as protection, privateness, reliability, scalability, reliability, and centralization avert the fast improvement of IoT clever cities. But this article proposes a cozy privacy protection framework (TP2SF) for smart towns. This feature includes three modules: a consider module, a -layer privacy module, and an intrusion detection module. A block recognition device turned into created based on the references in the believe module.

In another article (lilis.G, 2019, pp. 53-65) This paper presents and validates a software system that implements infrastructure virtualization in smart buildings. This Discrete Event simulation engine seamlessly integrates real-time components into existing control systems and physical components. Candidate proposals include financial and energy analysis of potential technology investments, rapid modelling tools for analysis, and the development of energy management algorithms.

(Yu, 2021, p. 103204) colour and engagement in touristic Instagram pictures: A system learning technique, journal Annals of Tourism studies, this looks at uncovers the connection between colouration and consumer engagement based totally on pictures with exclusive functions. The findings display that the shade of blue in photographs featuring herbal surroundings, excessive-quit gastronomy, and sacral architectures contribute to user engagement. A red/orange colour scheme enhances pictures concerning nearby cuisine and atmosphere, even as the coexistence of violet and warm colours is vital for photos presenting cityscapes and indoor format.

(Coburn, 2020, pp. 217-241)in this look, we examined two hypotheses approximately the relationship between human beings and constructed environments. First, aesthetic responses to architectural interiors reduce to a few key psychological dimensions that are sensitive to design capabilities.

Research literature

Psychological-biological processes of colour in human life

Despite the importance of the visibility process, according to the goals of this review, here is an aspect of psychology-biology that deals with aspects other than the subject of visual and sensory physiology that occurs due to colour in the human eye. Considering the wide connection between what the eye perceives and the nervous system, colour has a significant effect on regulating human vital rhythms. The biological effect of colour in human spaces can affect factors such as body temperature, sleep, psyche, and even the environment.

Colour theory is very important in architectural design and has a deep impact on human feelings. The purpose of using colours in the design of an architectural space is not only to decorate it, but the colours can engage the vision and create a feeling of calmness or anxiety by processing it in the brain.

Although the effect of colours is subjective and differs for different people, some effects of colours have a unique meaning all over the world. Colours that are in the red area of the colour spectrum are known as warm colours. This ranges from warm feelings to feelings of anger and rage. The colours in the blue part of the spectrum are called cool colours and include blue, purple, and green. These colours are usually soothing, but sometimes they may bring to mind the feeling of sadness and indifference. According to colour psychology, colour affects a person's emotions. (Zailskaitė-Jakštė, 2017, pp. 1373–1378)

Colorology in Architecture and its Impact on human life

Colour is considered an essential detail of our surroundings, no longer only represented in the dwelling organisms of the natural environment however additionally inside the man-made diverse environments, colouration usually played a critical position inside the human evolutionary tactics from the simple human shelters to the huge mega cities The surroundings and its hues are perceived, and the mind procedures and judges what it perceives on a goal and subjective basis. Mental influence, communicate, facts, and results in the psyche are factors of our perceptual judgment techniques. The desire for shade

design in an architectural space is not relegated to ornament alone. (Mahnke, 2015)
Colouration is a tangible popularity, and as with any tactile discernment, it has impacts that are probably regular, affiliated, and synesthetic. This obvious cause has been validated by using an experimental exam. Since the body and brain are one detail, neuropsychological angles, psychosomatic influences, visual ergonomics, and colour's mental effects are the segments of colour ergonomics. These being considerations of design desires that request adherence to comfortable human intellectual and physiological prosperity interior of their manmade environment. The colour clothier/ specifier has the mission of knowing how the gathering of visual incitement, its handling, and evoked reactions, along with the hormonal framework, supplies the first-class potential effects for the welfare of people. (Radwan, 2015)

Colour as a human need

Why is colouration to be had with us people in this global? This inquiry, stated by the Swedish physicist Pehr Sällström, could function as a beginning diploma for an investigation of the wealthy and stimulating occurrence of shade. Colouration might be understood through the usage of several branches of generation, additionally among artists, for instance, Paul Klee and Frida Kahlo, and writers, as an instance, Björner Torsson. Neither moderate nor colour can be virtually depicted; but a good deal we strive there are dependable measurements that compass past language and investigation. Light and colour are tangible traits that should be experienced.

