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Organizations as cognitive systems
is knowledge an emergent property of information networks?

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Abstract
The substitution of knowledge to information as the entity that organizations process and deliver raises a number of questions concerning the nature of knowledge. The dispute on the codifiability of tacit knowledge and that juxtaposing the epistemology of practice vs. the epistemology of possession can be better faced by revisiting two crucial debates. One concerns the nature of cognition and the other the famous mind-body problem. Cognition can be associated with the capability of manipulating symbols, like in the traditional computational view of organizations, interpreting facts or symbols, like in the narrative approach to organization theory, or developing mental states (events), like argued by the growing field of organizational cognition. Applied to the study of organizations, the mind-body problem concerns the possibility (if any) and the forms in which organizational mental events, like trust, identity, cultures, etc., can be derived from the structural aspects (technological, cognitive or communication networks) of organizations. By siding in extreme opposite positions, the two epistemologies appear irreducible one another and pay its own inner consistency with remarkable difficulties in describing and explaining some empirical phenomena. Conversely, by legitimating the existence of both tacit and explicit knowledge, by emphasizing the space of human interactions, and by assuming that mental events can be explained with the structural aspects of organizations, Nonaka's SECI model seems an interesting middle way between the two rival epistemologies.

Keywords: cognition, emergent properties, knowledge, mental states, organization.

1. Introduction

A growing concern about knowledge, information and data as crucial competitive factors and main drivers of social development obscured any eventual difference among them. It was taken largely for granted the possibility to create and transfer them within and between organizations, with or without the intervention of knowledge management systems. In this "epistemology of possession" (Cook and Brown, 1999) among knowledge, information and data there are (if any) only slight differences, and all of them can be considered "things" producible and transferable within and between organizations. This view has been challenged by a different approach, that started as an underground and minority approach and reached now the surface and legitimation of an alternative paradigm. In this "epistemology of practice" knowledge appears as radically different from information and data, and it is referred to the action of knowing rather than to an object.

This rival views have a lot of implications at theoretical, empirical and managerial levels. It is not just a question to replace information with knowledge, and to consider organizations as knowledge processors instead of information processors. Once stated that organizations are cognitive systems (and even this assumption is questionable), their properties should be investigated and become a disputable matter because they depend on what does it mean "cognition". In extreme synthesis, cognition can be marked by three types of capabilities, listed in the following ordering of growing complexity:

A) the recognition, manipulation and production of those special sensorial data which are symbols;
B) the interpretation of symbols, objects and events;
C) the manifestation and activation of mental states, which usually are identified with speech acts, intentionality, emotions, purposive behavior.

The two epistemologies take a univocal position for respectively the "A" and the "C" alternatives. In the epistemology of possession it is admitted that even artificial cognitive agents can create and transfer knowledge, and that the peculiar nature of tacit knowledge is substantially denied. However, this epistemology has been heavily criticized for not taking into account the specificity and the complexity of human interaction (Richardson, 2005; Tsoukas, 2005). Moreover, the theories consistent with that epistemology do not explain well the dynamics of competitiveness of firms and territorial systems (Amin and Cohendet, 2004; Nightingale, 2003). The epistemology of practice states that only individuals and human organizations can create knowledge, that tacit knowledge is irreducible to explicit knowledge, whose existence is questioned. However, the epistemology of practice has serious problems to explain such irreducibility and how tacit knowledge can be stored and transferred. Other approaches allow differentiating the required capabilities between the activities of knowledge creation and transfer, and between the creation of tacit and explicit knowledge.

Nobody contends that cognitive agents can have different cognitive capabilities, but the core question is: "where does cognition start from?" In other words, does exist a minimum threshold to detect the presence of cognitive capabilities or is it just a question of degree, according to which our refrigerator, being designed on a feedback mechanism, would be a very simple but cognitive agent? If keeping the highest threshold (the "C" capability), would agent-based simulation models show mental properties? They certainly have "A", and likely also "B" properties, and further they can be self-organizing and learning systems. Is all this enough to say that they have mental states?

The debate on the nature of tacit knowledge and the limits of codification is fully immersed in the previous issues. The supporters of the epistemology of practice, though claiming a non-reified nature of knowledge, often treat knowledge transfer in a rather traditional way, thus raising the question: transfer of what?

