

# 신경미학을 기초로 한 표상의 이해성(利害性) 가치에 대한 미의식 연구

Research on Aesthetic Consciousness of Interest Value Based on  
Neuroaesthetics

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## Abstract

Brain neural mechanisms of humans which are conducive to survival have evolved. Humans need careful intellectual activities to avoid the attack of beasts, to find a safer habitat, to find food effectively, for fertility and for generations. Such evolved intelligence is still used today, generating aesthetic intelligence to see the world, as well as to produce art and design. The purpose of this study is to figure out how the brain neural activity of interest's characteristic value apply in design. First of all, this study elaborates the concept of interest, then based on the theory of cognitive neuroscience to find out that the brain gives priority to processing the visual information with interest. It clarifies the relationship between the priority pathway of interest visual information and aesthetic emotion. Finally, it discusses the design method of using brain neural mechanism to obtain characteristic resonance. With visual design as an example, this paper summarizes eight disadvantageous visual elements suitable for public welfare poster creation. Next, it also concludes seven advantageous spatial features applied to landscape environmental design. Finally, it carries out three advantageous factors in interior space design. This study explores the neural activity of brain in judging the value of interest, summarizing the design value to meet such demand. Compared with the traditional design methods like the original "experiential" and "imitation", designing after transforming the interests into cognition can greatly improve the design efficiency.

## Keyword

Interest, Aesthetic, Cognition Neuroscience, Design Method

## 요약

인류는 생존에 유리한 신경 기제의 두뇌를 진화시켜 왔다. 맹수의 습격을 피하기 위해, 더 안전한 서식처를 찾기 위해, 먹을거리를 효과적으로 찾기 위해, 후손을 낳아 잘 키우기 위해서 섬세한 지능 활동이 필요하다. 이렇게 진화한 지능은 오늘날에도 여전히 사용되며, 세상을 보고, 예술과 디자인을 생산하는 심미적 지능을 낳는다. 본연구의 목적은 이해성의 표상 가치를 판단하는 두뇌의 신경 활동을 디자인에 활용하는 것이다. 본연구에서는 이해성의 개념을 정리하고 이를 인지신경과학의 이론을 기반으로 정리함으로써, 이해성을 나타내는 시각 정보 처리에 두뇌가 우선한다는 사실을 발견할 수 있었다. 시각 정보의 우선 처리 경로와 이해성의 심미적 감정의 관계를 명확히 했다. 이를 통해 표상적 공감을 얻기 위한 두뇌의 신경 기제를 사용한 디자인 방법을 탐구한다. 시각 디자인을 예시로, 공익 포스터 창작에 적용되는 8가지 유해성의 시각 요소를 요약했다. 다음으로 경관 환경설계에 적용되는 7가지 유리성으로서 공간 특징을 요약한다. 마지막으로 실내 공간 설계에 3가지 유리성 요소를 정리를 한다. 본연구는 이해가치의 판단에 대한 두뇌의 신경 활동을 탐구하고, 이를 만족하는 공간의 디자인 가치를 정리하였다. 조형을 '경험'해 '모방'하는 기존 디자인 방법보다, 이해를 인식한 디자인으로의 전환함으로써 효율성을 높일 것으로 사료 된다.

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### 1. Introduction

Before really doing aesthetics, interest judgement is automatically carried out in people's brain, which is very important, judging the advantages and disadvantages. While this step is the brain intelligence of organisms for not only adapting to the environment, but also surviving and multiplying successfully in the process of evolution, which is closely related to our physiological response, so as to generate the "survival feeling" in the human body. The advantageous behavior of improving survival is connected with positive emotion, on the other hand, the disadvantageous behavior of threatening is related to negative emotion. Aesthetic critics Clive Bell and Marcel Proust also said, "do not worry about intellect and intelligence just go for the raw emotions." Compared with the unattainable artistic talents, emotional works can resonate more. Therefore, the author believes that the corresponding design will arouse the corresponding emotional state since the brain has an interest judgment mechanism, so as to get the desired results more efficiently.