Colour is an inseparable element in our life. Colour is very important in architecture and has a deep impact on human feelings. Therefore, the purpose of using colour in the design of an architectural space is not only to decorate it, but the colour designer has a stimulating vision and processing it to create the best comfort facilities. This is more important in environments such as offices, industrial and manufacturing plants, educational centres, nursing homes, correctional centres. (Banu Manav, 2007, pp. 144-150)

Colour is not separate from design and architecture. The architect must consider the effect of the colour of each element in the building, from the primary building materials such as wood, stone, brick, and marble to the colour of the door and window. People associate certain colours with certain emotions based on experiences and cultural symbols. – for example, they may perceive red as threatening or scary because of its association with blood.

Colour perception in human

The perception of shade depends on how an item absorbs and displays wavelengths. Human beings can easily see a small part of the electromagnetic spectrum, from approximately four hundred to 700 nm. However, it's sufficient to permit us to see tens of millions of colours. This is the basis of the trichromatic idea, additionally called young Helmholtz after the researchers who evolved it. It changed to best shown in the Nineteen Sixties, meaning this element in information wavelengths and colourations is 60 years antique. Within the intervening time, the opponent method concept postulates that how we see colour is based upon three receptor complexes with contrary movements: slight/dark (or white/black), pink/green, and blue/yellow. Collectively, the two theories help describe the complexity of humans. (Spectrophotometers, 2023)

The concept of biological colouration differs from that of colour since it relies upon numerous elements, inclusive of the relative vicinity of coloured regions at the organism, the first-class and depth of mild falling on it, the shape posture, and motion of the organism supplying the colouration and, of the path, the visual skills of the organism searching at it. Seeing those visual structures, described in phrases of mild touchy organs ready with receptors and mechanisms permitting visible indicators to be processed, are not the same in distinct animal species including fish, birds, and non-human and human primates, colouration notion is what evolutionary biologists call a species-unique system. (Birgitta Dresp, 2016)
Colour perception, like many organic phenomena, results from evolutionary stress. The capability to peer colour has developed, to a greater or lesser quantity, in numerous species. To distinguish positive colourations from others performs an important element within the strategies which ensure survival. Such potential is determined thru the anatomy and useful development of the visual gadget a species is prepared with. Inside the animal global, at least 40 special sorts of seen systems exist, the only just in a

position to distinguish mild from dark, on the equal time as state-of-the-art ones can distinguish every shape and colouring, the maximum complex belonging to the mantis shrimp, a predatory crustacean living on the sea floor. There may be an extensive variety in both retinal shape and visible neuronal mechanisms across the animal kingdom, with a corresponding diversity in the position of shade imaginative and prescient in animal’s notion, behaviour, and interactions with the environment. (Land and Nilsson, 2002)

Emotional needs belong to the spiritual level, and its miles a manner of acquiring a feeling of identity psychologically. Design is constantly observed by the dual traits of cloth and non-secular, and the space combines the dual capabilities of emotion and fabric. (Uzun, 2018, pp. 112–128) (Swasty, 2017, pp. 17–24) aimed to look at the outcomes of incorporating one-of-a-kind emotional design approaches into multimedia on tremendous emotions, intellectual engagement, and studying achievement (don't forget and switch) among seventh-grade centre college students. The results display that effective feelings normally increase because the wide variety of emotional layout capabilities increases. However, his experiments have many elements. (Jing, 2021)proposed a convolutional neural network model based totally on the multicolour area and builds a convolutional neural community based on VGGNet (visible Geometry organization net) in 3 one-of-a-kind colouration areas, particularly RGB (pink green Blue), LAB (Luminosity a b), and HSV (Hue Saturation value) colour spaces. When (Okur, 2020, pp. 307–313)touches on consumer buying behaviour via emotional design, he finds three essential attributes: emotion, reasoning, and belief. Then, as a human, in addition, explains the emotional design, he touches on 3 ranges of layout: instinctual, behavioural, and reflective. To lay out something is to lay out emotion, developing brilliant and symbolic photos of high creative price. However, its sensible significance is not massive. (Le, 2018, pp. 40-47) used effort-related physiological measures (i.e., coronary heart price variability) to look at the effect of emotional design standards on an individual’s funding in the intellectual effort. The findings are consistent with the affective mediation speculation of cognitive-affective media studying concept, suggesting the ability significance of such affective and motivational elements in multimedia mastering research. However, his content material is not exactly sufficient. (Sun, 2022) introduces neural community modules together with 3-D spatial convolutional (3DSC) neural networks and fuzzy neural networks (FNN), and a deep learning algorithm of indoor spatial format design (ISLD) based totally on the adversarial neural community (ANN) is formed. (Zeng, 2017, pp. 140–149) analysed and summarized the emotional factors of products on the idea of preceding research for you to help use the innovative relationship in product layout to deepen the 4 ranges of emotional software, and summarized the manifestations of product emotional layout. Primarily based on the above evaluation, the four layout levels concerned with the awareness of emotional layout products and the hierarchical dating among the 4 levels are summarized. However, his innovation is not sufficient.

