

What is cognitive science?

By Julia Lee Ai Cheng

AS a lecturer who works at the Faculty of Cognitive Sciences and Human Development, friends or acquaintances frequently ask me what cognitive science means.

History

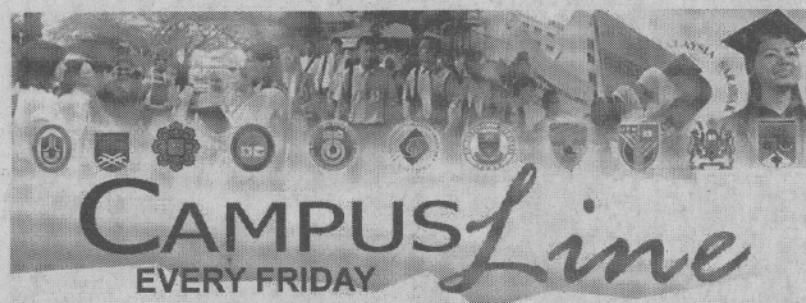
Cognitive science is a very young science in the world and even more so in Malaysia. The history of cognitive science dates back to the time of the Greek philosophers such as Socrates and Plato when they began ruminating about the human intellect. They were possessed by the quest to answer questions such as: Where is the mind? What does it consist of? How is knowledge represented in the human mind?

However, the questions of the human intellect were put aside when scholars such as Ivan Pavlov, B F Skinner, and J B Watson, who subscribed only to the public methods of observing the human mind and to the science of behaviour, toppled the proponents who were interested in understanding the human mind. These three scholars, known as behaviourists, were more interested in explaining how the human being functions from observable behaviours.

After much debate in the 1940s, the "forefathers" of cognitive science began to realise that a better and more scientific study of the mind was on its way. They were convinced that human activities such as learning, speaking, and performing on a musical instrument can be accounted for with insights about the brain and computers.

In the mid-1950s researchers from various areas such as linguistics, mathematics, neurophysiology, computer science, and artificial intelligence met at the Massachusetts Institute of Technology for a symposium on information science (Gardner, 1985). They wanted to understand the functions of the mind and began to build theories of the mind using complex computational representations with the help of computer systems. This meeting led to the cognitive revolution and cognitive science was born.

The researchers' quest to understand the mind led to the idea that there were similarities between the computer and the human mind. The computer was a useful analogy to understand the human mind.



Computers have input facilities such as the keyboard, mouse, bar code reader, and joy stick, while human beings have five senses to receive and filter information.

Computers have hard disks which are very similar to the long-term memory in human beings. Computers also have software programmes to run a set of procedures while human beings have memories in the mind capable of remembering procedures and knowledge to function efficiently and effectively in the world.

Computers have output tools such as the computer monitor and printed hardcopies while human beings have the capability of producing knowledge representations of the world around them.

Based on this discovery, the early cognitive scientists began to rely heavily on computers to understand how the human mind functions. This knowledge of the similarities between the human mind and computer systems was thought to be able to guide research in both psychology and computer science. The computer serves as the most viable model of how the human mind works.

What is cognitive science?

Today, cognitive science refers to the scientific study of the mind; how we think, perceive, remember, and learn. The coalition of researchers from various fields such as philosophy, psychology, artificial intelligence, neuroscience, linguistics, education, and anthropology has resulted in the interdisciplinary study of the mind through the studies and exchange of ideas of researchers in these fields.

As the human mind is the focus of the field, what was previously studied in a compartmentalised manner has now amalgamated to form clearer understandings of the human mind. The MIT Encyclopaedia of the Cognitive Sciences classifies the cognitive

sciences into six domains.

These are: computational intelligence, culture, cognition, and evolution, linguistics and language, neuroscience, philosophy, and psychology. Clearly the interdisciplinary coalition between these multidisciplinary fields is the best way to uncover our search about the human mind.

Many other reputable sources converge where the definition of cognitive science is concerned. The Stanford Encyclopaedia of Philosophy states that cognitive science is the interdisciplinary study of mind and intelligence, comprising psychology, philosophy, artificial intelligence, anthropology, education, linguistics, and computer science.

Meanwhile, Howard Gardner who wrote *The Mind's New Science* (1985) defines cognitive science as "a contemporary, empirically-based effort to answer long-standing epistemological questions particularly those concerned with the nature of knowledge, its components, its sources, its development, and its deployment".

Today, Cognitive Scientists still ruminate about the nature of the human intellect. How is knowledge stored? How might knowledge be lost?

