Reexamination of Individual Knowledge and Common Behavior Rules: A Cross-disciplinary View Based on Empirical Evidences

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Abstract

Based on evidences from empirical disciplines, the paper offers three different basic assumptions and one simplified framework on individual behavior when dealing with signals from uncertain environments. On the basis of these, the paper defines individual knowledge and shows its hierarchical state, the connatural- and the acquired-shared-knowledge among individuals. Furthermore, the paper describes and explains the sources and general mechanisms of changing of these kinds of knowledge, and stresses that human connatural knowledge is the most stable level in the entire knowledge, which constitutes the fundamental prerequisite for mutually recognizing signals (or events) and interactions among individuals; The acquired-shared-knowledge, however, is the common anticipation owned among individuals about behavioral response of other individuals facing a signal; it derives from interacting experiences between individuals and circumstances or among individuals; and stable accumulation of the knowledge is one of key foundations on which the stable anticipation of individual behavior, commonly behavioral beliefs and rules will can be formed in a group.

Key Words: individual assumptions, simplified behavior-framework, individual knowledge, knowledge hierarchy, shared knowledge, common behavior rules, empirical evidences

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1. Introduction

What behavioral and knowledge state do human beings possess through the long history of natural evolution? How do they obtain knowledge and change their behaviors in a truly uncertain environment? How are common behavioral rules, such as conventions or customs, formed and changed within human groups? These questions have being discussed in guess and ambiguity (Vanderwolf, 2007).

Nowadays, however, an obvious trend in economics is the emphasis on cognition element of an individual and its influences on behavior (i.e., Masahiko Aoki, 2001; D. C. North, 2003, 2005; V. L. Smith, 2003; ect.). These weaken the rational assumption held by main stream economics and struggle make efforts to grasp the truth of individual behaviors and cognitive changes.

Along the above-mentioned developmental path, under the real uncertain environment, how should we properly set individual behavior as a premise, and explain individual knowledge change and formation or evolution of common behavioral rules within behavioral interactions, so as to avoid simply induction or abstractly deduction from phenomena, even if with no perfect mathematic formalization initially? In order to do this, we might need to surpass the original economic boundary and go farther along the naturally evolutionary road of human beings.

Following the thought of "falsifying a theory" (K.P. Popper, 1963) and building on testable findings from empirical disciplines, such as cognitive neuroscience, evolutionary psychology, animal behavior study, and so on, the paper tries to exposit general conditions of individual behavior, formation of individual knowledge in behavioral process, and the change mechanism of common behavioral rules (i.e., shared knowledge) among individuals in the behavior interacting process. The structure of this paper is as follows: based on empirical materials, three different

basic assumptions and one simplified framework on individual behavior are offered in the second part; in the third part, individual knowledge change, and formation and change mechanics of shared knowledge among individuals are explained respectively; finally, the conclusion of the paper is provided and related questions are discussed in the fourth part.

2. Basic Assumptions and a Simplified Framework of Individual Behavior

2.1 Basic Assumption 1: Hierarchical Preference

In the process of natural selection dealing with uncertain environments, human beings form stable behavioral tropisms or propensities internalized in their genes (K.Z.Lorenz, 1981; D.Morris,1970; E.O.Wilson, 2000; etc.), which might mainly include propensities of energy ingestion, sex, exploring(or novelty-seeking), etc[1].

In human economic-social activities, however, those behavioral tendencies or interests (e.g., G. S. Becker, 1976), varying with different circumstances or individuals, are not innate, but are acquired by experiencing uncertain environments and by behavioral learning of trying or imitating; so they are changeable and can be different from each other.

Mainstream neoclassical economics usually uses one conception "preference" to characterize behavioral tendency, but does not distinguish the naturally evolutionary ones from the others formed by acquisition. So in its description or analysis of individual behavior, there always exists deviation from reality.

It is necessary to divide preference into at last two hierarchies - the inner and the outer. Derived from the process of natural evolution, the former is stable and keeps the same among human beings (if neglecting the difference on food-taking among Inuit lived in the Arctic regions and other humans); based on this biological foundation, individuals undergo their environments and

form their mutable outer-hierarchy preferences, as shown by the Figure-1.

