

The Development of Science and Technology May Change People's Sense of Identity-Taking the Research in Neuroscience as the Theoretical Basis

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Abstract—The development of science and technology increases people's exposure to large amounts of information and data. Information determines the mode of operation and output of the brain; consciousness is a product of the brain. Meanwhile, as a process of understanding and comprehension, consciousness serves as the basis for the formation of identity. So in a way, information can determine people's idea of identity. Nowadays, the development of science and technology brings a sharp increase in the quantity of information. Thus, the final result can be the change in people's identity. Brain Science (Neuroscience) can be used as a medium and an analytic approach and methods in the study of human identity in this new information era.

Index Terms—Identity, information, neuroscience, science and technology

I. INTRODUCTION

The advancement and the impact of science and technology is increasingly changing people's view on the problem of "Who am I?" The human brain is constituted by a large number of neurons cells. These neurons have contact with each other and store information from the outside world. According to neuroscience, the differences in people's language, behavior, thinking, etc are caused by the differences they use their brains as well as the ways their brains process information. People take in a lot of information every day. Neurons in the system assemble the information together, make analysis and pass it onto the body, directing people to react differently. To some extent, information feeds the brain while how the brain works determines what kind of person one will become. In other words, the development of science and technology put people in a different world. Human beings are surrounded by a huge amount of rapidly changing information which influences and changes people's perception of themselves and the world. This paper tries to explore the influence of science and technology on people's identity, taking the research in neuroscience as one supporting theory.

II. THE INFORMATION EXPLOSION BROUGHT BY THE DEVELOPMENT OF SCIENCE AND TECHNOLOGY

Science and technology is a distinctive kind of social

phenomenon and activity, carried out on the basis of human practices. While in turn it exerts great impact on human society. As mankind enters the late 1950's, the curtain of the Third Industrial Revolution has been drawn up, marked by the breakthrough and the rapid progress in information industry. The prelude to another age has begun. If one can claim that the first industrial revolution belongs to Watt and his steam engine and the second one belongs to the Siemens and his electricity generator, then the 21st century can be said to belong to the computer and the Internet.

The internet offers people a new and colorful world. Via major media such as television, Internet, newspapers, magazines and so on, people are exposed to a lot of information everyday while these information has been updated at a remarkable speed. At the same time, countless new information has been generated and spread worldwide. IDC (International Data Corporation) estimates that the total amount of data generated worldwide in 2012 reached 2.8 Ze byte (Ze byte: the measurement unit of computer storage capacity. English as ZettaByte, referred to ZB, a Ze byte = 1180591620717411303424 bytes). If these bytes are converted to high-definition movies, one of which is equivalent to 2 hours, then more than 3,000 million movies can be produced. These movies will take people more than 7,000 years to watch. And IDC predicts that the amount of data will double every two years. By the year 2020, the amount of data produced all over the world will reach 40 Ze. Although the average data an ordinary person can receive is comparatively quite limited, it is still an astonishing quantity in contrast to the information our ancestors received every day. An ordinary person just received a small part of the data, but compared to our ancestors it is still very large. Victor Mayer-Schoenberger, professor of the current Internet governance and supervision network of Oxford University, wrote in his best-selling book "Big Data: A Revolution That Will Transform How We Live, Work and Think" like this: "the existing knowledge and system is based on the results of the scarcity of data. People's thinking and working methods must adapt to changes taking place in the coming era of big data." Information age is a big change, bringing new values and methodology. It is also revolutionizing the way human beings work, live and think.

First, this new era changes the way people work and live. With the rapid development of science and technology, people see the coming of the "knowledge explosion" which demands people to constantly update and enrich their knowledge to meet the needs of the times. Learning has increasingly become an important part of life. At the same time, modern information technology has provided people with methods to process, store and transmit information, which is of great convenience to study, work, modern

Manuscript received July 14, 2016; revised October 23, 2016.

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transportation and communications. It can also enhance labors' productivity so that people can have more leisure time to fulfill their overall development and self-cultivation. People are enabled to engage themselves in more creative activities and undertakings like science, art, culture and education.