The confrontation of the two epistemologies raises a number of other questions: is the juxtaposition between the two paradigms so radical to avoid any compromising position? If yes, then what would be the practical consequences for management and organization science? In particular, would it still

making sense to speak about knowledge management systems? If yes, in which terms? What such systems could eventually manage?
The answers can be found only revisiting and facing with two crucial debates which have developed during last decades, but which have received less attention by economists and organization scholars. The problem of the nature of cognition and the mind-body problem run parallel in the second half of last century, though the former dates much longer, back to Cartesian philosophy and, to some extent, to ancient Greek and Indian philosophy. The problem of the nature of cognition concerns what does mean "thinking", computation, and, paradigmatically, whether computers can think. In organization science, given that knowledge creation is the peculiarity of cognitive (thinking) agents, the issue immediately affected by this debate refers to the eventual differences between data, information and knowledge. The mind-body problem deals with the relationship between the physical and the mental states (events) in cognitive systems. It gives indications for the question whether organizations can be considered collective minds, and thus, whether they can have mental states, and whether they can be assigned socio-cognitive and social-psychological properties, like intentions, identity, trust, reputation, etc. Both debates (cognition and mind-body) supply insights on the nature of tacit knowledge and its codifiability, and the related issue of a theory of knowledge management systems. The confusion, difficulties and ambiguities marking the plethora of positions in these fields come from the illusion that it would have been possible to avoid the confrontation with those fundamental issues. The major aim of this paper is to show the strong connections between them and the problems of theorizing in organizational cognition, in simulation modeling, in firm or territory competitive analysis, and finally in knowledge management systems. Here of course we cannot revisit extensively both problems, but just refer to them for what matters mostly when considering organizations as cognitive systems.
In next section it is discussed the problem of the nature of cognition, showing the differences between (old and new) cognitivists constructivists. In the third section it is address the mind-body problem, which is applied to the issue of organizational knowledge creation and transfer. It is proposed a correspondence between the philosophical approaches and the main current positions in economics and organization science. In the fourth section it is addressed the codification dispute, which is referred to the different positions occurring in the debate on the nature of cognition and the mind-body problem. It is shown how the seemingly distant question of intentionality gives interesting suggestions for the codification problem. The constraining consequences of the rival epistemologies for the crucial question of knowledge transfer are discussed in section five. Finally, in the sixth section some implications for organizations, territorial systems, and knowledge management systems are developed. The issue of complexity is not treated apart, but it will result evident how it crosses all the others. The discussion of this paper is taken mostly at the organizational level, with few indications for the individual and the inter-organizational (and territorial) level.

2. Constructivism vs. cognitivism and connectionism

Winograd and Flors (1986), Varela *et al.* (1991), Varela (1992), and Venzin *et al.* (1998) look at the debate on artificial intelligence as a key reference for understanding knowledge in organizations. They identify three epistemological positions: the cognitivist, the connectionist, and the autopoietic. In the field of economics and organization science the first perspective is well represented by Simon (1969, 1977, 1997; March and Simon, 1958), Galbraith (1973) and non-evolutionary economists, while the second has been developed in different ways by Nelson and Winter (1982), Kogut and Zander (1992), Kogut (2000), Cohendet and Llerena (2003), Monge and Contractor (2003). Connectionists differ from cognitivists in that information and knowledge are supposed to be distributed within organizations and parallel computed, instead of centralized and sequentially computed. Moreover, behaviors are embedded into a set of routines and rules, which are taken

together by means of socio-economic relationships. Indeed, the patrol of "old cognitivists" has been now replaced by "new cognitivists", who can be considered as one single group with connectionists. The distinction between old cognitivists and connectionists (or "new cognitivists") is addressed by Casti (1989), who suggests to identify them with respectively the supporters of the strong and the weak program of artificial intelligence, or even the top-down and the bottom-up approaches to artificial intelligence.

In the autopoietic perspective information is seen as interpreted data, and as such it cannot cross organizational borders. Only data can do that. As for knowledge, while in the connectionist position it depends on the organizational network, in the autopoietic epistemology "knowledge is always private". Magalhães (1998) underlies the difference between data and information, which in its essence corresponds to that between syntax and semantics: by simply manipulating data is never possible to get information. It is necessary to interpret data through meanings. Human interactions create knowledge, which is seen as a process and not as an object. From knowledge to knowing (Orlikowski, 2002).