This paper explores the brain mechanism of the universal "survival instinct" of human, analyzing how to use this mechanism for design and creation. Thus, this paper first summarizes the concept of interest in theory, and then carries out the operation mechanism of interest in the brain based on the previous research and experimental results of cognitive neuroscience: 1. The connection between interest and aesthetic

emotion. 2. The processing area of interest in brain. 3. Interest judgment has priority in brain processing. In the end, three fields closely related to the value of interest, namely public welfare poster design, landscape design and interior space design, are selected for analysis, and the design method of characteristic resonance is sorted out.

### 2. Related Concepts

#### 2-1. Concept of Interest

Generally, the interest refers to the relationship between the application of a thing and its purpose, in which the application and function that can meet a certain purpose and need are advantageous, also known as "utility". While, on the contrary, disadvantage refers to survival threatening, as well as the failure to meet practical needs of survival activities. However, we cannot simply see human needs and satisfaction. Human needs should be divided into two types: one is the practical needs related to survival, and the other is non-practical needs that is not related to survival activities. Therefore, the practical needs and satisfaction of survival are called utility or interest. The concept of "interest" in aesthetics means the value attribute directly related to people's needs. There are generally three types of survival needs: The first is physical needs, which are related to natural attributes that can directly impact on people's living conditions, like habitat, sleep, diet, safety,

etc. They are the most basic and important interest needs of mankind. The second is the need of sociality, including social status and social relations; Because people are specific social existence, which can affect human's living state in real society. The third is spiritual needs, such as the sense of collectivity, honor, happiness, family, love, dignity, etc. Spiritual feeling is the direct reflection of the natural existence and social existence, so it has the nature of interest needs. 1)In addition, the interest value of things is constant, which is the basic characteristics.(Fig. 1)

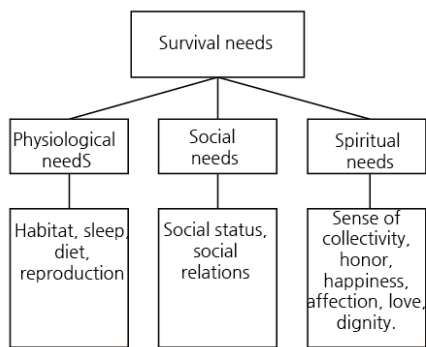


Fig. 1. Classification of basic needs

### 2-2. Concept of Disinterestedness


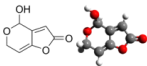
The needs other than the interest needs mentioned above can be called disinterestedness needs, which refer to the needs without physical, social and spiritual needs. For aesthetics, aestheticians represented by Kant believe that "beauty has purposeless purpose", which means that human's aesthetics can have a common sense except the material desires of the senses and the interest of specific practical purposes. If aesthetics is mixed with interest, there will be preference rather than pure appreciation and judgment. After that, Benedetto Croce, George Santayana and many modern aestheticians believe that aesthetics has the non-utilitarian

nature rather than a direct practical utilitarian purpose, and some aestheticians even completely reject the utilitarian nature of aesthetics.

### 2-3. Concept of Form and Essence

The objective form of a thing just contains the explicit physical characteristics, such as point, line, surface, shape, order, gradient, transparency, etc. While the essence refers to the new information related to the interest, which is implicit with a certain impact on the processing the aesthetic objects. When we judge an aesthetic object, we usually investigate its appearance and essence. For example, when there is a new food, we usually first look at it with our eyes, which means the essence, and then smell. A food with moldy appearance but nutritional value seems to have advantageous value today, like the famous blue cheese (Table. 1). However, the food appearance gives an expired or toxic signal, which has no positive advantage. In this example, the rotten appearance and unpleasant smell are the form, and the toxins and danger are the essence. Therefore, although the nutritional value of the food is positive, it has little aesthetic impact on people's perception of its form, so it will not be appreciated by most people. In other words, the utilitarian information carried by the essence of a thing will be integrated into people's aesthetic cognitive model about the thing, constituting the later aesthetic cognitive model together with the information related to the form of the thing.