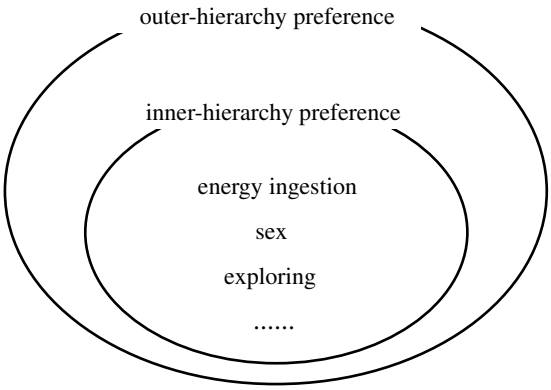

Figure-1 Preference Hierarchy

From the viewpoint of modern neurobiology (J. G. Nicholls, et al., 2001; V. K. Jirsa and A. R. McIntosh, 2007; ect), behavioral propensity of an individual can be considered as connections of different signals between neurons. So, the inner-hierarchy preference is the stable and common neuronal connection in all human beings. By contrast, the outer-hierarchy preference is the acquired neuronal connection, and is alterable or adjustable.

Therefore, we get the Assumption 1 - hierarchical preference: Preference can be divided at least into the stable inner-hierarchy and the mutable outer-hierarchy one.

2.2 Basic Assumption 2: Learning Capacity

After experiencing their environments, why can human beings acquire outer-hierarchy preferences (i.e., form certain neuronal connections)? The key reason dose not lie in learning behavior itself, but in the capacity which make the former possible. When discussing human aggression, E.O.Wilson (2000, p.255) indicated, "We are now sophisticated enough to know that the capacity to learn certain behaviors is itself a genetically controlled and therefore evolved trait."

M.D.Hauser and E.Spelke (2004) showed that the foundations of human acquiring skills are a set of psychological and neural mechanisms, which are shared by all individuals.

That is to say, from the viewpoint of behavioral performance, an individual deals with various (repeated or new) signals from outside environments, undertakes behavioral learning and acquires outer-hierarchy preferences. The capacity itself, however, forming neuronal connections and making learning possible, derives from the process of human natural evolution, and is stable and the same for everyone.

Empirical disciplines have discovered some types of capacity, for examples, capacity of (chemical or social) signal recognizing (S.Hao et al., 2005; P. H.Rudebeck et al., 2006), capacity of (anticipatory or generalizing) signal operating (W.Schultz et al., 1997; J.W.Brown and T.S.Braver, 2005; N.P.Rougier et al., 2005), capacity of dynamic switching between signal connections (C.K.Machens et al., 2005; K.R.Ridderinkhof and W.P.Wildenberg, 2005), ect.

Before economics analyzes and explains individual behavior, it is necessary to understand and differentiate between learning capacity and learning. The former is the unlearned biological foundation on which signal connections can be formed among neurons. It is to the same for every individual. But learning is a behavioral process in which an individual forms signal connections. Please see the Figure-2.

Therefore, there is the Assumption 2 - learning capacity: It is unlearned and to the same for everyone, by which an individual performs learning behavior.

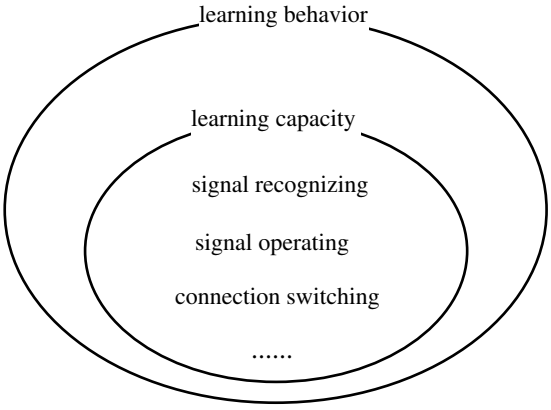

Figure-2 Learning Capacity and Learning Behavior

2.3 Basic Assumption 3: Evaluation-feedback Mechanism

How do human beings process environmental signals when possessing hierarchical preference and learning capacity?

Empirical findings reveal that there exist some types of signal processing mechanisms in human beings. According to functional differences, these mechanisms possibly can be divided into three types : firstly, the most stable mechanisms, such as reflex in early behavior studies (I.P.Pavlov,1927); secondly, more stable mechanisms, mainly including most neural response systems derived from natural evolution except reflex[2]; thirdly, mutable mechanisms, formed in individual experiences. The first two are likely evolved from the process of natural evolution together with inner-hierarchy preference and learning capacity, and cannot be consciously perceived by human beings; the last one, however, under the regulation of the first two and directly based on the outer-hierarchy preference, can be consciously used and be adjusted with acquired preferences by individuals.