Human needs and changing it in the age of technology

The hierarchy of needs as described by (Maslow, 1943) stays one of the maxima seen and widely discussed theories of fundamental human desires inside and outside of psychology.

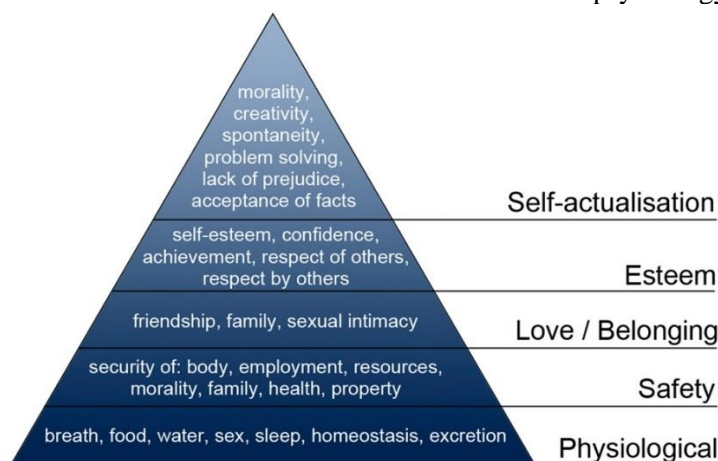


Figure 1: Hierarchy of human needs (Maslow., 2021, pp. 358-379)

Maslow, in his famous theory of motivation and personality development, proposed five needs that guide human behaviour. The most important needs were summarized in terms of physiological needs and included hunger, thirst, and sexual urges, among others. According to Maslow's concept, those physical needs ought to be met before the other higher wishes inside the pyramid may be met (Montag.C, 2020).

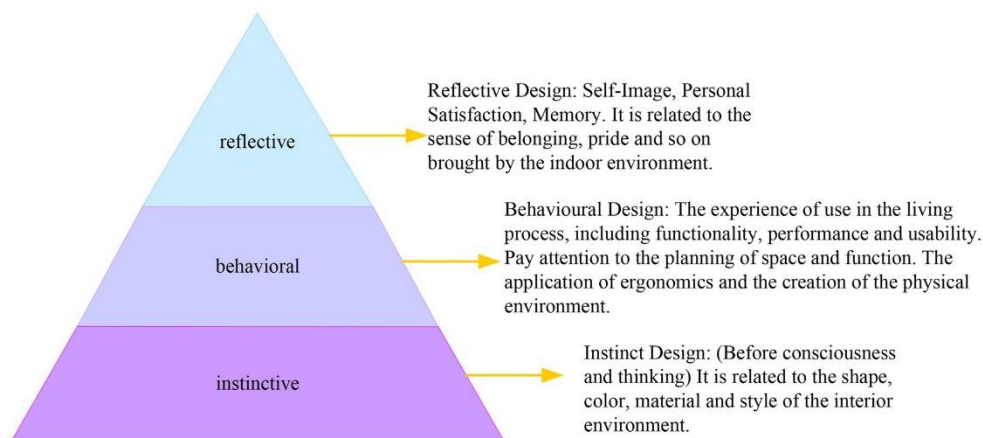


Figure 2: The application of emotional design principle in indoor layout. (Yunkai Xu, 2022)

Based on the analysis of a study on the relationship of individual differences in the satisfaction of each of Maslow's needs, the following analysis results have been observed:

Table 1: Value range of NSI scale (to assess the satisfaction of basic needs; left side), importance value of basic needs (middle), and Maslow's hierarchy of needs (right) (Montag.C, 2020).