Table .1 Form and inner Essence of rotten fruit

Form	Endoplasm
Rotten appearance, bad smell	Patulin, toxic substance
	

1) Li hongzhi., Cognitive Neuroscience  
Beijing:China Book Publishing House. 2020,p49

### 3. Processing Mechanism of Interest in Brain

#### 3-1. Processing Area of Interest in Brain

Empirical studies shows that neurons in the brain judge the physical information and the interest information of things differently. A brain central system of animal for biological significance is created by such brain structure and specific neurons that respond to external things. Roll (1999) finds in the experiment that when monkeys are full, the orbitfrontal cortex (OFC) will stop firing to the shape and smell of food, showing a decline in neural response. While other "reward neurons" (except hypothalamus and amygdala) still maintain a constant response to this scenario, which means that they only encode the "sensory nature" of taste stimulation. Thus, when the experimental monkey is full, or the interest needs are met, the representation effect of food shape and smell on the interest value disappears without firing.<sup>2)</sup> However, the perceptual processing of food vision and taste in experimental monkeys still continues. In the study of human beings, Brown et al. (2011) summarizes 93 neuroimaging studies on four different sensory modes of vision, hearing, smell and taste participating in aesthetic evaluation. They find that there is an overlap between the brain system used in the aesthetic evaluation of the aesthetic object and its biological value (such as the attractiveness of the spouse or the desirability of food): anterior insula and orbitfrontal cortex. Martin Skov analyzes that the human brain has only evolved a common neural network to calculate hedonic value, which means that when we appreciate arts or faces, the "food", "smell" and "scenery" that evaluate the biological value with the brain also activate overlapping areas: OFC and anterior insula (Fig. 2). The insula receives signals from visceral and

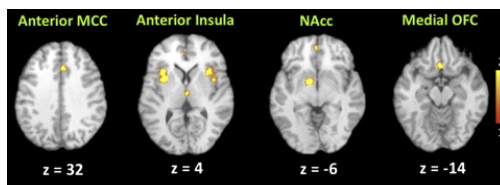


Fig. 2 general limbic network associated with aesthetic appraisal and emotion

skin receptors, transmitting them to other decision-making areas. Recently, a study shows that both the "what" and "where" visual pathways in the brain are connected to Angular gyrus<sup>3)</sup> (Fig. 3), and the meaning of connecting with the dorsal pathway is the detection of vigilance and significance (Singh and Husain, 2009). Always ready to take action, Therefore, OFC, anterior insula and Angular gyrus are the main processing areas when the brain makes interest judgment.

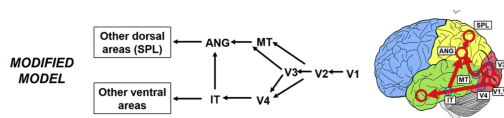


Fig.3 Visual stimulus processing pathway

#### 3-2. Priority of Interest Judgment in Brain

Interest will attract the brain's priority attention. In terms of cognitive neuroscience, there are many studies indicating that our visual attention not only gives priority to responding to threat-related and negative stimuli (Öhman and Mineka, 2001; Leutgeb et al., 2015), but also shows a bias against stimuli with strong positive evolutionary implications (Maner et al., 2007a; Nummenmaa et al., 2011). In a comparative study of aesthetic preferences between landscape architecture (with rich living resources, such as

2) Li hongzhi., Cognitive Neuroscience Beijing:China Book Publishing House. 2020, p98.

