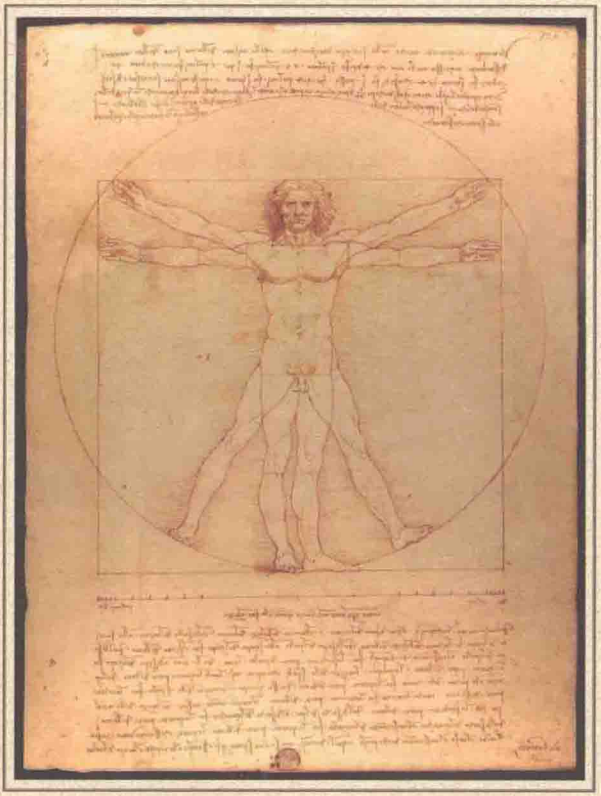
思维工程导论

INTRODUCTION TO MIND ENGINEERING

钱小一·著



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此书献给我亲爱的妻子林晓冬

This book is dedicated to my dear wife Xiaodong Lin

感谢陈芝荣先生、李忠良先生、宋玲玲女士、苏维锋先生、
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照着造物造人的道理去造一个智能体

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Introduction

Ages are mutually inoculated.

As the computer era leads to the advent of the Internet era, the Internet era will give birth to the era of artificial intelligence. In that age, each person's concept of work and life will be toppled, artificial intelligence will replace us in our work either physically or mentally, they will enter our life. Naturally we will consider what this era would bring to us, and decide to accept it or refuse it. However, like anyone who existed before in the constellation of history, we lack the ability to change the tide of the age. That day will come, and artificial intelligence will change everything we know about this world we are familiar with.

As early as the beginning of the computer age, man has started the creation of artificial intelligence (AI). For once, AI became a hot spot in the scientific field. As time passed, researchers for AI differentiated. One very small group of people kept their grand goal to achieve strong AI, in which they dedicated to reconstruct the core mechanism of human intelligence in computer. The others shift their goal to weak AI, in which the engineering practice is task oriented, for example built an answering machine that could answer certain customer calls, or build a robot that could research the space. After then, strong AI has remained stagnant in recent decades. Many people aspired to achieve strong AI in their young age, but entered the field of weak AI eventually. Because the research in weak AI can be commercialized in short run, so it can attract researchers and capital. The strong AI, on the other

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hand, is more difficult and complex, and no benefit would be achieved in a short run.

Everything has its reason. One major reason that strong AI remained stagnant in recent decades is that people mixed the system that creates "feeling" together with the system that generates "intelligent presentation". We cannot deny a possibility that intelligence is merely a presentation, and "true feeling" comes from a pure receptor. This conclusion may come from the discussion of philosophy concerned existence, a deduction of pure logic, which we will discuss in detail in Introduction II. This conclusion forms the basis of our theory in this book, and defines the boundary of our task — about what we can create and what we cannot. If "true feeling" comes from pure receptor, then we cannot gather any information about how it is generated, as no information comes out from the pure receptor. So it is impossible for us to reconstruct the mechanism of true feeling. We could construct is its presentation. Now we could understand that if we try to create intelligent presentation together with true feeling, it is like mixing a solvable problem with an unsolvable problem and renders the solvable problem unsolvable. If our assumption is right, this may explain why strong AI remained stagnant in recent decades. The presentation of intelligence is something we can create, we can create such a perfect presentation that in the future we cannot possibly tell a robot is true human or not if we meet him and talk with him, although it does not have true feelings. As the old saying "Pay to Caesar what belongs to Caesar — and God what belongs to God".