Magalhães (1998) and Venzin *et al.* (1998) argue that this autopoietic viewpoint is well represented by Nonaka, Nishiguchi and Takeuchi (Nonaka and Nishiguchi, 2001; Nonaka *et al.*, 1998; Nonaka and Takeushi, 1995), but indeed they consider explicit knowledge as one of the forms in which knowledge not only can be obtained or transferred, but also created. On the contrary, for the supporters of the autopoietic view, explicit (codified) knowledge is an oxymoron (Zeleny, 2005). Knowledge would be associated only to the tacit nature, which, on its own, is seen in the action of knowing and not as a state, as something which can be possessed. The supporters of autopoiesis differ quite a bit when concerning data and information. Some underline the distinction between information and knowledge (Zeleny, 2000, 2005), then assuming the conventional view that information is a sort of structured data. Others (Aadne *et al.*, 1996; Magalhães, 1998; Venzin *et al.*, 1998; Von Krogh *et al.*, 1996) make a sharp distinction already between data and information, which is seen as interpreted data.

Besides the criticisms that Biggiero (2001a) moved to the fundamental argument that organizations are autopoietic systems, one of the problems in this debate is that constructivists often assign cognitivists too naive or positivist epistemological positions. Although it is not impossible to find them, it is a too easy game to assign cognitivists the most traditional view of extreme rationalism and positivism. That reality is subjectively perceived does not seem a concept so hard to be accepted by new cognitivists (Biggiero, 2001b). Fighting against the idea of objective perceptions and observers, and emphasizing the issue of self-reference constructivists seem to "force an open door".

Approaches close to social constructivism (Berger and Luckman, 1967; Brown and Duguid, 1991, 1998; Gherardi, 2001; Organization, 2000; Orlikowski, 2002; Weick, 1969, 1995) or to cybernetic constructivism (Magalhães, 1998; Mingers, 1995; Varela *et al.*, 1991; Von Krogh *et el.*, 1998; Watzlawick, 1984; Yolles, 2006; Zeleny, 2005) belong to the epistemology of practice. If cognition were identified only with mental states (the "C" capability), and these were allowed to pertain only to humans, and, finally, if methodological individualism were accepted while connectionism rejected, then organizations would be not seen as cognitive systems. While we have many contributions towards a theory of organizational knowledge creation, with few exceptions (Yolles, 2006; Zeleny, 2005), we lack indications for knowledge management systems, assuming that this is possible and would not result in another oxymoron.

If we come back to the graduate scale of cognition from symbols processing capability to the property of exhibiting and performing mental states, we see that cognitivists and constructivists lie at the opposite extremes: the former tend to consider symbols processing as a full sign of cognitive ability, while constructivists tend to limit it to systems able to exhibit and perform intentionality. Although not yet developing a theory of organizational knowledge creation, the supporters of social simulation through artificial societies are naturally consonant with the epistemology of possession.

3. The mind-body problem

As well known, this problem concerns the relationship between the physical and the mental states of humans (Guttenplan, 1994; Haugeland, 1981), and we could say, by extension, of any cognitive system. It is a very old question, whose controversial development in systematic way dates back at least to Cartesio, who first proposed his famous ontological dualism: thought and consciousness derive from mind, which has a different substance from body. There are no laws connecting phenomena generated by them. Thus, the original position denies any relationship between physical and mental states. Cartesian ontological dualism is nothing but anachronistic in social sciences, and specifically in economics. Technological and economic structure of organizations has nothing or less to do with its socio-cognitive and social-psychological aspects, like identity, reputation, emotion, etc. Even more radically, the inner structure of organizations was regarded as a black box preventing investigations. Non-economic or non-technological variables were neglected or excluded from the attention of economists. This view is still the mainstream, but evolutionary theory of the firm and organizational economics have decided to open the black box, and at least to recognize the existence of the two spheres of physical (structural) and mental events.

