

The occurrence and development of autism from the perspective of perceptual ecology

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Abstract. This paper discusses three theoretical models to explain the occurrence and development of autism disorders. The psychological model regards developmental disorders or psychopathological disorders of autistic patients as the manifestation of impaired mental activities, the neurobiological model mainly considers specific brain structure damage and its effect on behavioral dysfunction in autism. The ecological model doesn't directly study the mind or brain, instead it tries to explain the behavior of autistic people by studying their interactions with the environment. This paper will mainly focus on the ecological model of autism, autism is a process in human's life development, people who suffer from autism, the influences of this disease will along with the entire lifetime, autism is not caused by a moment, but is a life through process. Compared with psychological model and neurobiological model, the ecological model view of autism based on perceptual ecology theory highlights the interaction between individuals and the environment, which indicates that autism can also effect by environment, outside components can consider as triggers of autism as well.

Keywords: Autism, Psychological Model, Neurobiological Model, Perceptual Ecology.

1. Introduction

Since 1943, autism research has been going on for 60 years. From the researches, people realized that the more they know about autism, the more problems arise. There are two main aspects in autism research. First, how much is the increase in the number of people with autism related to the lack of diagnostic standards for autism? Second, which brain regions are developing abnormally that cause the core symptoms of autism? How do genes, brains, minds, and their interactions with environmental factors play out in people with autism? Autism is a neurodevelopmental disorder characterized by deficits in social interaction, speech, and behavior (formal or compulsive stereotyped activities). Social sexual deficits are one of the most visible signs of autism. They have difficulty establishing relationships with others, have difficulty engaging in activities requiring joint attention, exhibit stereotypical and repetitive behavior, and may resist change in favor of routines and patterns that seem meaningless.

Due to the complexity of the symptoms, the diagnostic evaluation of autism requires a wide range of expertise. For the diagnosis of a disease, only when the etiological mechanism is clear can accurate diagnosis be made. However, although researchers have realized that the original cause of autism is in the nervous tissue or organ, no conclusive results have been found. There is still no specific physiological indicator or test for autism. In that case, autism can only be diagnosed by the behaviors of the patients.

However, the standard for diagnosing these behaviors are not specific. As a result, researchers have to create the concept of “autism-spectrum disorders” to describe a patient that fits these standards. In fact, there are other types of disorders in the larger category of autism, like Asperger’s syndrome, childhood disintegrative disorder, Rett’s disorder and atypical autism. Within the large population, occurs in individuals with different levels of intelligence and language ability, and in varying degrees of severity. Thus, the broadening of the diagnostic criteria has led to a surge in the number of people with autism, autism is no longer a rare childhood disorder, and is currently conservatively estimated to have a prevalence of 0.6%.

Understanding the etiology and pathogenesis of autism is very important for early diagnosis and targeted psychological intervention and educational training. Previous studies have focused on behavioral deficits and the effects of psychosocial factors, family structure, and parental characteristics on autism. At present, the focus of research has turned to the genetics, cognitive psychology and influence from environment. Researchers have proposed a theory about autism from new perspective, such as ecological model, which appear to be complicated, but in essence it has explain the environmental factors that relate to autism.

2. An Ecological Model View of Autism

Loveland applied the framework of perceptual ecology theory of James J. Gibson and Eleanor J. Gibson to explain autism and proposed an ecological model view of autism [1].

Whereas traditional theories of perception hold that sensations must be “translated” into perception and that stimuli must be given a name through intermediaries such as, Gibson sees perception as a system for forming perceptual impressions from source data without the use of association or other mediating variables. Perception is a function of the stimulus, the stimulus is a function of the environment, and therefore perception is a function of the environment. At the same time, perception is also a function of the individual’s internal and external activities, because the three development mechanisms of perception are closely related to individual activities [2].