Weak AI has influences on many fields, such as visual intelligence, acoustical intelligence, linguistic intelligence, and thinking intelligence etc. However, empirical data shows that weak AI though aimed at duplicating certain intelligent function of human but it stopped progressing as it get closer to human level. As will be discussed, every dimension of intelligence of human beings relies on one common core which combining every aspect of human

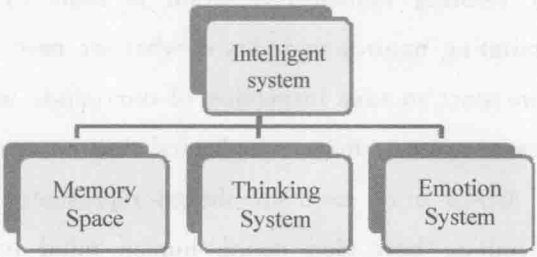
intelligence as integral. In fact, the existence of such a core makes intelligence inseparable, and this core helps us to realize all the mechanism of every partial functions of intelligence. Therefore, it is difficult for us to create partial intelligence of visual, acoustical, linguistic and thinking that could be compared to human beings without the construction of the core. When we do, that means we already create a core of strong AI successfully, and this means that the stage we achieve strong AI is not far away.

Another reason caused the slow development of strong AI, is that human beings are always overly confident on their own creative ability. As a matter of fact, the already existing human civilization is built by the process of discovering and imitating nature, and this is what we need to do for the AI industry. When we start to take inspection of our mind, we realize it is an extremely complicated system, more complicated than any engineering designs we already have. God's most exquisite design represented here. What we should do is to imitate how God create human mind to create artificial intelligence. And overconfidence of our creative ability will cause stagnant dilemma as it has always done on the career of strong AI.

We need to point out that what we do is not innovating, but imitating. On another level, we are not starting from the observation of neuron behavior to reverse the function of human brain, but to investigate the mechanisms behind human intelligence in the logic level through introspection. Whatever the carrier is, we should be conscious that as long as we could reconstruct the information flow in human mind and achieve each sub-system mechanism, and link these sub-systems together, we are able to reproduce the logic of human intelligence. "Logic Bionic" can describe what we do.

As we define our work as logic bionic, systems theory is a perspective we can use to generate theory for Mind Engineering. As what we do in all dynamic systems, the cognitive task can be divided into two parts. In the first part we treat the system as static, we consider how the system under certain state

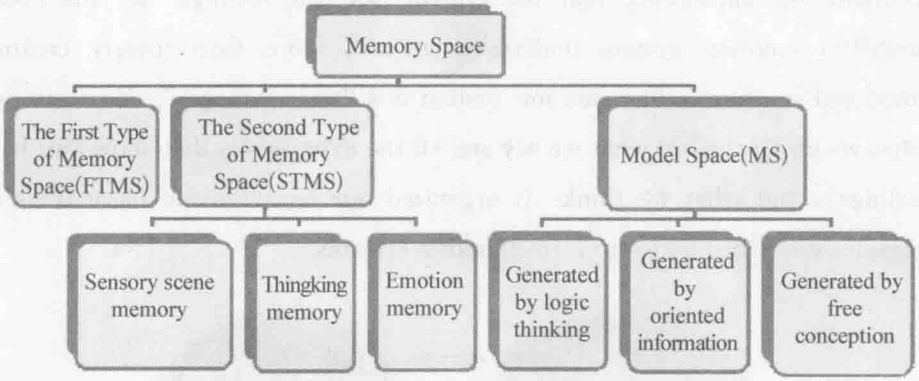
creates external reaction; and then we consider the mechanism how the system changes itself. In the perspective of system theory, we could divide a system into modules. A natural thing to do is to distinguish two kinds of modules, one is called "Operational Module", one is called "Storage module". Operational modules will not change because of the operating of the system, but storage modules do. Under the spirit of this division, in this book we divide the system into three sub systems — memory space, thinking system and emotion system. Later we will see that memory space is a storage module, and thinking system and emotion system are operational modules.



Memory space can continue to split, it includes: The First Type of Memory Space (FTMS), The Second Type of Memory Space (STMS), and the Model Space (MS). The first type of memory space, stores objects, their attributes, and relation of inclusion①; the second type of memory space, stores the information of perception experience in the space-time frame, including external sensory experience, internal thinking experience, emotional experience. They respectively correspond to sensory scene memory, thinking memory, and emotional memory. Model space stores covers abstract scene②, or logic structure③. Model Space can be generated in three ways. The first way to generate those models is from the existing model space by strict logic thinking. Abstract models could be generated from relative concrete models by

① As we shall see.
② Like those models in physics.
③ Like those equations in mathematics.

the process of induction①; concrete models could be generated from relative abstract models by the process deduction. The second way to generate model is from so call "Oriented Information Stimulate Recording Process (OISRP)". It is what we do when we read a book, listen to a lecture, or watch a movie. The third way to generate model is by free conception, which is driven by emotion system. In the future we will see how those three types of memory space cooperate with each other so that our memory is being "understood", and we shall see that information being "understood" is the foundation of everything we are going to do in this book, and also the foundation of strong AI.