The second interesting position to be listed here is the eliminative materialism (Churchland, 1981), which denies any peculiar existence to mental events. They are pure appearance; there is only body. This view can be found in current organizational economics too, for instance when trust is treated as a phenomenon masking calculativeness (Williamson, 2002). Trust would be considered just and purely as an unclear term to indicate risk and agents' ability to calculate their convenient decisions. Analogue concern is deserved to "epiphenomena" like reputation, identity, etc. Management and organization science do not follow this line of denying real existence to mental states, though faced by unilateral approaches reflecting single specialized disciplines, like accounting, marketing, etc. Thus, it is possible to find an accounting perspective on reputation, where this phenomenon is looked and measured essentially in terms of financial results. However, the difference with economics is that, even in these partial approaches, it is recognized the complex nature of mental events, which further are supposed to feed back on accounting or other variables as well.

What has been long (and partially it is still) debated is whether mental states and intentionality can be assigned at organizational level, and not restricted to the individual level, and ultimately whether organizations are cognitive systems. According to methodological individualism the answer is negative, because these are properties peculiar only of individuals. This is also the dominant position in economics, with some differentiation in evolutionary economics. Conversely, in management and organization science that possibility is growingly accepted and it is consolidating the field of study of organizational cognition, identity, trust, reputation, etc. Even more, and following the same idea, these concepts are becoming to be applied also at inter-organizational and territorial level (Biggiero and Sammarra, 2003; Sammarra and Biggiero, 2001).

The third perspective is reductionism, according to which the physical and the mental states have its own ontology and proper concepts and theories, but the mental derive from the physical states. This is currently the dominant view in natural and social sciences at individual level, with differentiated positions when concerning the organizational level. Reductionism has many variants, among which two mostly matter for our discussion. Both can be referred to the theory of tokens, which states that to each mental token does correspond a specific and unique physical token. The two variants differ in the epistemological relationships between physical and mental events. In one variant mental events are totally predictable by studying the corresponding physical events, while in the other variant the predictability is denied.

This latter is the position of Davidson (1980), who argues that the predictability of mental from physical events is precluded because psychology -he says- is not a science but just a categorization and rationalization of behavior. The ontological reducibility of mental to physical events is complete, but the nomological reducibility definitely incomplete. Physical and mental events are

mutually influencing, but the former have a major autonomy because there can be physical without mental states but not vice versa.
Now, besides the philosophical implications and the disputable judgment on the epistemological status of psychology (MacDonald and MacDonald, 1995), Davidson's view, once transferred on the field of organizational cognition is interesting for our discussion. It would suggest that, although mental events and knowledge as practice come from the cognitive patterns of human interactions within organization, the created knowledge would remain not completely available, traceable and explainable. As we will see in the next section, this could be the philosophical support for an explanation of why part of knowledge, which can be identified with tacit knowledge, will never be reduced to bytes or someway codified.

4. The codification dispute

One of the main results of developing an evolutionary theory of the firm has been that of replacing the view of firms and information processors with a view of firms as knowledge processors (Amin and Cohendet, 2004). This change has had very valuable outcomes in better understanding firms' behavior, in linking routines and decision making, and ultimately firm competitiveness to capabilities and learning processes, and finally in reducing the gap between economists and management scholars because of looking inside the black box. However, lacking a clear distinction between information and knowledge or reducing knowledge to systematized or structured information diminishes the impact of the evolutionary theory of the firm. The current debate on tacit knowledge and its codifiability mirrors this state of ambiguity and confusion.
Connectivists and constructivists seem to share the same reductionist approach to the mind-body problem: mental states can be reduced to and explained by the underlying cognitive networks. However, the measure and extension of reduction and explanation can vary to a large extent. It can be almost substantially eliminated by constructivists, or conversely viewed as a strict mapping by some connectivists. This latter is the position taken by many economists in the current debate on the possibility of codifying tacit knowledge (Cowan, 2001; Cowan *et al.*, 2000; David and Foray, 1995; Foray and Cowan, 1995). They argue that in principle it is always possible for any practice to generate a codebook, which would gather all necessary tacit knowledge making it explicit, and consequently transferable. The concrete production of such codebooks would depend on economic convenience in broad sense.
Nightingale (2003) suggests an intermediate view between constructivists and connectivists. He shares the connectivist idea of cognitive networks as the generators of mental states, language, tacit and explicit knowledge. Thus, he accepts the existence of both a reified and an interactive form of knowledge, and he agrees also to consider tacit knowledge as resident in cognitive patterns. He suggests to justify the existence and non-codifiability of tacit knowledge by placing it partially into unconsciousness and into that part of conscious mental state where non-verbal knowledge resides. The rationale comes from merging studies on neural networks and consciousness by Damasio (1994, 1999) and Edelman (1987, 1989, 1992), and those on intentionality, language and consciousness by Searle (1983, 1993, 1995, 1998). This way, tacit knowledge remains non-reducible to codebooks, but at the same time it escapes out of the mist of something non-definable and pseudo-scientific. Nightingale's position appears consistent with Davidson approach to the mind-body problem.
The seemingly similarity between connectivists (or new cognitivists) and constructivists in considering cognitive systems as compound by cognitive networks, and its mental states as characterized in terms of emergent properties can disappear when looking at the different outcomes of their approaches to the nature of knowledge and the mind-body problem. For connectivists tacit knowledge would present no any peculiar status which prevents its codification into explicit knowledge. At the very end, it would be just a question of bytes. Moreover, knowledge and mental states can be precisely, though hardly, understood and predicted by studying the structure and