Satisfaction (NSI scales)			Importance (rating of basic needs)			Maslow's Hierarchy of needs	
Ran k	Scale	M (S D)	Ran k	Scale	M (S D)	Ran k	Scale
1	Esteem	4.34 (0.82)	1	Belonging	3.64 (1.29)	1	Self-actualization
2	Safety and Security	4.33 (0.77)	2	Physiological needs	3.27 (1.56)	2	Esteem
3	Self-actualization	4.32 (0.80)	3	Safety and Security	2.88 (1.24)	3	Belonging
4	Belonging	4.29 (0.80)	4	Esteem	2.66 (1.24)	4	Safety and Security
5	Physiological needs	4.07 (0.73)	5	Self-actualization	2.54 (1.42)	5	Physiological needs

When comparing the average values of the NSI scale (assessment of satisfaction of the five basic need categories) and the satisfaction values of the recommended needs management and basic need categories, there are numerous differences. Although self-actualization is the goal/need, according to Maslow's hierarchy, people viewed existence as the most important thing to achieve but only ranked

fourth in terms of satisfaction. Sanitation is said to be the minimum requirement. In contrast, physiological needs were identified as the least satisfied needs category, but the second most important need satisfaction category (see Table 1) (Montag.C, 2020).

Modern life depends on both quantitative and qualitative skills. People want to use their minds to achieve a goal based on the need for comfort and well-being. For this reason, environmental protection can be achieved by adhering to the principles of human benefit. People's worldview (value concepts) is important in the way of creating a society, and what is important for world designers should be planned based on science and provide fundamental conceptual plans from a human perspective.

In comparison, each field with the basic human needs and how human needs change in smart cities, or other words, the change of human needs in the future, can be examined as diagrams. (Figure 3) (Yaghoobloo, 2022)

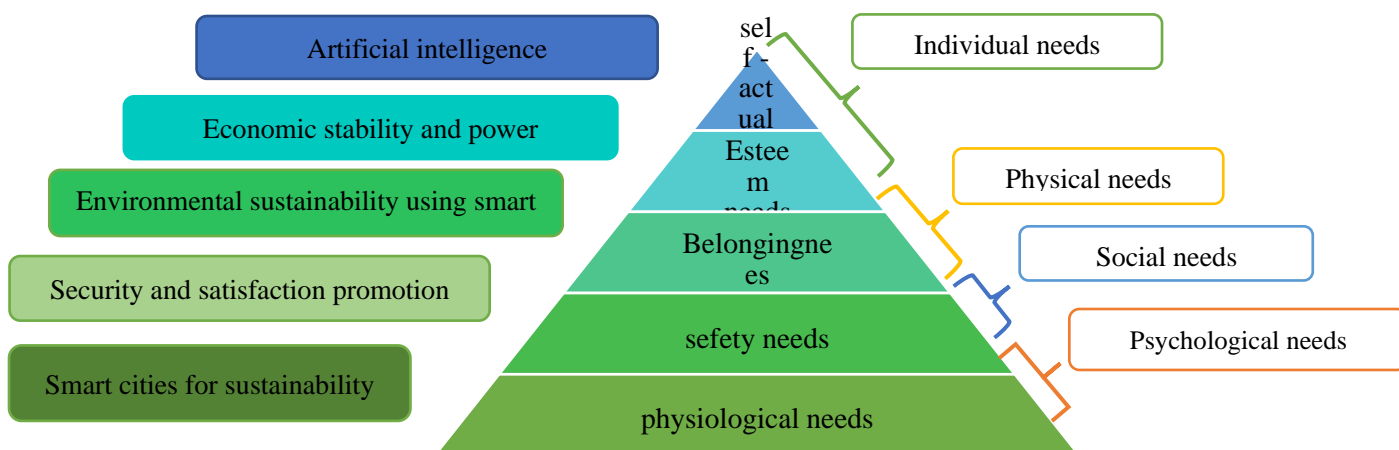


Figure 3: Changes in human needs according to the criteria of smart cities (Yaghoobloo, 2022)