Second, information era promotes the transformation of thinking mode. Modern scientific and technological progress revolutionizes people's way of thinking in the following aspects: scientific theories and techniques influence the thinking subject, object and tool. Along with the rapid development of network technology, the Internet has swept its way into every household, becoming the major way many people get access to information. The internet is a virtual space. Its advantages such as being convenient, fast and flexible are beyond any doubt. It expands our knowledge and broadens our horizon, offering people channels for a space travel. Many people prefer reading books online without stepping their foot outside their house. One can receive letters from thousands of miles away within a very short period of time and get all aspects of information he wants to know. Through distance education network, people can learn more knowledge. The distance between people is getting much closer. One can upload texts, images, sounds, etc. on the internet. One can video-chat with people far away. One can download learning materials and other information, simulate 3D animation, make purchases online, seek medical assistance and tips. The merits and influence that information technology has brought to human beings are endless. At the same time, the traditional linear way of thinking is challenged. People have to get used to this new leap-like, non-linear way of thinking.

Finally, science and technology promotes the continuous changes of human cognitive ability, extending the limitations of human brain and senses. Thus, the depth and confines of human knowledge continues to expand and open up. As an important part of human beings' cognitive ability, languages are changing secretly. Young people are the majority group of internet users. Because of the fastness of the spread of information, many popular internet expressions appear and are welcomed overnight. Youngsters even try to combine these expressions with the daily oral language for various reasons such as for the sake of fun or labeling themselves as a special group. For those netizens, the use of those expressions can arouse a sense of belonging and make their communication easier since those funny expressions can create a light and relaxing atmosphere. The emergence of this new language crosses the differences in areas, dialects, ethnicity and even cultures. This kind of phenomenon is not a rare case. The changes in languages brought by the wide use of internet are happening everywhere. Though when and whether those expressions will become part of the official language remain a puzzle, one cannot neglect this trend. What's worthy paying attention to is that those expressions reflect the exchange and communication of different languages and cultures. People's vision about the world and other cultures must change accordingly. Technological revolution is such a powerful force that human being's work, life and way of thinking cannot escape its impact.

III. THE INFORMATION PROCESSING MECHANISM OF HUMAN BRAIN

The rapid rise of neuroscience (brain science) is a significant event in the fields of natural science in the last 30 years. It has also become one of the fastest developing frontiers of life sciences. The human brain is the most complex known structure in the universe. The reason why man has become the top of the life chain lies in the fact that human beings have a fundamental different and highly developed brain. Thus, in a sense, the understanding of the human brain is the key to recognize the man himself. If human beings want a better understanding of themselves, one needs to explore the mysteries of the human brain.

A. The Basic Structure and Working Principles of the Human Brain

The animals on the Earth have a nerve system after a long evolutionary process. All animals from lower-class animals to higher-class animals and then to humans, the nerve system is composed of nerve cells and glia cells. The structural and functional unit of the nerve system is the nerve cells (also called neurons), which is a class of highly differentiated cells. The human brain contains about 100 billion neurons. "Strictly speaking, neuron refers to neuronal inclusions (also known as perikaryon) and all of a nerve cell axons and dendrites. It can receive stimuli, produce and spread nerve impulses, and transmit nerve impulses to other neurons or to effector cells." [1] The complexity of the behavioral activity depends on the neuronal loops formed by a large number of neurons. Generally speaking, the nerve system is composed of neurons, constituting the basis of human behavior in different activities. Each neuron has formed a complex network in connection with other neurons. Then comes the so-called intelligence. A neuron receives input from other numerous neurons and then outputs the integrated information to other neurons. This vast network structure with numerous neurons becomes the basis for the generation of intelligence and consciousness.

B. The Human Brain: the Physiological Basis for the Birth and Development of Consciousness

Daily life is inseparable from the human consciousness. As an ancient philosophical proposition, the definitions of consciousness are complicated. In the field of philosophy, consciousness and matter are a pair of corresponding philosophical ideas. The former includes sensational forms like senses, perceptions and representations. It also includes rational forms such as concept, judgment and reasoning. "Modern psychology and neural science generally accept that consciousness is a product of the brain, but not neural activity per se. It is beyond the scope of neural activity; it is a mental activity. Some people call it the 'product' of neural activity; some people call it 'emergent properties'. In addition, there are people referring the neural activity of the brain which produces consciousness as neural correlates of consciousness. Neural correlates are the basic substances of consciousness." [2] Consciousness and the human brain are closely inextricably linked. It is a significant and intensive reflection of human brain's function and properties. All complex human behaviors are processed by the highly developed and flexible brain.