evolution of cognitive networks which are supposed to produce them. Finally, knowledge is reified to the status of object, as a database or a book. "The range of knowledge is much greater than the range of action" (Carley, 1999: 8), while for most constructivists in practicing there is much more knowledge than in explicit knowledge.
According to connectivists and new cognitivists, artificial cognitive agents can create knowledge, because for cognition it is requested just the minimum capability –the alternative "A"- and, due to its recursive cognitive patterns, they are supposed to generate (or simulate) mental events. Being not able to use natural language and, from an evolutionary point of view, being at its infant stage, its thinking is poor, at least if compared with that of humans. Agent-based simulation models (Conte and Castelfranchi, 1995; Gilbert and Terna, 2000; Gilbert and Troitzsch, 2005; Hegselsmann, *et al.*, 1996; Pitt, 2005; Sichman *et al.*, 1998) are interesting cases for this issue. Indeed, most theorists in this field are perfectly wary of the social nature of information and knowledge, albeit they usually do not make sharp distinctions between the two. Some of them are fully engaged in steering their scientific communities far from purely computational approaches (Castelfranchi, 2002). When their simulation models are built in an emergentist way, that is when its agents are able to see their individual and/or aggregate behavior, they possess both properties of self-reference and emergent cognition. Thus, they "think" and create knowledge. Is there any tacit knowledge? Computational scientists engaged in social simulation would answer positively to also this question (Falcone *et al.*, 2002). When models are enough complex it would be possible to get the knowledge creation effects of collective behaviors lacking the possibility to exactly trace when where and how they occurred. If tacit knowledge is considered as a new form of the "ghost into machine", it would be much closer to the supposed ghost operating in human interactions.
Some computational scientists (Carley, 1999; Krackhardt, 1992, 1995) tend often to take an even more extreme position than "simple" cognitivists by assigning cognitive properties also to pure symbols repositories, like databases or books. Conversely, if computers or artificial cognitive networks were denied to think and create knowledge, or if it were assumed some form of ontological dualism or anti-reductionism between physical and mental states, then any social simulation obtained by designing and "running" artificial societies would be totally meaningless. On the other hand, being artificial cognitive networks based on bytes and (seemingly parallel) computation, if the previous conditions were reversed, then explicit knowledge would make sense. Tacit knowledge could be interpreted as residual knowledge, which would be measurable and explainable but not detectable and codifiable because embedded into the processes and "ecologies" (Carley, 1999) of interacting patterns.
Nonaka seems to be in an intermediate position, which admits the existence of both tacit and explicit knowledge. According to the SECI model, one of the main goal of knowledge management systems is just that to enable the formation of a space of interaction in which knowledge can be easily created and converted from one form to another.

5. Knowledge transfer

Although related, the questions of creation and transfer can be considered also separately: a system could be able to transfer but not to create knowledge. For example, if knowledge were concerned in both its forms of explicit and tacit knowledge, but at the same time the creation of knowledge were associated only with the highest cognitive capability (the "C" category of cognition), then a simple information technology platform of knowledge management would be a system able to transfer but not to create knowledge. It is noteworthy that this is a possibility allowed also by Nonaka's SECI model. The reverse is apparently harder to imagine, because intuitively it seems that the capacity to create is more sophisticated of the capacity to transfer, and so one can think that, if a system is able to create, then it is able also to transfer knowledge. However, this logical relationship is not so certain, and it depends on the categorization of knowledge. For instance, if knowledge is narratives, if it is action in progress, if it is knowing, how is it possible to be transferred?