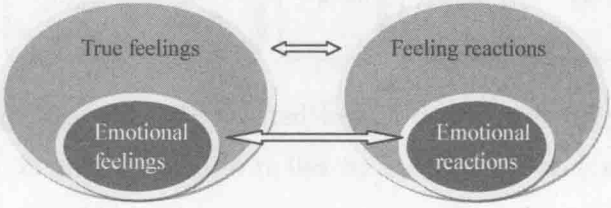


Thinking System as we defined here as "the Memory Space changer". Yet, it is not very appropriate to call it a system, just as we do not call Memory Space a system. Because for a system it should have a clear boundary, the causal chain come in or come out of a system should be in a neat pattern. However, for those three "subsystems", they interleaving together in the causal chain, and no clear boundary could be seen. Thinking System, as we defined here is consists of different Basic Thinking Modules (BTM). Each module receives and outputs specific types of information. Different thinking modules work together to form Thinking Process (TP) to modify the memory

① It should be mentioned that elements in the second type of memory space include the most concrete models.

space.

For the Emotion System, we need first to distinguish two easily confused concepts — emotional reactions and emotional feelings. Emotional feeling is a part of the above said "true feelings", including happiness, anger, sadness, fear and so on. Emotional system creates information flow that input the "pure receptor" to form those emotional feelings. This receptor is "pure"① according to our basic assumption, thus cannot be cognized, cannot be modified or rebuilt in this world. Emotional reactions, on the other hand, are part of so called "feeling reaction", is a information stream comeback to the intelligent system to create the appearance that the system has true feelings. In this book, however, emotion system undertakes a task more than merely creating emotional reactions. The emotion system is a "task manager". It determines what we do (including what we say and all the expressions that shows we have feelings), and what we think. It organized our behavior and basic thinking modules we talked above to form thinking streams.



Above we have described the rough framework of Intelligent System. In the future we will increasingly feel that the Intelligent System of human is an entirety. Though we separate it to several sub-systems to discuss them, yet those sub-systems work together to create every complete stream of information in the system. Artificial intelligence is not an apple that can be cut apart. There is no partial function that could be perfectly achieved independently without the construction of the whole system.

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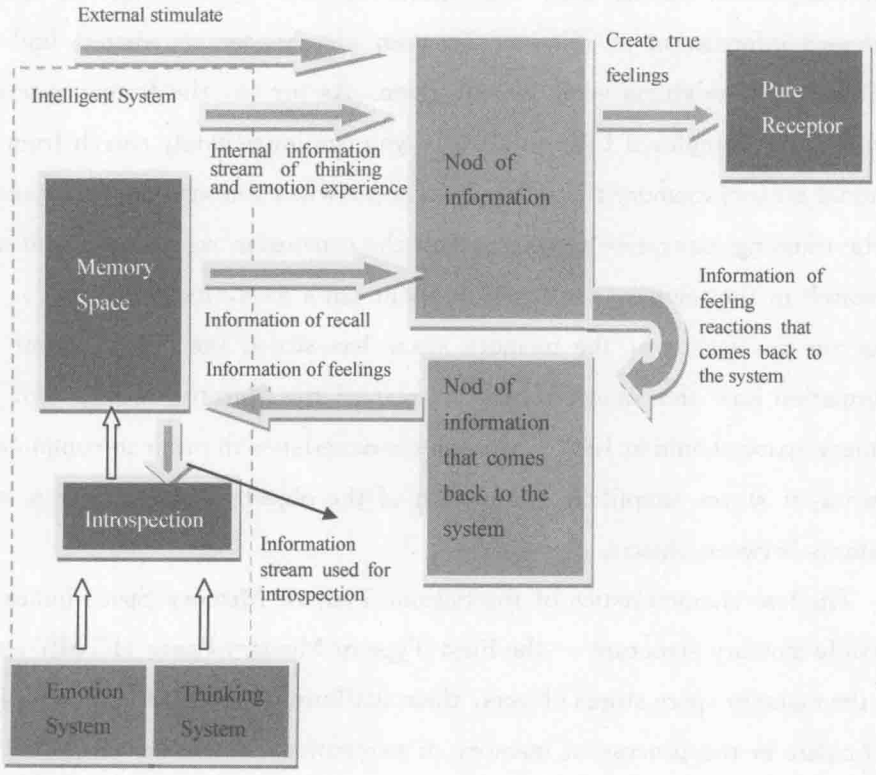
① See in Introduction 2.

When we take introspection to see how our every cognitive conclusion is formed, we will find that memory provides all the materials that are needed for our thinking. In addition, we can also see these materials are from different types of memory. When we see two ants in a fight, thinking about who would win, we will call the memory of winner's characteristics; when we miss our lover, we will call the memory of being together, the scene and the feelings. So, on the first level, a type of memory is to record the abstract relationships between things of the objective world; there is also a second type of memory is the recorder of our perception experience, that is how we create the concept of The Second Type of Memory Space (STMS). There are clear boundaries among STMS: memory that records sensory experience, including where we



Information stream relative to introspection

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