In technology, there is a vision for the future of the age of unity and trans-humanism (R.Kurzweil, 2005), and the human world system is based on the understanding of the mutual separation of human well-being from the effects of the supported environment (Ecomodernist, 2015) According to Kurzweil, the human species will transcend biology. This can mark the beginning of the age of trans-humanism characterized by using a greatly more desirable human intelligence and body structure. This appears to be the current country of studies on technological improvement and social change. And the significance of various growth engines and productions in introducing know-how stays. We argue that an important cause for this uncertainty is that the drift of recent ideas or information as a technique is poorly understood and regularly taken as it's far, as it develops in a deductive version. However, what's this new movement of ideas? Can it be measured? And a way to play with time? (P.Cauwels, 2022, p. 121267) We must start with a paradigm shift in the way we think about the built environment. Building efficiency and traditional building practices are all about 'reducing the negative'. The goal of the West's local climate modelling seems to be "if no one notices and complains, we win". But what if the purpose of design is to see the environment they live in and see it positively? To provide a framework for thinking about this, Maslow put our basic life needs first at the bottom of the pyramid—breath, food, water, etc. We can borrow from the hierarchy of needs that suggest we meet them. - Feed us before you go. Our highest desires are those for joy, love, value, and creativity (S.Altomonte, 2020, p. 106949) (Maslow., 2021, pp. 358-379)

Artificial Intelligence in Architecture Design

Architectural design is a complicated technique that draws on experience and creativity to develop new designs. The software of artificial intelligence for this process ought to no longer be oriented to finding an answer in a described seek space, because the design requirements are not nicely defined in the

conceptual degree. As an alternative, this process should be considered as an exploration. (B. Logan, 1993, pp. 139-176) of the necessities, in addition to viable answers to satisfy those necessities (J.S. Gero, 1994, pp. 315-336) (M.L. Maher, 2000, pp. 195-208). Many design elements are selected by thinking about a huge variety of quantifiable and non-quantifiable capabilities concurrently. Even if trouble permits for numerical systems, the shortage of explicit and well-known evaluation standards makes defining design intentions hard. (R. Choudhary, 2005, pp. 149-159)

Using computational tools in the generation of architectural designs implies the use of parametric relationships, self-organizing processes, and algorithms to create designs with limited human interaction (R.I. Pazos Pérez, 2017). Sutherland proposed the introduction of a set of regulations through parametric relationships and algorithms that evolve the unique design via guiding manipulation of its parameters through the user, leading to results that the designer might not count on. (I.E. Sutherland, 1964). Dunn added that [parametric design](#) makes it possible to define the relationships between elements or groups of elements and to assign values or expressions to organize and control those definitions. (N. Dunn, 2012, p. 23) In addition, Davis indicated that the geometry of a layout additionally modifications whilst the parameters trade. (D. Davis, 2013, p. 47); that is, a parametric design creates connections and relationships between all design elements, and while one is changed, the others additionally adapt to the trade, usually by routinely changing parameters or associated values, as in a gadget of equations. The drawback of this layout technique is the huge quantity of time ate up in the development of parametric codes. This fee has led the maximum current tactics to apply generative algorithms, taking complete benefit of the pc's analytical capability to address the inherent human obstacles. (C.L. Marcos, 2010, pp. 81-87)