People's feeling, cognition, emotion, thinking and

behavior are based on the activities of the nerve system. Modern neurophysiology and brain science and other disciplines show that the human brain is connected with uplink and downlink transmission systems, forming a complex, dynamic network system. This uplink transmission system includes sensory configurations from the sight, hearing, smell, taste and touch. It also includes the sub-system formed by neural pathways connected to sensory configurations. Downlink transmission system is the circulative pathway system from the information generated by the brain to the effector organs (limbs and other organs of execution). People's social practice reflects the outside world in the process through a complex series of selection, integration and conduction of actions. The uplink transmission system sends the obtained information to different functional areas of the human brain, and the different function zones of the brain process the information through classification, selection, cross-network restructuring and integration to make judgments, forming instructions (decision-making), etc. Therefore emerges consciousness. Then, the downlink transmission system will send instructions (decision-making, etc.) to the effector organ. Human being can do according actions based on the instructions sent out by the brain. Through the practice of human beings, the outside world can be changed. This is a complete process, including the dynamic process of reflecting the external world and also the active course to change the external world and the subjective world. The basis for this process is the consciousness of the human brain and neural network systems. [3]

C. Information: Nutrients and Prerequisites for the Normal Function of the Human Brain

Human living environment is very complex and human activities (behaviors) cover a very wide range. Human beings are continuously and intentionally transforming and creating the living environment. Human brain receives a steady stream of incoming information from different brain receptors. Then the brain assembles and processes the information. By the further integration of these information, the brain can develop action plans and organize effective behavioral activities. One can say that information has become the raw materials for the human brain to produce and generate consciousness and to a great extent determines how people see themselves and the outside world.

As the first step of generating consciousness, simple reflex activity starts from the external stimuli feelings and senses. The birth and development of perceptual consciousness depends on external sources of information. Vision, hearing, taste, smell and feeling of the body compose of the human nerve system which is the most important sensory pathways. The formation of perceptual consciousness relies on the information delivered by these pathways. "In the process of social practice, people get access to all kinds of information from the outside world through the eyes, ears, nose, tongue, body, and other functional and sensory neural networks, and the information is transmitted to the brain central nerve system. In this process, neural network system and the human brain, especially the brain central nerve system, together process these external sources of information at different levels, in

different types and complete different levels of selection, integration and construction. This process simultaneously takes its departure from the concrete reality, and then enters into evaporation-like stage: concrete information becomes a variety of primary, abstract provisions. The abstract image of the external information has been reproduced in the brain. This is the preliminary stage for the birth of consciousness in the interactive and complex communication of the brain and the external world." [4] In this process, the visual system of humans and other higher-class animals is the most important sensory pathways. About 80% of external information transmitted into the brain is through the visual system. Blind humans lost most of the information. It is because the human visual system has a superior understanding of the world and thus is able to change the world. But for many other species of animals, the importance of the auditory system is beyond any doubt. Although the human perception of outside information relies mostly on visual system, a notable proportion of interpersonal communication is carried out through the auditory system. In fact, the decline of some aspects of personal social skills caused by blindness is more obvious. The key factor is the language which is critical for the formation of individual's identity and personality. What is obvious is that the lack of information has led to the improper function of human brain. The central nerve system doesn't have sufficient raw materials to process. This will greatly affect people's normal thinking activity and interfere with the way people see the world.

IV. THE FORMATION OF SELF-IDENTITY

"Identity" was initially a philosophical and logical concept, answering the question of "Who am I?" And later this idea enters into many other areas such as psychology, culture, history and so on. Therefore, the explanation of the term is complex. Many scholars analyze this concept from different angles. Ross Poole points out that "identity" first appeared as a social psychological concept describing the relationship between social life and the self: we can understand who we are through the resources our mode of social life can offer. More precisely, we have an identity because we recognize the features of image or performance we have. [5] Chryssochoou also agrees that "identity" is a special representative form of personal and social relations. She notes that identity creates links between social rules and psychological systems (or self-identity category). Its function is to integrate the individual into the social environment and help people to communicate, to establish contact with others. Charles Taylor claims that one cannot be one based on his own self unless in relation to some interlocutors [6] Roberta Guerrina has aired this opinion like this: From an initial discussion of the academic study of identity it is possible to ascertain that identity itself is part of ongoing debates and thus remains a difficult concept to grasp and define. There are, nevertheless, some key features that most scholars agree come together to create identity. On a general level, identity is a set of feelings that defines belonging. This notion of belonging implies assumptions about participation in a group's values, background and outlook. The group can change according to time and place,

and can include, amongst others, some or all of the following features: culture, class, gender, ethnic background, language and religion. The process of identity formation implies a degree of self-reflection and interaction with the external environment. [7]