For radical constructivists the non-reification of knowledge prevents the possibility of transfer, regardless how distant are the supposed senders and receivers. This limit holds even in the face-to-face relationship between a teacher and her disciples (Von Glasersfeld, 1995). Being not an object, nothing can be transferred.
This is a very crucial issue because even the ones who inspire their positions to some form of constructivism, when dealing with the problem of transfer, do accept that possibility. Indeed, almost all economic, management, and sociological literature on territorial systems, inter-firm networks, innovations and strategies is focused on, and takes for granted the possibility of knowledge transfer. It would be quite uncomfortable to have a theory of knowledge creation that implies the impossibility of transferring that knowledge.
The epistemology of possession assumes that all the three entity are transferable, eventually with some difficulty when using computer-mediated communication technologies and/or when treating tacit knowledge. Indeed, in their view of tacitness there is no any impossibility, but just inefficiency (difficulty) in terms of computational or economic resources. They could argue also that, when knowledge is well codified, computer-mediated communication technologies are more and not less efficient than face-to-face. These positions are firmly rejected by constructivists (Magalhães, 1998; Venzin *et al.*, 1998).
It is hard to believe that explicit knowledge does not require the intervention of tacit knowledge to produce any useful and effective outcome. Any amount of cookbook does not guarantee at all to be a good cook. A reason of interest for Nonaka's SECI model is that it admits the existence of, and considers both tacit and explicit knowledge as two complementary forms. Nonaka *et al.* (2006) seem particularly wary of the problems connected to the definition of knowledge and cognition, and they try to find a way to make their model consistent with constructivism. In their model *Ba* represents the contextual condition for the most critical operations of transformation between the various forms of knowledge. It could be seen as covering the area between unconscious and conscious actions where Nightingale (2003) places the limits of codifiability, and where Davidson (1980) could put the breach to the reducibility of mental events to physical events. The reinterpretation of the Japanese concept of *Ba* refers to that space of interaction where gnosiological and semiotic complexity (Biggiero, 2001c) move perceptions and cognition into the sphere of unconsciousness, and non- or para-verbal knowledge.

Conclusions

In the light of the debates on the nature of cognition and on the mind-body problem, the two rival epistemologies of possession and practice can be updated and better reformulated underlining its implications. In the former perspective: (i) cognition is the emergent outcome of complex adaptive (partially self-referential) networks; (ii) knowledge can be also explicit; (iii) artificial societies can have mental states; and (iv) tacit knowledge is, at least in principle, completely codifiable. Conversely, in the epistemology of practice: (i) cognition is associated with mental states in a one-to-one relationship; (ii) explicit knowledge is an oxymoron; (iii) artificial societies, being composed by non-cognitive agents, do not have mental states and thus, cannot simulate in a satisfying way any mental event; (iv) (tacit) knowledge is a peculiarity of organizations and it is irreducible, because qualitatively different, to information and data.
The two epistemologies seem juxtaposed and have even opposite implications. However, especially but not only in organization science, we are in a rather paradoxical situation. On one side the epistemology of practice is recruiting more and more adepts, giving a strong and exciting impulse to understand organizational mental events. On the other side the computational approach to social science has been renewed under the development and the extraordinary heuristic power of agent-based simulation models. But, as we have seen, this perspective finds its scientific sense only into the epistemology of possession. Moreover, many social simulation scientists are supposed to be

absolutely sensitive to the question of organizational mental events. Thus, it seems that the research agenda of next years has to cope with this question.
Being a sort of third way between the two epistemologies, Nonaka's SECI model is an interesting point of reference. It has the great merits to take into account (or at least to be open to consider the relevance of) organizational mental events, to legitimate the existence of explicit knowledge, and to admit that computational social simulation models can be cognitive systems in the highest sense. Its missing point is that it lacks a clear theory explaining where cognition comes from, what gives space to tacit knowledge, and to what extent mental events can be derived from organizational structure. In short, it is necessary to take clear positions respect to the two problems of the nature of cognition and the mind-body relationship.

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