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Abstract: There are essential differences in ‘methodological individualism(MI)’ between neoclassic economics and Hayek’s theory. On basis of *The Sensory Order*, this paper shows relations between Hayek’s MI and it, the micro-bases of Hayek’s MI from contemporarily empirical disciplines, and some viewpoints verified by succeeding ones; then points out some questions that need to be answered henceforth between Hayek’s theory and interdisciplinary studies in modern economics. It is concluded that Hayek’s MI has its empirical micro-bases, and that his interdisciplinary exploration in the youth can help advance modern economics.

Keywords: methodological individualism, Hayek, the sensory order,
empirical micro-bases, interdisciplinary research in economics

A Discussion on Empirical Micro-Bases of Hayek's Methodological Individualism

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Introduction

Mainstream neoclassical economists usually claim “methodological individualism”. The essential about this methodological principle of mainstream economics is concluded “.....The individual in economy or in the society is like the atom in chemistry; whatever happens can ultimately be described exhaustively in terms of the individual involved”(Arrow, 1994, p.3). So, “methodological individualism” in mainstream economics is almost synonymous of the position of “methodological atomism” (G.Zwirn,2003) ¹. On the contrary, F.A.Hayek persists in the principle of methodological individualism and uses the same term “methodological individualism”, however, he objects explicitly to new-classical position above, and insists that individuals with “structural limits in knowledge” cannot be separated from one another in economy and society, and plays his emphasis on the interaction among individuals and individuals with differently mental states among interplaying relations(Hayek,1969). In short, the essential connotation of Hayek's ‘methodological individualism’ is ‘interactions—relations’ among individuals. With these characteristics, Hayek's principle of methodological individual is treated his economic thoughts and theory in addition to his other theories².

Why and how can Hayek achieve views about individuals? In other words, apart from his heritage of Scottish classical liberalism and Austrian School Economics since Carl Menger, whether or not do Hayek's views about methodological individualism have verifiably empirical micro-bases? What are they, and how are they verified, if do? What relations are there between Hayek's views and relative researches in modern economics?

Hayek's explorations to human mental and behavior micro-bases are mainly showed in his work, *The Sensory Order*(F.A.Hayek, 1952). Although published very late, its core thoughts had formed in early 1920s, and were not be changed before published³. Hayek himself attached importance to the researches in psychology and other disciplines(such as philosophy, etc.) in his youth, to which he had called "unusually spiritual adventures"(Hayek,1963/1967). Later, in a note of a postscript(Hayek,1979, note '26', pp.199-200.), he stressed the importance of those early explorations to his whole studies. Other scholars also explained the significance of the work⁴. So to speak, Publishing of *The Sensory Order*, in fact, shows clearly the essential differences in mental and behavior views among theories of Hayek, Keynes, Oskar Lange, neoclassical economics, and rationalism as well. From this view, Hayek's methodological individualism has surpassed the limits of pure metaphysics discussing similar topics and stepped into the empirical realm that can be verified.

Based mainly on *The Sensory Order*, the paper tries to show the empirical micro-bases of Hayek's methodological individualism and its relative view of points verified by contemporarily and subsequently empirical disciplines, and then according to development conditions of economics in modern time, the paper will sum up several aspects to which should be considered and studied deeply between Hayek's theories of mind, spontaneous order and the relatively interdisciplinary studies in economics. It is concluded that Hayek's principle of methodological individualism and even his whole theories based on it have empirical micro-bases about individual mind and behavior, and that his relative explorations can also help interdisciplinary development in modern economics .

1. The main Framework and Contents of *The Sensory Order*

In *The Sensory Order*, according to Hayek, the essential question was "what is the mind"(Hayek,1952,p.1[1.2]), which is also the core one in modern cognitive psychology(Sternberg,2003).