3) Sang-HanChoi., et.al., Proposal for humanvisual pathway in the extrastriate cortex by fiber tracking method using diffusion-weighted MRI". NeuroImage, 2020, Vol 220, No15, p7.

trees, water, mountains and stones) and other types of architecture, it is found that landscape architecture will be considered first in visual processing (Fig. 4), which indicates that the

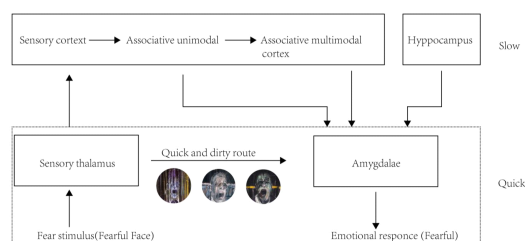


**Fig. 4. Evolutionary Landscape Architecture**  
weizhang 2018

beauty of landscape architecture may attract more visual attention in explicit and implicit aesthetic perception.<sup>4)</sup> Such attention bias appears rapidly in the early stage of attention processing, which is endogenously maintained in the later stage of visual processing. Besides, the neural mechanism of aesthetic emotion also suggests that utilitarian judgment has priority, which has been confirmed in some neuroscience studies in recent years: When the aesthetic subject contacts with the object, its nervous system often first needs to evaluate the interest of the object to itself, determining whether to treat the object as an aesthetic object according to the evaluation results. S. Zeki's study finds that the main brain area affecting aesthetic pleasure is the middle orbitofrontal cortex (mOFC). When the subject does not consider the interest factors other than the aesthetic object, only attracted by the object itself, mOFC will be activated to promote the subject to produce aesthetic pleasure. At the same time, OFC and AI mentioned above are the first to evaluate the value of the object related to human survival, i.e., interest. "The objects that highlight their biological importance should be evaluated first, such as living environment, food, appropriate

4) Wei Zhang, .et.al. "Attentional Bias to Beauty with Evolutionary Benefits: Evidence from Aesthetic Appraisal of Landscape Architecture, Front Psychol, 2018. Vol.71 , p9.

ating activities, etc., and then the appreciation of arts such as music and fine arts." For example, in the paper published in 2021, the author states that when people see a fuzzy face image with fear expression, the brain has a fast-processing channel connected to amygdala, which is related to fear emotion, so that you can feel fear and make decisions immediately. Such mechanism does not allow you to identify who he is, but allows you to judge whether he will pose a threat to you (Fig. 5).



**Fig.5 Quick processing of fuzzy fear faces in artistic works.**

Thus, many painters inadvertently find this secrete to create works with interest (Table. 2).

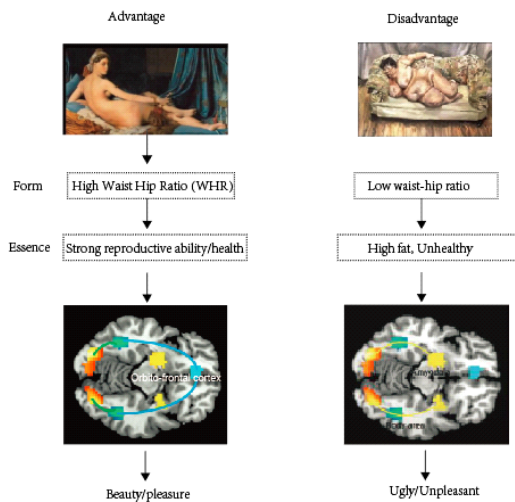
**Table 2. Portraits of Bacon**

Screaming portrait		
Study for a Portrait, 1949	Study for a head, 1952	Study for a head, 1952

### 3-3. Interest and Emotion

When we perceive the aesthetic object, the model we rely on in the process of perception includes not only the physical characteristics of the external object, but also a large number of

interest value factors related to emotion. In the long-term process, this factor will be integrated into our aesthetic cognitive model to help us



**Fig.6 Relationship between interest and emotion**

participate in the review of external things. From the perspective of biological study, it suggests that human cells have emotional potential, which means that the potential function carried by DNA can stimulate emotion. When the external factors stimulate emotion, the emotional potential in the cell can be activated to drive the match between emotional model and external emotion. "The external emotional stimulation meets the emotional potential in the cell, which have the same nature, resulting in the emotional response with the same nature, so it is arousal, the psychological process that activates the emotional psychological potential with the same nature, and an explicit emotion shows up." For example, innate fear is genetically encoded, which does not need response learning (such as the fear response to predator's smell).<sup>5)</sup> Our aesthetic judgment contains emotional factors, which are based on the subject's utilitarian evaluation of the aesthetic object. Kant said,

5) AntonioRiccio., et, al, Essential Role for TRPC5 in Amygdala Function and Fear-Related Behavior, Cell , 2009, Vol 137. p761.