One is brain activity, specifically the function of the brain to extract information. Perceptual objects in the environment (objects, events, spatial relations, etc.) always contain a variety of characteristics, such as size, color, weight, etc., which are contained in the stimulus and only become perceptual information when the child uses perception to extract these characteristics. The second is brain activity, specifically the function of the brain to filter out irrelevant information. Filtering and extraction are two sides of the same problem. In the perceptual process, filtering is needed to extract useful information while eliminating messy, irrelevant stimuli. Children’s ability to filter out irrelevant information has a process of development. The third is the individual’s external activity, that is, the peripheral mechanism of attention. Extraction and filtering are the internal processes in which individuals accept or reject information [3]. At the same time, perception also shows the peripheral mechanisms of attention, such as children turning their eyes to the speaker, reaching for the cookie box, sniffing the plasticine with their nose. Through these explicit behaviors, children demonstrate the ability to collect information.

The ecological thinking of the Gibsons is mainly reflected in the description of the “perception-activity loop”. In this loop, the individual human being (or any organism) is seen as part of an organ-environmental system, not as a passive recipient of environmental stimuli, but as an active perceiver. Because a person always has a goal or need for a specific task or situation, his perception is always directly related to the goal or need of his activity. For example, when doing a puzzle, we pay less attention to the texture of the pieces, and more attention to the shape and color of the pieces, because this information is useful for us to complete the goal of the puzzle. In other words, perception can guide our activities [4]. And our activities not only directly affect the production of perception, but also affect the object we want to perceive. For example, when we want to take the biscuit tin on the shelf (the activity target), our visual perception will guide us to the action of the biscuit tin, and our actions at this time also guide our perception, which determines what stimuli in the environment enter our perceptual activity and form perceptual information: At this point, we will only notice the cookie box, but not the

scraps of paper thrown on the floor, and finally in the interaction of perception and activity, we get the cookie box we want.

In the process of describing the “perception-activity loop”, J.J.Gibson proposed the concept of “affordance”, which reflects the relationship between individual perceptual behavior and environmental characteristics. Gibson claims that stimuli in the environment contain a variety of properties, one of which is called “availability.” Availability indicates how feasible it is for an individual to perform an activity in response to this environmental stimulus [4]. To perceive the availability of an object (or event, person, social situation, etc.) is to know the functional significance of the object in relation to one’s current activity. “We do not perceive a stimulus or a still image, a combination of sensations or a thing, we perceive an object that we can eat, write, sit on, or talk to. [4]” That is, we perceive not only the physical properties of objects, events, people, etc., in our environment, but also their functional meaning, which depends on our current needs or expectations. He proposed that availability is provided directly by the environment and is directly perceived by the organism; The perception of “availability” arises directly from an organism’s interaction with its environment [4]. For example, whether an object can withstand me standing on it depends on the interaction between some of my features and the features of the object. Therefore, the study of an organism’s perception of availability in the environment must be carried out in the ecological environment.

The same is true for social perception. The behavior of others, as a stimulus in the social environment, involves “availability” in terms of the extent to which we can respond to that behavior [5]. For example, if I meet a person on the road and he smiles and says “hello” to me, I am aware of his behavior, and I am aware of the exploitability of this behavior, that is, “he says hello to me, and I can act as if I say hello to him.” There is a lot of evidence that we can perceive a lot of information about another person through direct observation, without even relying on speech as a mediator. Are all types of availability information in the social environment still directly perceived by the organism? There is much debate among researchers on this issue. Although we cannot say that a person’s perception of other people’s personality traits, behavioral intentions, or mental states is direct and does not need to be mediated by mental representations, we can at least be sure that many rather complex aspects of human social life (such as behavioral intentions, inner desires, etc.) can be transformed into explicit information [6]. And can be perceived and understood by others (sometimes directly, sometimes indirectly with the involvement of mental representations).

It must be emphasized that the Gibsons’ theory of “perception” is no longer limited to perception in the usual sense. Both perception and cognition are homologous from the starting point, they have to go through the continuous differentiation and selection of stimuli, and then through the extraction of different features to form knowledge and the abstraction of different relations to form cognition. Perception can be the primary stage of cognitive process, or it can be parallel, and the perception and cognition also feedback each other to bring new information. Loveland in 200 also failed to distinguish between perception and cognition when elaborating his ecological model of autism [1].