In order to answer it properly, he avoided probable limits within old theories, and first considered “a more definite and specific question”: “how the physiological impulses proceeding in different parts of the central nervous can become in such a manner differentiated from each other in their functional significance that their effects will differ from each other in the same way in which we know the effects of the different sensory qualities to differ from each other”(Hayek,1952,p.1[1.3]). “We shall have established a ‘correspondence’ between particular physiological events and particular mental events if we succeed in showing that there can exist a system of relations between these physiological events and other physiological events which is identical with the system of relations existing between the corresponding mental events and other mental events”(Ibid., pp.1-2[1.3]). And, because that ‘the determination of the order of sensory qualities’ raised ‘in the clearest form the peculiar problem posed by all kinds of mental events’, and “an answer to the question of what determines the order of sensory qualities constitutes an answer to all questions which can be meaningfully asked about the ‘nature’ or ‘origin’ of these qualities, and further, that the same general principle which can be used to account for the differentiation of the different sensory qualities serves also as an explanation of the peculiar attributes of such other mental events as images, emotions, and abstract conceptions” (Ibid., p.2[1.4]), therefore, Hayek simplified ‘the question of mind’ into ‘the question of sensory order’⁵, converged on the point of discussing the question of ‘the determination of the order of sensory qualities’, and adopted the way that “construct a system of physical elements which is ‘topologically equivalent’ or ‘isomorphous’ with the system of sensory qualities”(Ibid.,p.37[2.2]), made use of contemporarily empirical facts and theories of physiology and psychology, and followed the path of generally originating process of ‘physical stimuli—nervous impulses—sensory(mental)events’, to explain the non-isomorphous(not strictly corresponding to each other) between ‘physical order’ and ‘sensory(mental) order’, the strictly mathematic isomorphous between

‘nervous order’ and ‘sensory(mental) order’, the ‘static and dynamic classification and reclassification of nervous system’ to physical events, the originating and general characteristics about sensory qualities(link one another to form a whole structure) and behavior, ‘the pre-sensory experience’ based on phylogenesis and ‘the sensory experience’ based on ontogenesis, and in the end generalized his views to ‘philosophical consequences’, which mainly included that, for examples, “mind and consciousness are rather products of experience”(Ibid., p.166[8.5]); the differentiation existed between ‘sense experience’ and “a sort of accumulated ‘knowledge’”(not consciously aware of but implicit in)⁶; ‘reclassification framework’ (therefore, the mental order) could be adjusted with experience(Ibid., pp.168-169[8.14-8.18]); mind could explain the physical or phenomenal world only in the way of ‘explanation of the principle’ and “cannot explain the mind as a whole”—‘the nature of explanation’ and ‘the limits of explanation’(Ibid.,pp.179-190[8.48-8.86]); and ‘human decisions’ were ‘the result of the whole of a human personality’, so mind could never be reduced to ‘something else’(Ibid.,pp.193-194[8.93-8.98]), ect. According to modern discipline-criteria, in fact, Hayek has brought forward to the one which might be called ‘cognitive and behavior theory about ontogenesis and phylogenesis’, and offered micro-bases to explaining the differences of individual behaviors(Rizzello,1999,p.26).

2. *The Sensory Order* and Hayek’s Methodological Individualism

In Hayek’s view, impulses within nervous system affected one another, any characteristic of which was not determined by physical attributes the single impulse possessing, but done by relevant places(structural relations in topological meaning) in which a impulse(or a nervous fibre conducting it) was connected with other impulses(or other fibres) in the whole nervous structure(Hayek,1952, pp.37-38[2.3], p.38[2.4], ect.). Also, any nervous effect impulses producing was not dependent on any individual impulse, but on the eventual results from the interaction produced by ‘primary impulse’ and the ‘bundle of secondary impulses’

which usually occurred with it spontaneously in the nervous system(Hayek called the ‘bundle of secondary impulses’ the ‘following’)(Ibid., p.64.[3.34]). Each individual mind produced by the isomorphous nervous system was, on the one hand, not identical because of there were different ‘map’, ‘model’ and ‘associative process’ in respectively mental structure⁷; on the other hand, however, it had the ‘similarity’ so as to make possible the recognition, understanding and interaction among them also because of the formations of ‘map’, ect. in different brains had the ‘similarity’ from nervous mechanisms to the represented outside world (Ibid., p.110.[5.28]).

‘Map’, formed by the existing ‘semi-permanent’ connexions of nervous network, therefore, representing individually past experience, had characteristics of non-perfectibility, ever-changing, non-representation of the momentary environment, ect., and gives the ‘framework’ for impulses within it(Ibid., p.110[5.26-5.27]; p.115[5.42-5.43]); ‘model’, representing the experience of momentary environment in a given time, had instant characteristic, determined and acquired within the ‘map’, and traced a further pattern of connexions(Ibid.,pp.115-116[5.44-5.45]); ‘associative process’ represented the possible connexions about future events which would be selected or expected by a ‘map’ or ‘model’, and “is not something additional to the appearance of mental qualities, nor something which acts upon given qualities; it is rather the factors which determines the qualities”(Ibid., p.119[5.52]).