"only when needs are met can we distinguish who is elegant." Judging the interest of a thing mainly depends on whether it can satisfy people, and survival needs are the foundation of all. Thus, it must be first considered whether a thing poses a threat to human survival, when measuring whether it is advantageous or not. "Taking people's survival needs as the standard, what can meet the survival needs is mostly advantageous to people; what is advantageous to people can arouse people's favor and pleasure, which is also regarded as the beauty. Thus, there are the survival relationship and emotional response relationship with interest between advantageous things and people, stimulating emotional experience in the corresponding central structure of the brain. " (Fig 6) For example, it is said that the dopamine system, which regulates happy emotions, expanded as early as homo sapiens by walking long distances to find meat (protein)<sup>6)</sup>. Besides, braised pork is advantageous to people, so for formal cognition, it is beautiful. On the other hand, our fear response to disadvantage is controlled by the amygdala complex of the brain, which will also be defined as ugliness (Fanselow and LeDoux, 1999; LeDoux, 2000; Davis and Whalen, 2001; Fanselow and Poulos, 2005).

## 4. Possibility of Interest in Design Application

### 4-1. Interest in Visual Design

In terms of our five senses, vision can is the main channel to obtain information, but not all information will be "seen" and processed by the brain. Based on the previous evidence, the brain is more concerned about information that is advantageous or disadvantageous to people.

6) Fred H., Previc, Dopamine and the Origins of Human Intelligence, Brain and Cognition, 1999,Vol, 41 p 299

Therefore, it can be properly designed with such brain rule of interest, which will attract the viewer's rapid attention. For example, the public welfare posters, the author believes, can use the disadvantages of threatening the value of human survival in the interest can arouse people's fear, disgust and other negative emotions more than the advantages of peace to alert people to pay more attention to the event. In addition, some thriller films often exaggerate the disadvantages of threats to people to create the figure of monsters, such as the giant python in the Harry Potter and the Chamber of Secrets, which can make people feel incomparable fear and panic. Therefore, the author divides disadvantage into direct disadvantage and indirect disadvantage (Table 3). Direct disadvantage generally does not require too much thinking, which can be reacted instinctively by the brain, while indirect

**Table 3. 9 elements of disadvantages**

Disadvantage	1. Destruction of living resources
	2. Physical injury
	3. Future generations of humans / the kind are threatened
	4. Interpersonal relationship destruction
	5. Snake / spider
	6. Rotten food, corpses
	7. An asymmetrical face, body, etc
	8. Blood
	9. Threatening expression

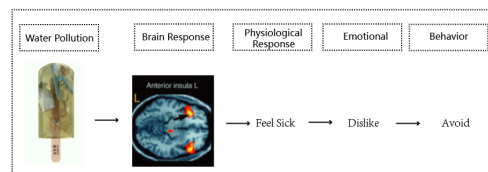
disadvantage can not respond quickly, but needs the accumulation of context and acquired experience. For example, in the public welfare posters of "no smoking", disadvantage factors are often used in design. Moreover, compared

**Table 4. Application of disadvantage in packaging design**

Write the words that	Pictures of smoking
----------------------	---------------------

smoking is harmful to health	harmful to health
	

with writing "smoking is killing your health" on the cigarette packaging, it is more effective to show photos of organs damaged by tobacco (table 4). Such visual expression can quickly



**Fig 7 The process of dealing with harmful public service advertisements in brain**

attract attention or vigilance, causing negative emotions of people (Fig 7) , so as to achieve thought-provoking publicity effect. (Table 5).