From the various definitions listed above one can see the concept of "identity" is extensively and frequently used and researched in various disciplines and fields. It has the following basic characteristics:

First, although identity is regarded as a fixed concept, it is not immutable. It is in a process of change and development;

Second, identity is inseparable from the social environment. Social identity is a self-expression, a social form of self. On the one hand, it is a kind of self-image; on the other hand, this self-image is manifested through our social life; [8]

Third, identity is generated in the comparison with others. The reason why "I" am "I" is because of the existence of "others".

Therefore, from the discussion above, one can see regardless of the different definitions of identity, it is on the earth the consciousness about "who am I". The physiological and physical foundation for the production of this consciousness is still our brain. Then the next question is how this kind of consciousness is produced? In the field of brain research, there are some interesting findings. "Maybe it is unbelievable, but in this big world, only orangutans and humans can recognize their own image in the mirror. This is an astonishing fact. Another fact indicates that if one cuts off a bunch of fiber connecting the cerebellum and frontal cortex, we will lose the ability to recognize our own image." [9]

In addition, one must not forget that during the production process of self-awareness, the participation of information is also needed. The previous section discussed the importance of information in the process. "The generation of self consciousness needs several conditions. First of all, there must be self-related information and information processing. As far as mirror identification is concerned, the participation of the cerebellum and prefrontal integration of somatosensory information and visual information is needed. There is the need for self-centered spatial reference information system. Only on these bases, there comes an internal information process or namely psychological activity. Language plays a very important role in the generation of this self-consciousness. The birth of this kind of consciousness may exert an immeasurable role on primates animals in the use of their hands, planning behavioral programs, forecasting future events and even the expression of bitter-smile which is unique to humans. A highly developed prefrontal brain is the basis for the production of self-consciousness. If one compares self-consciousness as 'uncle Tom', then the prefrontal cortex is the 'uncle Tom's cabin'." [10] As a sense of feeling and self-awareness, identity is also a sense of consciousness. So the birth and development of identity is inseparable from the neural activities of the human brain. Many scholars reach the consensus that the formation of identity is impossible in a closed environment when the brain cannot produce this consciousness without outside sources.

V. THE DEVELOPMENT OF SCIENCE AND TECHNOLOGY'S IMPACT ON INDIVIDUAL'S SENSE OF IDENTITY

As described above, the development of science and technology brings all sorts of changes. With the development of high technology, machines can completely replace human's physical activity; computer takes the job of human brain; artificial intelligence develops so fast that the proportion of manual and mental work changes greatly; labor structure tends to be more intelligent; all kinds of artifacts replace the natural beings; human beings continue to use the "technical matter" to transcend themselves, freeing mankind freed from "hard labor". However, this "survival with technology" relieves the load of people, but at the same time, it makes people rely more on technology. This dependence will mercilessly but unavoidably develops to a degree that technology will control human beings. The direct consequence of the control is the drastic decrease in human freedom. On the other hand, how the changes brought by scientific and technological development will act on the brain and one's consciousness and consequently changing the way one sees himself and the world becomes a question. The answer still centers around the keyword - information.

One is already clear that self-consciousness is the advanced level of self-awareness. Monkeys and other lower-class animals have no self-consciousness. It only happens to higher-class primates such as chimpanzees. Human babies have no self-awareness either before the age of two. It is obvious that self-consciousness is the product of evolution and learning. And this process is indispensable from the human brain. "The survival activities of humans and animals in nature require the acceptance, analysis and storage as well as utilization of information from the surrounding environment The complexity of the structure of these information sets a high standard and offers the necessary preconditions for humans' and animals' psychology and behavior Feeling or consciousness can unify several basic processes and other cognitive ones such as attention, memory and thinking and other subjective feelings at different levels. At the same time, it can express the processing result in aspects like emotional experience, motivation, language and behavior, thus making the individual's cognition and behavior more adaptive and proactive." [11] The formation of people's self-consciousness can be viewed as the concentrated embodiment and reflection of the outside information. The human brain receives a large number of exogenous information from the outside world through various sensory channels at all times. With the development of science and technology, modern information and data has undergone tremendous changes every day.