The reasons why mental structures were imperfect were that the organism itself had several limits in apparatus and nervous system⁸, so the structures could not be formed perfectly in one time. Except for the ‘absolute limits’ above, in practice, the selection of the particular behavior pattern, which evoked by imperfect nervous order, needed also to be continuously controlled, adjusted and modified according to the interaction and feedback principle between impulses made by nervous system in the light of the changes of environments, in order to achievement of aims in acts. So, it didn’t take place in one act but a gradual

process(Ibid., p.95[4.53-4.54]), and imposed the relative limits on mental order.

Therefore, absolute limits in physiology, relative limits in practice, and non-perceived pre-conscious experience, all of these make the shared sensory classification and mental order imperfect; in the condition of similarity in individually mental structures, the factual differences in particular environments and experience lead to the differently individual sensory classification and mental structures; all of the above makes individual not only pervasively innocent and limited in knowledge, but also similar and different in mental order. In order to acquire 'explanation of the principle' to the ever-changing physical world, individuals must continue reclassifying or re-explaining outside events including other individuals. In this way, the eventual outcome is the very sort of interacting process between individuals and environments, individuals and other individuals, based on each mental order. This is the micro-expression about Hayek's methodological individualism possessing the connotations of individual interaction and its relations.

3. Experiential Bases of *The Sensory Order* and Its Main Viewpoints Verified by Experience

In *The Sensory Order*, Hayek used a large number of neuroanatomical and neurophysiologic materials to which were universally accepted in the contemporary academy⁹, such as the highest and most complex of the cerebral cortex as one of the channels connecting nervous system; the hierarchy of central nervous system; estimation and comparison in numbers among separate nerve cells, afferent fibres and efferent fibres, and those afferent fibres reaching the cortex; general character of the peripheral receptor organs, nervous impulses and nervous fibres conducting the impulse; etc. His analysis of connexions formed among the simultaneously exciting neurons and none permanent or invariable features of 'synapses', and views about the final outcome of nervous effects resulted from mutual influences between the particular impulse and its 'following', had been verified by experimentations from a contemporary neurophysiologist, Donald Olding Hebb, the founder of modern neuroscience. In *The Organization of Behavior*(Hebb,1949),

Hebb treated organism learning and memory from the level of nerve cell, and brought forth the principle that connexions tend to be likely formed between simultaneously provoked cells, which is called 'the Hebbian synapse' in modern neuroscience. Hebb's works verified the connected mechanics of nerve cells in the level of experimentation. Hebb insisted that organism's cognition and its behavior responses were dependent on functionally rather than anatomically positional neural assembly, and concluded that the formation of neural network was not necessarily determined by outside stimuli, but could be shaped by means of inner characteristics of organism itself. Hebb's neurophysiological theories provide experimental evidences with subsequent researches regarding biological bases on which the innate features and the acquired features of organism are formed. To this, Hayek himself pointed out the similarity between his and Hebb's theory in the 'Preface' and the text of *The Sensory Order*, and explains the complement existing in the two books¹⁰. Gerald Maurice Edelman, a laureate of the Nobel Prize in Physiology or Medicine 1972, amazed it and said, "these days, this is known as the Hebbian synapse, but von Hayek quite independently came upon the idea. I think the essence of his analysis still remains with us"(Edelman, 1982, p.24). Hayek's views about nervous system network structure of brains also have been accepted in modern neuroscience. J. M. Fuster, a modern famous Professor of Psychiatry and Biobehavioral Sciences in School of Medicine, University of California at Los Angeles, called Hayek the first person of proposing 'cortical memory networks on a major scale', and said "....., with much less neuroscientific knowledge available, Hayek's model comes closer, in some respects, to being neurophysiologically verifiable than these models developed 50 to 60 years after his"(Fuster,1995,pp.87-89;from: Steele, 2002, p.127).