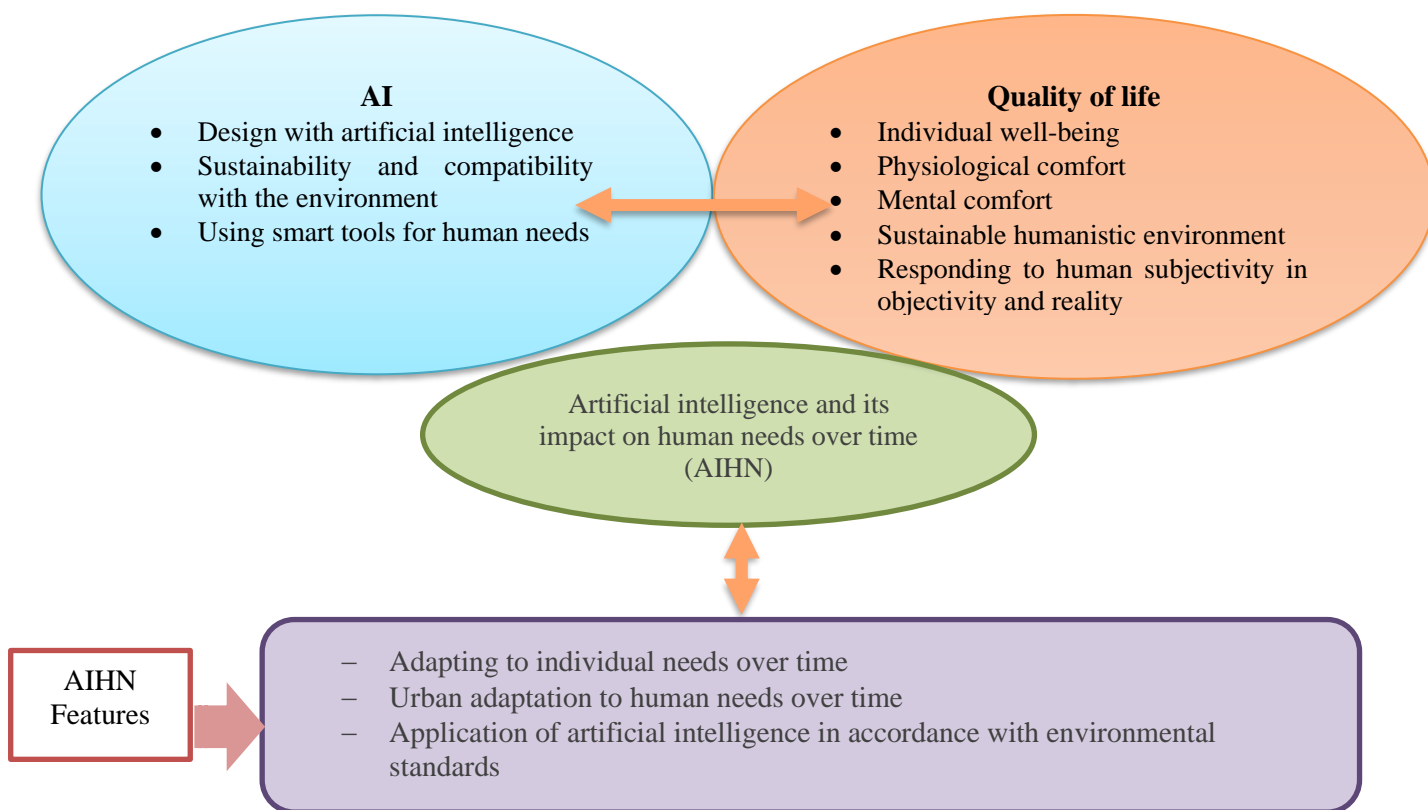


Figure 4: Changes in human needs based on artificial intelligence design (author)

Method

The inquiry about the strategy of a case considers based on introducing the specified criteria. That will be developed and reviewed according to the research criteria. (Roth.S., 1999)

The research method based on these cases is step by step:

1. Problem statement

2. Expression of research hypotheses
3. Collection of research theories and components
4. Analysis of the study’s findings using quantitative and coding techniques.