**Table 5. The Application of disadvantages in Public Welfare Posters**

Interst ( number)	theme	source	picture
2	Smoke and You Destroy Yourself	<a href="https://www.nlm.nih">https://www.nlm.nih</a> .	
2	It's a fact.	<a href="https://toucane.d.shop">https://toucane.d.shop</a>	
7	Your Beauty, up in smoke	<a href="https://www.sayidaty.net">https://www.sayidaty.net</a>	
2	Put out the smoke before you die.	<a href="https://www.pinterest.com">https://www.pinterest.com</a>	
3/9	Smoking is not suicide, but murder.	<a href="https://kknews.cc">https://kknews.cc</a>	



8/9	Don't call him while he's driving.	<a href="https://i.pinimg.com">https://i.pinimg.com</a>	
3/2	It's not just the car that's unlucky in a car accident.	<a href="https://blog.hubspot.com">https://blog.hubspot.com</a>	

#### 4-2. Interest in Landscape Design

A number of evidence prove that beauty is related to the survival and reproduction of organisms. Landscape architecture contains a series of natural elements with important evolutionary significance. In the process of space design, the disadvantage of interest should be avoided, while the advantageous value conducive to survival should be emphasized. The reason why the author can do research here leisurely is that people's ancestors have been constantly looking for safe habitats with rich resource in the process of evolution, so that they can survive



**Fig. 8 Viewers pay more attention to natural feature elements and high contrast,**

from generation to generation. Thus, looking for a favorable living space is also one of our instincts. In 1964, German social psychologist Erich Fromm first proposed the concept of biophilia. It means that human beings will be attracted by living things with an unconscious psychological obsession. <sup>7)</sup>This concept was popularized in 1984. Our body and mind have

evolved from nature. In this long and profound process, the characteristics of the body produced by nature are branded in the genetic genes, achieving an inseparable relationship between man and nature, which determines that it is difficult for human beings to exist independently from nature. Geologist Jay Appleton said, "the habitat theory assumes that the aesthetic pleasure of the landscape comes from the audience experiencing an environment conducive to meeting his biological needs. <sup>8)</sup>" Eye movement experiments also show that when people explore the building environment, they will project more eyes to elements with natural characteristics. (Fig 7) .Therefore, the advantages of the landscape environment are all related to our instinct to positively find a better habitat.

**Table 6. 7 elements of advantages**

Advantage	1. Abundant living resources, predictable bushes / fruit trees, etc.
	2. Clean water
	3. Bio-diversity
	4. Space to protect the body (shelter space)
	5. Open prospects
	6. Explorable path
	7. Interpersonal relationship

The author also summarizes the advantageous visual elements (table 6). Chinese traditional garden is a typical design in line with the "advantage". For example, the Humble Administrator's Garden in Suzhou is a typical

7) Wilson E. Biophilia [M]. Cambridge: Harvard University Press, 1984 pp1-35.

8) Oshin Vartanian, Impact of contour on aesthetic judgments and approach-avoidance decisions in architecture PNAS, 2013. Vol 110 , pp 10446-10453.

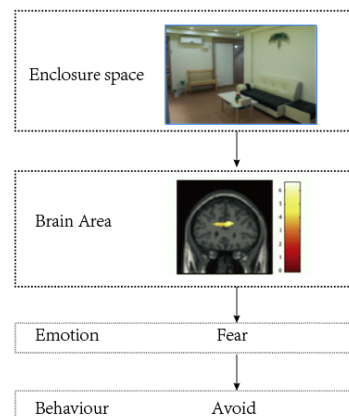
garden in Jiangnan area of China, which is also a 5A scenic spot in China. Although it was built 400 years ago, up to now, an endless stream of people still goes to "visit the garden" every day, which also shows the unchangeable people's instinct to pursue advantage. At the same time, based on this theoretical support, the author participated in the planning of the "HYPER HOUSING" project in Fu's Lab. This project is a transition from the past focusing on architectural "style" to pleasant space design. The most important thing to bring pleasure is to create "advantage", which is more conducive to attracting people to go outside, to explore, to communicate and to connect with positive emotions than the past space environment (Table 7).