Is autism an internal problem? In some ways, yes. Because some of the symptoms of autism are only found in autistic people, and different autistic people have behavioral characteristics that are related to differences in development within individuals. It must be acknowledged that there is some accuracy in the neuropsychological model of autism, and that autistic people do have innate deficits in the ability to feel and share meaningful emotions and thoughts with others, which makes it difficult for them to accurately infer the beliefs, opinions, intentions, or emotions of others in a given situation. But such explanations still do not answer the question of why these deficits lead to inappropriate behavior in autistic populations and are therefore incomplete [1].

From the perspective of ecology, autism is not a static symptom that exists within the occurrence and development of autism from the perspective of perceptual ecological theory. Autism is a developing process, and it occurs in the interaction between individuals and the environment. In other words, autism is not a problem that occurs in the mind of an individual, but occurs because of a disturbance in the interaction between the individual and the environment [1].

2.1. Difficulty Finding and understanding in Social Affordance

In some studies of emotion recognition and emotion matching tasks, people with autism often misinterpret facial expressions or emotional signals from others [2]. Although they can recognize facial expressions of simple emotions, such as happiness or sadness, simply being able to recognize or label such expressions is not enough to enable a person to communicate with others unimpeded. The overall performance of individuals with autism on theory of mind tasks is worse than that of other groups, but studies have also found that the performance of individuals with autism on theory of mind tasks is correlated with their level of development, and those with better levels of development are often able to successfully infer the opinions or beliefs of others. However, when the social situations in the experimental tasks were designed to be complex enough, even very intelligent autistic individuals had difficulty recognizing the mental states of others (difficulty reading the minds of others). The low performance of individuals with autism on theoretical mind tasks is often explained by a defective cognitive model of the metacognitive process of mind reading, the ability to speculate mentally [3]. But from an ecological perspective, we might say that theoretical tasks of mind, such as false beliefs and deception, actually measure a subject's ability to directly perceive the availability of a particular social situation to another person. That is, instead of measuring the subject's mental speculation, it measures the subject's perception. Theory of mind studies that use eye-only pictures to present stories have found flaws in the availability (functional significance) of certain types of facial expressions provided by autistic people [4]. Some studies have examined more complex social perception. For example, Moore, Hobson, and Lee in 1997 used the point-light walker technique to examine the ability of autistic people to perceive life, activities, and attitudes (such as mental states, emotional feelings, or behavioral tendencies). The results found that although people with autism were just as able to perceive an image as human and recognize the activity of the image as normal people and non-autistic people with intellectual retardation, they were worse at recognizing the attitude of the image activity. Together, these studies suggest that people with autism have difficulty detecting the exploitability provided by other people's behavior and perceiving the extent to which it is feasible to respond to that behavior.

2.2. Difficulty Self-regulating Social Behavior

The social deficits of autism are manifested not only in their difficulty in understanding others, but also in their complex and rapidly changing social lives. Environments in which they have difficulty regulating their behavior appropriately. Therefore, even if some individuals with autism are able to recognize emotions or other important aspects of social situations, or even have a motivation to interact with others, they still have difficulty properly monitoring and continuously regulating their social behavior. If individuals with autism have difficulty not only in recognizing the internal states of others, but also in using this and other information to self-regulate social behavior, then it can be said that they have difficulty in accurately identifying the activity possibilities offered to them by the behavior of others [6]. In other words, the perception-activity circuit of human behavior appears alienated in the autistic population. Not only do people with autism have difficulty reliably and accurately capturing information in social contexts but they also have difficulty correctly identifying what that information means for their own activities. These two deficits explain why some high-functioning individuals with autism continue to behave strangely in real life despite being able to pass certain emotion recognition tasks and theory of mind tasks. For example, when a man sees a tall man coming with a wooden stick in his hand, he may think that the man is going to hit him and run away quickly, unless he also sees that the man has a smile on his face and a baseball in his hand. The correct perception of the big man's exploitability (danger or game) depends on the man's ability to extract enough appropriate information from the situation, as well as on having learned the exploitability of a baseball bat and recognizing that although the bat is primarily used for hitting, the presence of a baseball means that it is more likely to be a ball game than that he is going to be hit. Some studies suggest that people with autism have difficulty interpreting the functional meaning of things said and done by others (such as what this information means to their own actions), leading to inappropriate behavior [1]. For example, studies of empathy in children with autism have found that they are less likely than control children to respond to the sadness