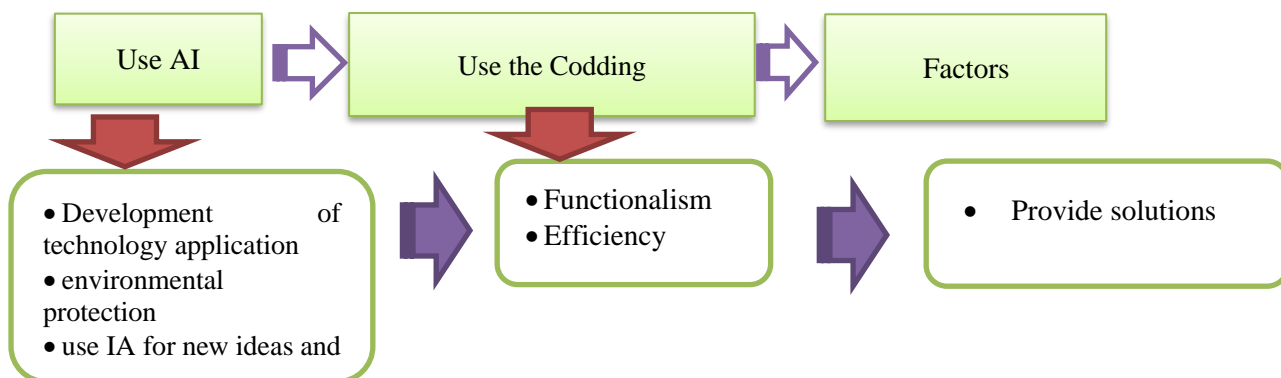


Figure 5: the research model. (Author)

Equation modelling is based on graph analysis in the first step and the next step is the inference of multivariate regression to correlate the obtained criteria and determine the response patterns.

Quantitative research model steps: (respectively)

- Coding and evaluating the components and questions separately
- Collect data and import it into the software
- Analysis of data by variance, criterion weight coefficient, t-test, and Pearson
- Determining qualitative and quantitative models based on results and data analysis
- Finally, reviewing the final criteria and presenting the model

Findings

The First Step

The present study uses SPSS statistical software to analyse this and review the results of the questionnaire and all the results of this research have been extracted from SPSS 21 software.

The Second Step

Evaluation of the proof of the three main research factors has been done with numerous homogeneities and also using research tools.

In the first stage of the test, there is no difference between the relationship between the components of the research, and the number **P** is equal to **0.001** and based on these three main areas of research, they can have a clear and meaningful relationship with each other. (Table 2)

Table 2: Evaluation of Analysis Characteristics Factors Based on Model (CCBQ). Source: Authors

Statistics		Human needs	Physical comfort	mental comfort
N	Valid	100	100	100
	Missing	0	0	0
Mean		50.50	3.02	2.76
Std. Error of Mean		2.901	.107	.109
Median		50.50	3.00	3.00
Mode		1 ^a	3	2
Std. Deviation		29.011	1.073	1.093
Variance		841.667	1.151	1.194
Minimum		1	1	1

Maximum		100	5	5
Percentiles	25	25.25	2.00	2.00
	50	50.50	3.00	3.00
	75	75.75	4.00	4.00

A correlation matrix was examined to check the correlation between the three items. Based on this, the numerical relationship between coding for human needs, mental comfort, and physical comfort, obtaining the number 1 in all cases, indicates the establishment of a meaningful numerical relationship between the variables. (Table 3)

Table 3: Examining the matrix of the correlation coefficient of the secondary and main factors and the total score. Source: Authors

Canonical Correlations

	Correlation	Eigenvalue	Wilks Statistic	F	Num D. F	Demon D.F.	Sig.
1	.105	.011	.989

Correlations

		Human needs	Physical comfort	mental comfort
Human needs	Pearson Correlation	1	.070	.088
	Sig. (2-tailed)		.490	.383
	N	100	100	100
Physical comfort	Pearson Correlation	.070	1	.159
	Sig. (2-tailed)	.490		.114
	N	100	100	100
mental comfort	Pearson Correlation	.088	.159	1
	Sig. (2-tailed)	.383	.114	
	N	100	100	100

Friedman-test

In quantitative research, the Friedman-test can be described as a non-parametric one, which is examined based on the analogy of several categories at the desired levels. In the present study, the Friedman test was based on the answers to the questions that were analysed in variables. (Table 4)

Table 4: Friedman tests to identify the level of important parameters and use those parameters in the conclusion. Source: Authors

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation
	Statistic	Statistic	Statistic	Statistic		Statistic
Human needs	100	1	100	50.50	2.901	29.011
Physical comfort	100	1	5	3.02	.107	1.073
mental comfort	100	1	5	2.76	.109	1.093
Valid N (listwise)	100					

It seems that by using artificial intelligence in the design of human spaces, it is possible to respond to the human need for the science of colour and the correct use of colour in architecture.