Here we refer the above-mentioned three types as evaluation-feedback mechanism, in which an

individual compares received environmental signals with all hierarchical preferences. If signals are identical with those preferences, “quasi-reward” evaluation will be produced, and the related signal connections can be formed and accumulated in individual’s learning process or outer-hierarchy preferences. On the contrary, “quasi-punishment” evaluation will be produced, and the related connections will be formed in the similar way.

So there is the Assumption 3 - evaluation-feedback mechanism: On the basis of assumption 1 and 2, an individual has an evaluation-feedback mechanism to process outside environmental signals.

2.4 One Simplified Framework of Individual Behavior

Synthesizing the above-mentioned three assumptions, we offer a simplified framework of individual behavior when dealing with outside environmental signals, shown in the Figure -3.

Inner-hierarchy preference and learning capacity constitute the most stable level of individual behavior; based on it, an individual evaluates environmental signals, and gradually acquires perceivable and alterable outer-hierarchy preferences with different stability through experiences; together with learning capacity, inner and outer-hierarchy preference, he or she makes behavior when facing those signals. Especially, when dealing with repeated signals, he or she shows repetitious behavior mode (such as behavioral habits, customs, etc.); after his or her behavior acts on outside environment, he or she anticipates or receives relevant feedback signals. Through evaluation-feedback mechanism's processing again, he or she may maintain original behavior (or behavioral mode), or adjust it (such as changing one’s habits, customs). Please see the Figure-3.

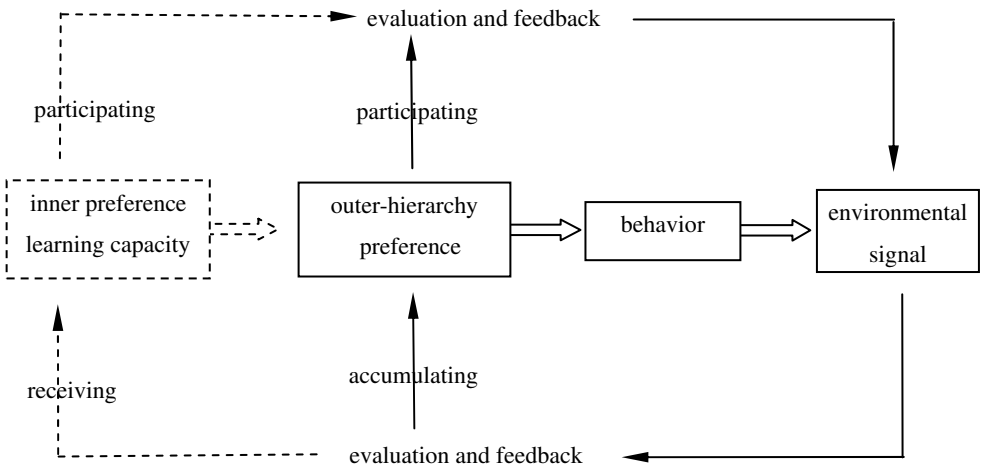

Figure-3 Simplified Framework Based on the Three Assumptions

It needs to be noticed that, first, the most stable inner-hierarchy preference engages in the process of evaluating and feeding back signals all the time; but, usually, it can not be perceived by human beings. So in the Figure-3, it is denoted by an arrow with the broken line. Second, results from evaluation-feedback mechanism cannot be accumulated in inner-hierarchy preference and learning capacity, but can do so in outer-hierarchy preferences. This is because, as discussed previous, inner-hierarchy preference and learning capacity, derived from the natural evolution process, are relatively stable. In the recent million years since the agricultural revolution, human behavior modes and social structures have changed vastly. From the viewpoint of natural evolution, however, the time is too short to select for new complex cognitive programs (L.Cosmides and J.Tooby, 2006). Therefore, the paper treats inner-hierarchy preference and learning capacity as unalterable ones.

3. Hierarchy and Change of Knowledge

As discussed above, preference is of hierarchic, including both evolved stable connection among

signals (inner-hierarchy preference) and acquired alterable connection from experience (outer-hierarchy preference); learning is a behavioral process forming and building certain connections among signals; what makes learning possible is the stable learning capacity evolved from natural evolution (capacity of forming connections); from the perspective of final outcome of behavior, after being evaluated and fed back, acquired connection is gradually accumulated in outside of inner-hierarchy preference which always influences on the former.