In order to answer these questions, the multi-disciplines such as philosophy, psychology, artificial intelligence, linguistics, anthropology and neuroscience have been drawn together to answer these questions and to produce products that would model human thinking and human behaviour.

How can we investigate the mind?

Historically, research in the field of cognitive science conducted extensive research on animals due to the non-existence of 'non-invasive machines that could capture what the mind was doing while a person was engaging in a particular task

such as singing, reading, crying, and sleeping.

Today, there are many non-invasive machines in the market that can scan the brains of both adults and children.

The popular types of brain scanners are Magnetic Resonance Imaging (MRI) and Functional Magnetic Resonance Imaging (fMRI). The use of these machines has illuminated complex problems such as dyslexia.

Researchers-cum-Professors of Paediatrics such as Sally Shaywitz and Bennett Shaywitz from Yale University have found through the use of the fMRI that they could directly evaluate the effects of specific reading interventions on the neural systems for reading (Yale Bulletin, 2004).

With the use of these high-tech tools they were able to discover that early intervention and effective reading instructions are important to take advantage of the plasticity of our human brain. This finding is very important because it points us to the path where education and health sciences experts can come together, exchange ideas, and discover a holistic solution to address dyslexia in society.

The field of cognitive science is therefore extremely important for the advancement of society, whether we are solving social problems or specific problems such as the learning disorder just mentioned.

Applications

The applications of cognitive science research are vast. Today basic cognitive science research has also moved into the classroom. A science of learning is possible because of the many research projects undertaken on cognitive development to understand how children learn. Going deep enough using what we know about cognitive science such as how the human mind works is helping us improve teaching and learning.

Zawawi Ismail (1998) mentioned in his keynote address on the Business of the Mind at the National Conference on Cognitive Science in 1998 that the understanding of cognitive science will also be able to address issues of human resource development and the management of organisations.

Recently, I learned from a professor from Nanyang Technological University of

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Singapore that we can apply the "Language of Leadership" to frame the minds of our subordinates. She suggested that "Language is the most powerful tool of influence. As leaders we must be selective of the images that we want to create or frame in the minds of people around us. Messages that are not thought of carefully or crafted well are much less likely to have the impact we want." Therefore, from my perspective, the understanding of how people understand messages is useful for those leaders who are interested to embark on paths of transformational leadership.

As you can see by now, the areas of application in cognitive science are so vast. It only depends on how a faculty in a university defines its niche areas. Cognitive science has a lot to contribute to our understanding of human development. The problems we face today are human development issues and they have to be analysed from a cognitive perspective.

For example, rapists should not only be jailed. Their minds and thinking processes should be investigated. Questions I raised about the recent case in Thailand and Sungai Petani are: Why did they want to rape and kill a woman without any alibi only to be jailed hours later after a short session of brutal fun?

Understanding the minds of criminals and killers would help us understand more about these social threats and would help us think further about preventive measures. We certainly do not want to build more jail cells. We want society to progress and not regress.

Cognitive science in Malaysia

Internet research reveals that there are more than 60 universities worldwide that offer Cognitive Science as a field of study. This list includes universities such as the University of California-Berkeley,

University of Edinburgh, Johns Hopkins University, University of Illinois at Urbana-Champaign, and Massachusetts Institute of Technology.

Universiti Malaysia Sarawak is one of the three universities in Malaysia having trailblazed this new field through the setting up of a faculty that offers cognitive science courses to its students.

The vision for the establishment of the Faculty of Cognitive Sciences and Human Development is found in the Unimas Tree Book (1993).

The pioneer leader of the university at that time mentioned that "as our society becomes more knowledge-based, ever more skills are required. New approaches will need to be sought to solve issues of growing complexity, and one central aspect of such change is the mind itself."

It was visualised that the Faculty of Cognitive Sciences and Human Development would "be geared towards the issues of creativity, technology utilisation, and value reinforcement."

To conclude, I share one last question people have asked me about cognitive science. Can people, trained in cognitive science or psychology read other people's minds? This was a question posed to me once during a dinner party.

My answer is very simply "No". People trained in the field of cognitive science cannot read other people's minds. We can however, use our training in scientific observation, empirical methods or questioning skills to understand a phenomenon or a person(s).

Julia Lee Ai Cheng is a lecturer at the Faculty of Cognitive Sciences and Human Development (FSKPM) and Head of the e-Learning Unit at the Centre for Applied Learning and Multimedia, Universiti Malaysia Sarawak (Unimas)