**Table 7. Application of Advantages in Landscape Design**

Advantage (number)	classical garden	Chinese	Hyper Housing
1/2/5			
4/7			
6			
6/4			
4/7			

### 4-3. Interest in Interior Design

In the culture developed material, people spend more than 90% of their time in building (Evans & McCoy, 1998). The buildings we live in wrap our thoughts and bodies, affecting the way we feel and behave every day (Ellard, 2015). Some researchers believe that the characteristics of space will affect our motivation and reaction. James (1892) describes interest as an automatic psychological process that enables us to identify and focus on advantageous sensory stimulation. Interest judgment can also stimulate the response of movements to the physical environment (Joye & Dewitte, 2016), including the basic decision to approach or avoid the building space (Ritterfeld & Cupchik, 1996; Vartanian et al., 2015). Another important behavioral response to space is to "need to learn more about what's happening around through exploration" (Kaplan & Kaplan, 1989). In the process of evolution, it is also very important for



**Fig 9 Enclosed spaces activate the brain's fear center**

people to explore the survival resources. Experiments indicate that the ceiling height will affect the psychological response to the room space, so people prefer to enter the space with higher ceiling. Functional magnetic resonance imaging (fMRI) results show that high ceiling activates the neural structures involved in visual spatial attention and exploration. In addition,

people prefer the enclosed space, because these environments provide opportunities that cannot be seen by others, and humans usually feel safer in relatively open spaces (Stamps, 2005). The experiments showed that viewing pictures of enclosed spaces elicited activation of the aMCC, an area that receives direct input from the amygdala, a key region that characterizes fear, and is more likely to trigger avoidance behaviors. (Fig 9) It is historically proved that these places are advantageous to the survival of our species due to they enable humans to see and avoid threats (Appleton, 1975). Finally, curve modeling is preferred in indoor space rather than straight line, and experiments show that people are more interested in curved contours. Bar & Neta believes that a sharp change in profile may convey an original sense of threat, arousing major negative reactions, then the avoidance or rejection.<sup>9)</sup> In general, the author summarizes the advantages applicable to interior space design into three points: high ceiling, semi-open space and curve modeling (table 8).

**Table,8 Application of advantages in indoor space**

Advantage	1. high ceiling	
	2. Semi-open space	
	3. Curvature space.	

## 5. Conclusion

Based on cognitive neuroscience and

9) Enric Munar, Common Visual Preference for Curved Contours in Humans and Great Apes, PLOS ONE , 2015 , Vol.10 No 11. P13.

knowledge of brain science, this study explores the possibility of applying interest judgment in design. First of all, this paper introduces the related concepts related to the interest. Secondly, with the previous research in cognitive neuroscience, this paper summarizes the key areas of the brain for interest judgment, indicating the importance of interest judgment. Furthermore, it draws the conclusion that interest will cause the brain's priority visual attention by the research results of previous scholars. After that, it defines the relationship between interest and aesthetic emotion, which is also the connection between advantages with survival value and positive emotion, as well as the connection between disadvantages with threat and negative emotion. Finally, In different design fields, the author summarizes the design methods for achieving representational resonance. In terms of visual design, especially for the poster or advertisement design with public welfare, the application of disadvantage can quickly attract the attention of viewers to arouse negative emotions. Therefore, nine elements related to disadvantage are put forward. On the other hand, for the landscape environment and interior design, the advantage can make people stay, explore and carry out other activities that arouse inner pleasure, and the relevant elements of the advantage are respectively proposed. From the perspective of science, this study explores a new design idea based on the neural activity mechanism of the brain to judge the survival value, so as to provide a scientific guidance for future design.

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