The above-mentioned concepts are set forth on the basis of signal connection. F.A.Hayek (1952) thought that the entire human mental structure or knowledge derives from the connections between neurons and their signals. Based on this idea and other empirical findings, we think that ***individual knowledge*** is a connection between one event (or a signal) and another. Accordingly, accumulation of knowledge is storage of the connections.

Given the behavioral assumptions and the above-mentioned framework, in real circumstances, what state of knowledge does an individual have? How does individual behavior interact with knowledge gaining, changing, and accumulation? How does behavioral interaction bring about shared knowledge (or common behavioral rules) among individuals, such as conventions or customs?

3.1 Hierarchy and Change of individual knowledge

As we defined above, knowledge is a connection. And there are both the stable and the acquired in connections. Correspondingly, knowledge can be divided into inner-hierarchic (or connatural) and outer-hierarchic (or acquired) one. Mainly relating to the stability of preference, the stability of knowledge is gradually weakened from the inner to the outer: the more stable preference is, the more stable knowledge is; the more alterable preference is, the more unstable knowledge is.

Connatural knowledge is most stable and is called inner-hierarchy one. Acquired knowledge (i.e., connections learned from experiences) is in out-hierarchy. Knowledge in a different hierarchy has a different degree of stability. Please see the Figure-4.

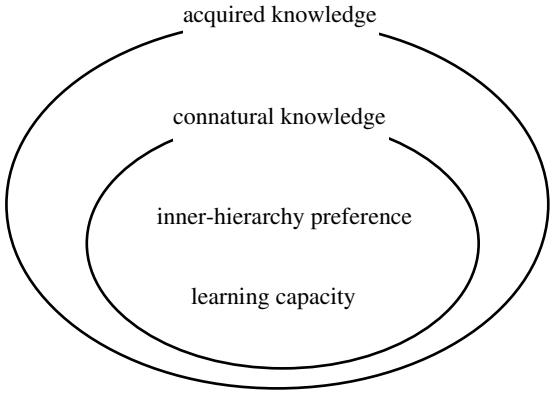

Figure-4 Hierarchical Knowledge

The first hierarchy: connatural knowledge. It includes inner-hierarchy preference and leaning capacity determined by genes, and is shared by all human beings. It is still steady and unalterable in social communication, which constitutes the fundamental prerequisite for mutually recognizing signals (or events) and interactions among individuals.

The second hierarchy: acquired knowledge. Besides the connatural knowledge, an individual owns acquired knowledge from experiences. This part of knowledge can be changed or adjusted and is different for different individuals[3].

Generally speaking, the source or change of acquired knowledge comes from new signals. The acquisition mode of the knowledge is direct trial and error or imitation. One situation is that facing a new signal, through the existing accumulated preference, an individual evaluates and feeds back it and its resulting signal. After the new signal repeats several times, by means of evaluation of the

original preference, he (or she) establishes a new connection between the new signal and its resulting signal. In this situation, he (or she) acquires new knowledge, but the original preference is not changed. There are many such things. For example, after a change of technology, an individual gets help from it to reinforce his or her original preference and improve the efficiency of his or her original act.

Another situation is that a new signal changes the original preference and forms new preference and knowledge. That is, when encountering a new signal a and its resulting signal a', an individual reevaluates original preference p_1; after a and a' repeat several times, they may increasingly change p_1 , and form a new preference p'_1 and related new knowledge. There are many such examples . For instance, after successfully having abandoned bow and arrow and used rifles twenty five years, facing massive slaughters, Maori in New Zealand started to question their centuries-old fighting preference. Then after a short time, the original preference was fundamentally changed, and all Maori were converted to Christianity and completely stopped their tribe wars (E.O.Wilson, 1978).

As discussed above, connatural knowledge of individuals is a common trait from human natural evolution and a fundamental precondition of interaction, which therefore can be called connatural-shared-knowledge among individuals. Although not exactly the same in acquired knowledge among individuals, there still exists partially common or similar acquired knowledge from common or similar experiences, which we call acquired-shared-knowledge. As far as the signal connecting feature of acquired-shared-knowledge is concerned, the knowledge is the common anticipation owned among individuals about behavioral response of other individuals facing a signal.