In the aspects of analyzing sensory qualities, Hayek used and appraised many more contemporary psychological or experimental psychological materials, for instance, Berkeley's theory of spatial vision and space perception, James-Lange's theory of emotions, von Helmholtz's view about the effect of experience

in determining sensory qualities, James Mill's principle of association, many experimental findings in the fields of taste, smell, hearing, seeing, touch, etc., experimentations on stimuli discriminations and memory, recognition, learning to stimuli, and those alternative theories with counter-arguments as well; etc¹¹. Hayek's views about mind structure as a whole and, mutual influence and linkage among sensory qualities, were essentially similar to the ones of the contemporary Gestalt School in Psychology and its relative experimental findings. Hayek himself had said that his theory might be regarded as 'a consistent development of the approach of the gestalt school'(Hayek,1952,p.151[7.15])¹². According to the Gestalt School's main ideas, life consisted of order; psychological and behavior process were dependent on a set of conditions including innate ones; it should explain the three fields of nature, life, and psychology integratively rather than separately; physical world could be reflected in but not be equal to human psychology; and so forth. Moreover, by means of experimentations, it had proposed some 'good perceptual laws of organization', such as proximity and continuation, whole and closure, spontaneous organization, motion in identical direction, etc(K. Koffka, 1935). In addition, Hayek's views about mutual connexions of sensory qualities have been confirmed by modern theories from the Connectionism Psychology(Steele, 2002, pp.125-147).

When expatiating the physiological limits of organism, neural connexions and limits in classification, Hayek indicated clearly that, "Which external events are recorded, at all, and how they will be recorded, will thus depend on the given structure of the organism as it has been shaped by the process of evolution"; "It is probable that the given anatomical structure will facilitate the formation of certain connexions and make the formation of others more difficult(or impossible)"(Hayek,1952, p.108[5.20]; p.109[5.23]). On another hand, although the limits of experiential materials(Ibid., pp.80-81[4.7]), he took the distinction between the parts of the individually mental order from its inherited constitution and from experiential

origin into less account, and gave mental order formation a starting point, i.e., “.....as if at the commencement of the life of the individual the central nervous system were fully completed before any connexions between neurons corresponding to the simultaneous occurrence of stimuli had been established”(Ibid., pp.102-103[5.3-5.4]), he briefly expressed the relations in the aspect of mental order between phylogeny and ontogenesis, and believed that, “[While] it is on the whole more likely that responses *via* the lowest centres will be innate for the individual, that is, acquired by the race in the course of evolution, [while] the responses effected by the higher centres will be largely based on individual experience,.....”(Ibid., p.92.[4.43]); “.....; indeed, it is at least likely that what for one species or at one development stage may be of experiential origin, may in other instances be constitutionally determined”(Ibid., p.102.[5.3]); and stressed the preconditional effects of non-perceptively preconscious experience imposed on the formation in nervous system network or in ‘map’, etc. of mental structure¹³. These views above are in accord with theories and experimental findings of modern evolutionary psychology of L.Cosmides, J.Tooby, and so on. By means of interdisciplinary researches and experimentations, evolutionary psychologists insist that originated from long evolutionary process, human species has possessed some particular cognitive circuits which based on neural tissue, such as engaging in social exchanges, detecting cheaters in situations of exchange, judging in some aspects of social morality, etc. These cognitive and computational devices are complex, reliable development in all normal human beings, particular to solving adaptive problems in relation to reproduction, and irrelative to human conscious effort. They are so similar to ‘instincts’ that make human engage in some social exchanges or perform some reasoning possible and easy (for examples, probability judgments based on the encountered frequencies of real events, social morality judgments about incest forbiddance, and so forth.), but make others impossible or difficult (such as navigating in water by utilizing echo location, Bayesian reasoning,

etc.)¹⁴. To these innate features from human evolutionary process which have been verified by evolutionary psychology, Hayek called them 'preconscious experience' or 'linkages' between nervous impulses.

4. Conclusion and Discussions

In a few words, based on the contemporary bases of neurophysiological and psychological experimentations and theories, starting from the generally character analysis of nervous system in human brains receiving outside stimuli, Hayek clarifies his main ideas on the imperfection in connexions and classifications of nervous system, the imperfection and differences in individually sensory/mental order, and preconscious experience which is not perceived by individuals and in the limits of human species; all of these lead individuals into innocence and limits in knowledge all the time. Within this framework, in order to gradually acquire 'explanation of the principle' on their respective environments, individuals must continue to reclassify and re-explain to them including other individuals; therefore, the eventual state is the process in which there are endless interactions between individuals and environments, between individuals and others. Also, these above offer empirical bases for Hayek's methodological individualism of the connotation of 'interaction-relation'¹⁵.