of others, even when they are able to notice it. Corona, Dis, sanayake, Arbelle, Wellington, and Sigman in 1998 suggest that children with autism have difficulty responding to their subjects' grief not because they avoid situations they don't like, but because they have difficulty understanding what they are seeing as meaningful to them. For people with autism, the perception-activity circuit may be disrupted or confused. If the emotions, thoughts, and motivations of others are not obvious but euphemistic, indirect, or confusing, then one of the important sources of social information is interrupted. As a result, they may have difficulty accurately detecting the availability of others in certain situations. Of course, individuals with autism may find some of these characters or situations exploitable, such as a wooden stick meaning that someone can be hit, but their perceived exploitability in social situations may not be the same as that of non-autistic people in the same situation [2]. As a result, the autistic group's perception of the possibility of activity is limited or distorted, leading to abnormal behavior.

2.3. Social Environment of Its Life

A person's abnormal behavior can in turn affect the social environment in which he lives [4]. Caregivers of children with autism are known to adjust their language and social behavior in response to the child's communication difficulties to be more straightforward, rather than indirect or euphemistic. Moreover, autistic children's abnormal emotional behavior, social behavior and communication behavior, such as inappropriate facial expressions, will have a negative impact on the caregiver's behavior, resulting in a different social environment for autistic children to survive than non-autistic children, for example, autistic children's mothers smile less to their children. Therefore, their abnormal behavior results in a different type of parent-child interaction than normal children, and autistic children experience a completely different social environment from that experienced by other non-autistic children from an early age. Not only do they experience and understand the world differently from other children, but their world is indeed different from other children's, precisely because they are in it. Failure of the perception-activity circuit in autism is not a single event, but an ongoing process that affects not only the development of behavior, but also neurobiological aspects of development. Neuroscience research confirms that experience plays an important role in modifying the structure of the brain and constructing mental structures [5]. The development and maturation of the brain is not merely a process of expansion of physiological drivers (e.g. genes), the overall structure of the cerebral cortex is changed by exposure to learning opportunities and learning in social situations, and the structural changes in the brain are the basis for changes in the functional organization of the brain (i.e. psychological development) [6]. It is therefore safe to say that the functional organization of the brain and mind depends on and benefits from experience. The different experiences of autistic children naturally affect their neurodevelopment and psychological construction.

In summary, the ecological model suggests that the abnormal interactions between the autistic group and the human social environment are both the result of early (or innate) neurobiological impairments and an important factor in the subsequent development of neurobehavioral abnormalities in individuals with autism [1].

3. Conclusion

Gibson emphasized that perception should be based on human interaction with the environment. He believes that man and the environment are complementary and inseparable parts. Compared with the previous two approaches to explain autism, the ecological model view of autism based on perceptual ecology theory highlights the interaction between individuals and the environment. Is autism something that happens within individuals with autism? In some ways, yes. But from an ecological point of view, autism is not a static symptom that exists within the individual, autism is a developmental process, and occurs in the interaction between the individual and the environment.

This paper aims to introduce a new perspective to explain the occurrence and development of autism disorder, but does not deny the psychological model or neurobiological model of autism disorder explanation. The contribution of ecological models to autism research lies in: first, it opens up a way to study the etiology and developmental mechanism of autism from the perspective of human-environment

interaction. The study of mental patterns or cognitive activity patterns, as well as brain science, is still in the exploratory stage, and the ecological model avoids the black box of directly studying the autistic person's mind or brain, and tries to explain the autistic person's behavior by studying the interaction between the autistic person and the environment.

Second, according to the ecological model of autism, we can understand autism as follows: Autism is first of all a congenital neurological damage, if autistic children in their interaction with the environment cannot overcome the neurodevelopmental damage caused by the disorder, then it will lead to autistic children's secondary physical and mental development disorders, cognitive problems, behavioral problems, emotional problems and so on. Therefore, parents of autistic children should recognize early that their responsibility and obligation for their children's future development is to help their children overcome the obstacles caused by autism in social life.

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