Here the connatural-shared-knowledge will not be discussed, but the emphasis is mainly put on acquired-shared-knowledge.

Source or change of acquired-shared-knowledge still originates in a new signal which can be received among individuals. Generally speaking, the signal may mainly come from change of individual environment (such as migration, ubiquitous uncertainty in economic systems, etc.), or from another's new behavior. When a new signal occurring, it breaks the stability of original behavior anticipation. Hereafter, along with learning and interaction, common behavior anticipation about the new signal, i.e., new acquired-shared-knowledge, will be increasingly formed among individuals. Please see the Figure-5.

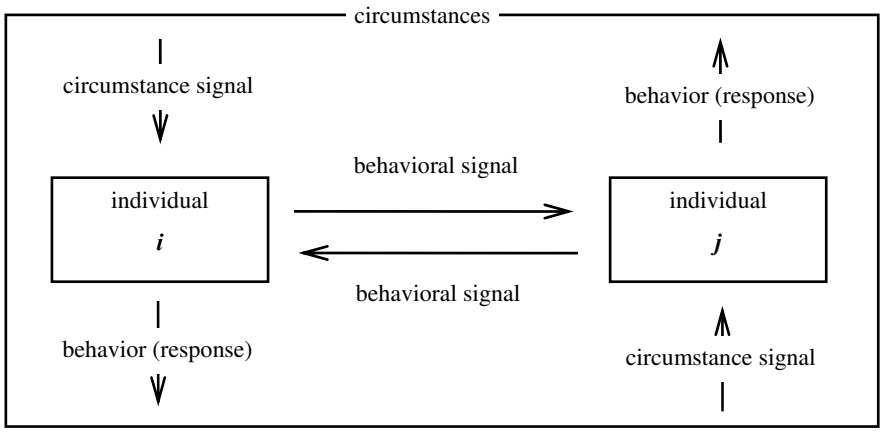

Figure-5 Interaction and Shared Knowledge

There are two key points in the Figure-5:

The first is formation of acquired-shared-knowledge in the interaction between individuals and circumstances. When a new circumstance signal is simultaneously recognized by individual ***i*** and ***j***, they observe each other's behavioral response. With the signal repeating, they can gradually

facilitate the previous observation and estimation about each other's behavioral response to change into common behavior anticipation about the same content. The process can be enlarged among n individuals and thus shared knowledge can be formed among them.

The second is formation of acquired-shared-knowledge in the interaction among individuals. Under a common circumstance, when individual i sends a behavior signal a_i to individual j, j gives off behavior response a_j by evaluating and feeding back a_i. If the connection a_i-a_j between a_i and a_j does not comply with i's anticipation, i will possibly adjust his (or her) behavior and again send out behavior signal a'_i according to his (or her) preexisting knowledge. If the connection a'_i-a_j between a'_i and a_j still does not comply with j's anticipation, it may subsequently induce an adjusting behavior a'_j from j, ……, and so forth. Through observation, try-and-error, or imitation within a certain period, shared knowledge between i and j will be ultimately formed. The interaction between i and j may serve as a new signal to individual k. In the same manner, shared knowledge about a same behavior signal will be formed among i, j, k, ..., n individuals. So according to this viewpoint, formation and possession of relatively stable shared knowledge only can provide firmly shared beliefs and behavioral rules for every individual's behavior anticipation and their interaction within a group. Acquired-shared-knowledge is the core of group's behavior convention, custom, or institutional rule.

4.Conclusion and Discussion

Based on evidences from empirical disciplines, the paper offers three different basic assumptions on individual behavior - hierarchical preference, learning capacity and evaluation-feedback mechanism, and one simplified behavioral framework when an individual dealing with outside environmental signals. On the basis of these, we think that individual knowledge is a connection

between one event (or signal) and another, accumulation of knowledge is storage of the connections, and point out the hierarchical state of individual knowledge - unalterably connatural knowledge in inner-hierarchy and changeably acquired knowledge in outer-hierarchy and, the connatural- and the acquired-shared-knowledge among individuals. Furthermore, the paper describes and explains the sources and general mechanisms of changing of these kinds of knowledge, and stresses that human connatural knowledge, from the natural evolution, is all the same and independent of individual experience, region or culture; it is the most stable level in the entire knowledge of human beings, which constitutes the fundamental prerequisite for mutually recognizing signals (or events) and interactions among individuals; the acquired-shared-knowledge, however, on the part of the signal connecting feature of knowledge, is the common anticipation owned among individuals about behavioral response of other individuals facing a signal; it derives from interacting experiences between individuals and circumstances or among individuals; and with its accumulation, the stable anticipation of individual behavior, commonly behavioral beliefs and rules will can be formed in a group.