In modern economics, comparing with the standard new-classical method, game theory plays its emphasis on analyzing strategical interactions between individuals. A.Schotter(1981) used game theory to restate socially institutional theory similar to the one of Hayek's spontaneous order. But Schotter's basic assumption about human agent was the actor who is of self-concern and maximum behavior. Thereby, it may conflict with Hayek's basic one about individual innocence and limits in knowledge. Comparing with Schotter's, the institutionally evolutionary theory of H.P.Young(1998) may be closer to Hayek's. Recently, behavior game theory represented by Colin F. Camerer, one of the method of behavior economics, tries to develop weakened rational assumptions based on the laws of psychology and expand methods of economic

theory mainly by means of behavior game experiments (such as, C.F.Camerer, 2003; 2006); at the same time, experimental economics represented by V.L.Smith, tries to solve 'the Hayek's problem', i.e., "how does spontaneous order come from complexity"¹⁶. What relations may there be between Hayek's and the two new methods about individually behavior adjustment based on behavior experiments? Whether and how can they re-exhibit Hayek's theory or method? All of these should be concerned and worthy of discussing deeply¹⁷.

In economics nowadays, mainly borrowing fruits from empirical disciplines, researches on explaining to adjustment of individual minds and behaviors and changing process of economy, such as, 'mental models' and theory of 'individual learning' of D.C.North (with other, 1994; with others, 2004), and the theory of 'subject game models and compared institutionary analysis' of Masahiko Aoki (2001), have more broad influences. Especially D.C.North (2005), which collects his 'more than ten years' thinking about 'reality—beliefs—institutions—policies—altered perceived reality' (Ibid., p.ix; p.4;), is called "an inspiring reinvigoration of the research program of Smith, Hume, and Hayek", and "particular attempt to marry cognitive science, anthropology, political science, history, and economics" (W.Wilkinson, 2005). What similarities and differences can there exist between these mental and behavior models and Hayek's? What relations in theories about 'model of minds' are perhaps there among Hayek's, North's, Masahiko Aoki's and even neoclassical economic theory (for instance, Marshall's theory about 'model of minds'¹⁸)? For the relative researches in modern economics, these are worthy of studying and discussing deeply, too.

Apart from the behavior theories of H.A.Simon, D.Kahnemen and A.Tversky, recently, other interdisciplinary explorations involving in economics are, such as, D.L.Mcfadden's microeconomic analysis of choice behavior of individuals based on cognitive sciences (for examples, Mcfadden, 2000; 2005; 2006; etc); G. A. Akerlof's researches on individual cognition and behavior in 'PSA-Economics (Psycho-

Socio-,Anthropo-Economics)'(for examples, G.A.Akerlof(with other),2000; 2001;etc); and Neuroeconomics based on functional anatomy of the brain and cognitive neurosciences(for examples,P.Zak,2004; E.Fehr,U.Fischbacher,2004,and so on);etc. In fact, Hayek himself always attached importance to interdisciplinary researches in economics. "An economist who is only an economist cannot be a good economist"(Hayek,1963/1967), which may be the best generalization about his attitude. From this view, no courage of 'spiritual adventure' on interdisciplinary researches is no *the sensory order* based on empirical disciplines and verified by succeeding ones, even no solid Hayek's whole theory. Therefore, in economics actually, Hayek is the early one of examples in engaging in interdisciplinary explorations.

Notes

¹ Although Carl Menger usually called his individualistic method of analysis atomistic one, and believed that the essential point of it was in that could “.....to reduce the complex phenomena of human economic activity to the simplest elements that can still be subjected to accurate observation”(Menger,2004,p.46), therefore, helped for studies of economic phenomena, and also called it ‘the empirical method’(Ibid.,p.47), in Hayek’ view, what was employed and systematically developed by Menger was a individualistically methodological tool of the classical economists(Hayek, “Introduction Carl Menger”, Ibid.,p.24). On the concrete contents about Carl Menger’s methodological individualism, the paper will not discuss.