Take China as one example. The number of Internet users now has exceeded more than 300 million, most of whom are youngsters. Some of them mostly spend their online hours watching Japanese, Korean and American TV series; some of them mostly play video games; some do online shopping, browse a wide variety of webs, news, blogs, articles and books; there are some other people surfing the internet to receive distance education, e-mail, contact with others, online-chatting. Among so many things people can do online, online-chatting has become a very popular trend (of

course, these categories are overlapping). The distance between people has been reduced to a face-to-face level. In this process, a large number of internet expressions become fashionable such as "fight father", "too young too simple", "Everything are clouds". One needs to note that languages, words and signals are actually the functional activities of consciousness which is the unique advanced function of the human brain. It is this unique function that makes the brain no longer simply rely on real environmental input information and internal sensory information to guide people's behavior. On the contrary, human brain can use the language stored in the brain cortex joint to abstract information and guide their thinking and behavior. At present, a large number of netizens using the internet buzzwords as a symbol. The network has become a part of their lives, which becomes the label for the young to flaunt themselves, to define and separate themselves from people paying no or little attention to network resources or information.

Next, information has started to cross borders and become unified. Through modern means of communication, in various parts of the world, news and events can be instantly known by people around the world. The initial important geographical factors that affect people's identity has been largely shaken down by the Internet revolution. Even the remotest corner on the Earth can be shortened to face-to-face distance. Text messages and online chat tools such as OICQ, MSN, Twitter and other popular ones eliminate barriers between different dialects settings. Development of science and technology weakens the important factors in the formation of identity such as language, religion, values, customs and different social systems and the like. Imagine what will happen in the future if one examines this phenomenon from the perspective of neural science. Since there is no significant difference in the basic structure of human brain, and if the nerve system receives and then processes a large number of similar information every day, the brain will send similar feedbacks to the body via neural circulative transmission system and guide people to make the corresponding actions and reactions. One can even boldly claim that the differences between modern Chinese and Americans in behavior and ways of thinking are much smaller than the differences between them and their ancestors. The boundaries of identity blur.

Finally, the changes brought by online games and TV shows on people's sense of identity should be paid attention to. Human perceptual experience has shown that people own the capacity to explore a specific target in a complex environment and to selectively process the target information. In the face of online games, it is not strange at all that some people become addicted to them because of the tremendous visual and auditory impact and the gorgeous pictures. They can not escape away from this kind of temptation. The sharing experience with others about the games they love, the talking and discussion about the game would naturally arouse a sense of belonging among those people. There are also some TV fans group in China. Some like to watch online Japanese or Korean or American TV programmes. These fans focus on specific fascinating stars, movies, TV shows, their favorite dialogues or clips. For

people who are addicted to video games or TV shows every day, what they see, hear, think are virtual events in a virtual space. In contrast to the excitement and wonders of the virtual life, the real daily life seems to be dull and boring. That's why a lot of people prefer the network and living a virtual life to get a sense of accomplishment and excitement that real life cannot offer.

VI. CONCLUSION

This paper can not involve a very detailed analysis of neuroscience, social psychology, media and other related fields. It just tries to study the "identity" issue from different disciplines. Based on the research in neuroscience at the present stage, the era of information explosion has influenced people's "identity" more or less. Many scholars have already focused on the changes of human identity in this information age such as American sociologist Turk Shirley. She is a dominant scholar in the study of identity in the network times. She made use of her expertise in fields of sociology, psychology and anthropology to explore how computer molds the way we think and feel by fieldwork and interviews, how people as human beings develop the sense of self-awareness, self-definition and self-identification. Manuel Castells's book "Power of Identity" also pays attention to the identity in the network society and its significance, but its emphasis is on social movements and political influence. We need to note that the scientific and technological development as well as the application of new equipment itself promotes the development of neuroscience. People can use more advanced and sophisticated instruments to explore the mysteries of the human brain, which can help to reveal the birth secret of consciousness and understand why people would look at themselves and the world in this way. It is often said that the development of natural sciences can promote the development of social sciences. In fact, social science can borrow new perspectives, experiment methods, discreet attitudes and strict research style from natural science. It is possible one day the research results of natural science can be directly used in social sciences to reveal some unresolved mysteries.

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