According to the quantitative research findings, it can be concluded that the human need for colour in residential and architectural spaces can have a direct effect on physical and psychological comfort.

Based on this, the use of soft colours such as: white, cream and bright can be effective in the space based on the human need for physical or physical comfort and mental or spiritual comfort.

Finally, by using artificial intelligence and architectural design with the help of artificial intelligence, the space can be coloured according to human needs, so that by using the science of colour, human sensory perception and vision and stability of the space can be achieved for physical and mental comfort. It is the first step to use architectural design with artificial intelligence for the science of colours.

Suggestions based on the findings of the research

In SPSS software, the correlation analysis between the questions of attachment to home and the questions related to the first, second, and third needs of Maslow's model was conducted to measure the most important factors among the intervening factors in providing the basic needs at home. Analysis, the most important factors affecting the basic human needs in housing were prioritized, which are described in the following order.

Priority of effective factors in physical needs:

Today, the science of colour is developing, and according to the human need to know the surrounding environment, which can be done with the help of colouring, it can also be associated with physical security or recognition of space based on physiological factors.

Therefore, according to the findings of the current research, the spaces whose colours lead to the efficiency and functionality of the space based on the science of artificial intelligence can be recognized for any age or physical body characteristics. Therefore, using new sciences such as colour science and using tools such as artificial intelligence can increase the practicality of human spaces from a physical point of view.

Priority of effective factors in mental needs:

The human need in space psychologically can reach a psychological approach according to the colour science approach, which can make the spaces unpleasant and uninviting, or people can easily visit and feel more relaxed.

Therefore, the colours that can provide comfort and peace to humans must first affect as visual elements and cause the human need for peace and self-fulfilment in the space.

The priority of factors affecting biological design and the effect of colour in environmental design based on the sense of belonging to a place:

The interior environment has dual properties of matter and spirit. In modern society, with increasing work pressure, alienation of interpersonal relationships, and weakening of human emotions, people's emotions need criteria for peace, liberation, and satisfaction. People are no longer satisfied that the indoor environment only focuses on meeting functional needs, but are more concerned about whether the indoor environment can meet spiritual and emotional needs.

Therefore, by using the influence of the surrounding environment and designing in harmony with biological factors to achieve sustainable human spaces in line with nature's colouring, it is possible to reach space with a sense of belonging to the place based on the human mentality to perceive and need nature in space. Therefore, by using artificial intelligence and estimating smart tools for future spaces, we can reach the ideology of human spaces in line with environmental sustainability.

(The current research can point to more practical cases and more detailed information for future research using artificial intelligence tools)

Conclusion

The role of artificial intelligence and architecture is pretty straightforward. AI accelerates planning and

construction. These two tasks are not something you can finish in a day. AI will create models and practical data. That's what people call an estimation tool.

You can also use the data when laying the foundation. It takes a millisecond for the AI to aggregate complex data and help you propose the ideal conceptual design. It's perfect for generating variations quickly. It simplifies the whole construction component and saves time.

Artificial intelligence (AI) has the potential to significantly reduce the concept-to-build delay in architecture. By utilizing AI algorithms, architects can quickly generate and evaluate different design options, ultimately helping them to arrive at a final design more efficient.

One way that AI can be used in architecture is through the use of generative design software. This type of software utilizes algorithms to generate a variety of design options based on a set of input parameters, such as the desired building size and location. Architects can then quickly evaluate these options and select the one that best meets their needs.

Another way that AI can be used in architecture is through the use of building information modelling (BIM) software. BIM software allows architects to create digital models of their designs, which can then be analysed using AI algorithms to identify potential issues and suggest improvements. This can help architects to catch and correct problems early on, reducing delays and costs associated with making changes later in the design process.

Additionally, AI can also be used to optimize the energy efficiency of buildings. Through the use of machine learning and simulation, architects can evaluate different design options and identify the best solution to minimize energy consumption.

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