² In economics, for instance, Hayek , in his one of early works, *Prices and Production*(1931), had stated his views of methodological individualism different from the one in neoclassical theory, although used the term “‘individualistic’ method” then(Ibid.,p.4). Later, he also clarified his methodological individualism in other works, such as, F.A.Hayek,1946/1969; 1961; 1963/1967; 1968/2002; etc.

³ See the Preface of *The Sensory Order*, especially in p.v, p.viii., etc.

⁴ For instance, Witt(1989), Vanberg(1994), Steele(2002),and V.L.Smith(2003) so forth. Others, instead, such as Machlup(1974), Tomlison(1990),etc., have different opinions to this.

⁵ In the work, terms ‘phenomenal’, ‘sensory’, ‘sensory order’, ect., were same meaning; terms ‘physical’, ‘physical order’, ‘objective’, ect. on another hand, were equivalent. See Hayek,1952, p.4[1.10]. Because Hayek transformed his question from mind into sensor, ‘mental’ and ‘sensory’ were also equivalent.

⁶ This sort of “accumulated ‘knowledge’”, according to Hayek’s view, was ‘the pre-sensory experience’. See Hayek,1952,pp.167-168[8.8-8.11].

⁷ Hayek thought that individual mental structure consisted of ‘map’, ‘model’, and ‘associative processes’. See Hayek,1952, p.109.[5.25], p.114.-115.[5.41], and p.110.[5.28].

⁸ Hayek pointed out five reasons in limits of human physiology. See Hayek, 1952, pp.108-109[5.20-5.24].

⁹ Hayek called them ‘predominant view’. See Hayek,1952, p.55[3.2]; about his outlines of those mainly physiological materials, see Ibid.,pp.55-58. Ch.3-1 ‘AN INVENTORY OF THE PHYSIOLOGICAL DATA’.

¹⁰ In the preface of *the sensory order*, Hayek mentioned that because of ‘the much greater technical competence’ of Hebb’s *The Organization of Behavior*, and ‘in many respects’ similarities to the former , he

“doubted for a while whether publication of the present book was still justified.” See Ibid,1952, p.viii; At the same time, in note ‘1’ of Ibid.,p.64, Hayek pointed the similarity between conceptions of his ‘following’ and Hebb’s ‘cell assembly’.

¹¹ The main theories and experimental evidences of psychology, see Hayek,1952,pp.147-164 Ch.VII. This also was one of the ‘tolerably satisfied’ chapters in Hayek’s opinion. See Ibid, p.viii.

¹² At the meantime, Hayek pointed out that his views didn’t derive directly from the gestalt school, and some views of it were of limits and illegibility. See mainly Hayek,1952, pp.76-78.CH.III-6.

¹³ See mainly Hayek,1952,p.102 Ch.V-1, pp.105-106[5.13], and p.106[5.14-5.16] so forth. Probably, it should be pointed out that in Hayek’s view, ‘preconscious experience’ and ‘linkages’ between impulses seem to be the same meaning.

¹⁴ Evolutionary Psychology’s views above are mainly from J.Tooby & L.Cosmides,1992; L.Cosmides, J.Tooby, 1994; L.Cosmides, J.Tooby, 1996; B.Duchaine, L.Cosmides, J.Tooby, 2001, pp.225-230; D.Lieberman, J.Tooby, L.Cosmides,2003; etc.

¹⁵ In economics early 1920s, there is perhaps only Frank H. Knight(Knight, 1921) who pointed clearly out the limits in knowledge and competence of individuals.

¹⁶ See V.L.Smith wrote Foreword for R. Miller’s book(2002), and V.L.Smith(2005). Other relative working papers in the web-station of Interdisciplinary Center for Economic Science, George Mason University, mainly are, for example, Crockett,S., Smith,V.L.,Wilson,B.J., May,2006; E.Kimbrough, V.L.Smith, B.J.Wilson, (a) June2006; (b) October 2006; etc.

¹⁷ In China nowadays, relative economic studies on preference hierarchies, behavior adjustment and interactions of individuals mainly following Hayek’s theories, for instance, see *Zhu XianChen*(2005); etc.

¹⁸ S. Rizzello showed clearly ‘the model of mind ’of Marshall’s theory. See Rizzello,1999, pp.22-24.

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