The paper thinks the three aspects as following are important and should be discussed further:

4.1 Connatural Knowledge, Individual Rationality and Neoclassical Economics

Although not perfect, the shared connatural knowledge from the natural evolution is a fundamental precondition based on which human beings can interact with each other and obtain acquired knowledge from their experiences. Rationality is one of imperfect items included in the connatural knowledge, just by which human ancestors can never resolve evolutionary adaptive problems repeatedly encountered (L.Cosmides and J.Tooby,1994). From the viewpoints of hierarchy of preference and knowledge in the paper, the behavioral analysis of neoclassical

economics based on the rational assumption is better adaptive to the domain of inner-hierarchy preference and knowledge, not to the domain of outer-hierarchy because of its mutability and difference from everyone. From the basic state of human beings reveled by empirical disciplines and uncertain environment faced all along by people, as D.C.North (2005) pointed out, neoclassical economics is not good enough to explain or analyze changes in human behavior and knowledge.

4.2 Individual Experience and Knowledge Acquisition

Based on shared inner-hierarchy preference and learning capacity and through experiencing, an individual acquires outer-hierarchy knowledge under his (or her) environment. Especially under the condition of repeated environmental signal in the long run, certain steadier behavior propensity can be accumulated in outer-hierarchy preference, which further forms some steady mode of knowledge acquisition and therefore influences individual behavior significantly so that different people undertake different behaviors.

On the other hand, differences in individual experiences and their continuity or intensity lead to the differences in stability in outer-hierarchy preference or knowledge, which bring about the differences in degree of individual behavior adjustment under the same condition of information when environments change (such as migrating), and so as to present the phenomena that some people can learn but others learn slowly or even never able to learn under a new environment. Therefore, individual experiences play an important role between human biological substrate and realistic behavior (P.Stern and P. J.Hines, 2005).

4.3 Shared Knowledge and Common behavior Rule within a Group

On the biological level, human beings share nondistinctive connatural knowledge from the nature

evolution. Because of partial similarity in their experiences, individuals can share some acquired knowledge accumulated in the outer-hierarchy. The acquired-shared-knowledge is still one of important conditions of smoothly communicating and forming common behavior rules, such as convention, custom, etc., among individuals within a group. But in fact, because of the different stability of the original preference or knowledge acquired by individuals, especially under the strong influences of factors, such as religion, country, and political coercion so on, the birth of the knowledge within a group is not easy. That is, under the above-mentioned conditions, when different individuals are encountering or communicating in the same environment, it is difficult to form shared knowledge and conform to common behavior rules among individuals, which may be dependent on individuals' interaction in a long period, and on common signals of environment and behavior being repeated or reinforced continuously with no or least intentional interference. For example, as showed and predicted in A.Alesina and Nicola Fuchs-Schündeln (2007), it will take about one to two generations for East German's some preferences and beliefs to converge completely towards those of West Germans from 1990 reunification then on. Therefore, it will be significantly meaningful to observe and record those kinds of real materials, and offer authentic interpretation and analysis of formation and change of shared knowledge or common behavior rule among individuals.

Notes

1. Other possible types of congenital propensities, such as obedience (S.Milgram, 1963), ritualized behavior (P. Boyer, 2006), and so forth, are also researched.

2. For instances, neural networks in the brain involving reward-evaluation (S.M.McClure et al., 2004); anticipatory evaluation of the brain to some cognitive information and relevant behavior regulating (N.Camille et al., 2004); and social evaluation mechanism in preverbal infant brain towards other individual's actions and intentions (J.K.Hamlin et al., 2007). Additionally, emotion systems play an important role when coping with risky and uncertain choices (M.Hsu et al., 2005). L.Cosmides and J.Tooby (2006) believed that some of human morality or emotions are evolved from the process of natural selection, which work so naturally that their operation is unnoticed, and disappears into the background, or is taken for granted.

3. Acquired knowledge can be further differentiated to many types, such as tacit knowledge (M.Polanyi, 1983), explicit knowledge described by symbols, ect. But here the paper only talks over general conditions of acquired knowledge.

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