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Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics
Düsternbrooker Weg 120
24105 Kiel (Germany)
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)
<https://www.zbw.eu/econis-archiv/>

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Knowledge Dynamics: Exploring its Meanings and Interpretations

Constantin BRATIANU

Bucharest University of Economic Studies, 6 Piata Romana, 010374 Bucharest, RO; 
constantin.bratianu@gmail.com

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Abstract: In the literature there are many and different interpretations of the concept *knowledge dynamics* that creates a real difficulty in working with it. There is no comprehensive study of all these meanings and interpretations attributed to knowledge dynamics. The purpose of this paper is to explore the semantic spectrum of the concept of *knowledge dynamics* and to reveal the most relevant meanings and interpretations researchers in the domain of knowledge management attribute to it. The multitude of meanings and interpretations can be explained as a result of using different metaphors for expressing the concept of *knowledge*. Also, many researchers come from different domains of science and have different practical experiences in working with knowledge and knowledge management. The research question is how can be found a common framework to explain the most significant meanings and interpretations of the knowledge dynamics concept. Understanding this concept is necessary for all researchers, academics, and practitioners working in the domain of knowledge management and intellectual capital. The research method is based on a critical literature review, on using metaphorical thinking and on a comparative semantic analysis. It is a conceptual paper and therefore its structure will follow the logic of analysis and not that used for empirical research papers. The findings are integrated into a complex but coherent semantic framework based on both Newtonian and Thermodynamics principles.

Keywords: knowledge; knowledge dynamics; knowledge sharing; knowledge hiding; knowledge flow; knowledge transformation.

Introduction

Knowledge is a concept with complex semantics that generated many interpretations during human history. With the emergence of the knowledge economy and knowledge management, knowledge became a strategic resource of organizations, and its interpretation is different from that in philosophy (Davenport & Prusak, 2000; Massingham, 2020; Nonaka & Takeuchi, 1995, 2019). The aim of this paper is to reveal that difference and to create a coherent semantic framework in order to understand the concept of knowledge dynamics in its complexity. The approach is encyclopedic because it uses knowledge from philosophy, psychology, physics, thermodynamics, cognitive science, sociology, and management. All of this knowledge is integrated and structured in concordance with an interdisciplinary perspective to make sense for the emergent domain of knowledge management.

Aristotle (1999) considered that there are five states of the soul in which the soul grasps the truth in its affirmation or denials. "These are craft, scientific knowledge, prudence, wisdom, and understanding; for belief and supposition admit of being false" (p. 88). Integrating prudence and wisdom and admitting that understanding is a generic background of learning and knowing, Aristotle (1999) defines three types of knowledge: *episteme*, *techne*, and *phronesis*. *Episteme* represents scientific knowledge that is objective and rational and satisfies the human need to find the truth. "Hence what is known scientifically is by necessity" (Aristotle, 1999, p. 88). *Techne* represents the craft

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knowledge that shows how to produce goods. *Techne* is related to production and the knowledge needed by the producer to make goods. *Phronesis* represents an integration of knowledge and decision making within a certain social context characterized by a set of shared values (Rocha, 2021; Rocha & Pinheiro, 2021). *Phronesis* has been translated as prudence or practical wisdom, and it is related to ethical decisions. "Prudence is a state grasping the truth, involving reason, concerned with action about things that are good or bad for human being" (Aristotle, 1999, p. 89).

For a long time, knowledge was considered by philosophers the result of our rational thinking because subjectivity induced by perception cannot be a justified belief. Thus, philosophers chosen for knowledge Aristotle's *episteme*. Explaining this attitude, Russell (1972) comments, "It follows that we cannot know things through senses alone, since through senses alone we cannot know that things exist. Therefore, knowledge consists in reflection, not in impression, and perception is not knowledge" (p. 153). Today, as a result of cognitive science (Damasio, 2012; Friedenbergs & Silverman, 2016), knowledge integrates perception and experiential learning (Kolb, 2015; Russell, 1972, 2009) and it is considered as a "justified true belief" (Audi, 2010, p. 247). In knowledge management, knowledge remains a "justified true belief," but the justification becomes contextual within the framework of an organization (Nonaka & Takeuchi, 1995).

Understanding the concept of *knowledge* requires metaphorical thinking because knowledge is an abstract concept without any direct material reference (Andriessen, 2004, 2006; Lakoff & Johnson, 1999). "Conceptual metaphors point to an obvious way in which people could learn to reason about new, abstract concepts. They would notice, or have pointed out to them, a parallel between a physical realm they already understand and a conceptual realm they don't yet understand" (Pinker, 2008, p. 241). However, the large number of possible metaphors one can conceive leads necessarily to a large number of possible definitions for knowledge and knowledge dynamics. Instead of looking for a unique definition for knowledge, one should search for the best definition within a certain metaphor and a given cultural context.

In the first stage of developing knowledge metaphors, most authors made the analogy between objects or stocks and knowledge (Allee, 1997; Bolisani & Oltramari, 2012; Borgo & Pozza, 2012). As a result, knowledge was conceived like an object with finite dimensions, static, and subjected to linear logic. In the second stage of metaphorical thinking, authors conceived knowledge as a fluid flow (Leistner, 2010; Nissen, 2006; Nonaka, Toyama, & Hirotaka, 2008; O'Dell & Hubert, 2011). This metaphor is very intuitive, and it has been used many times in science to explain some fundamental concepts like heat and electricity. The metaphor removes the static and the object's piecewise limitations. However, it still keeps the linearity logic. Nissen (2006) explained very well what this metaphor means "To the extent that organizational knowledge does not exist in the form needed for application or at the place and time required to enable work performance, then it *must flow* from how it exists and where it is located to how and where it is needed. This is the concept of *knowledge flows*" (p. XX).

To remove the limitations of tangibility and linearity, Bratianu (2011) introduced in knowledge management the *energy metaphor* that has been further developed by Bratianu and Bejinaru (2020). In the framework of this new paradigm, knowledge is conceived as a field that is intangible, continuous, and nonlinear. Thus, all the previous limitations in explaining knowledge have been removed. The metaphor was further developed to define the basic fields of knowledge and the continuous dynamics between them and to show how we can apply it in analyzing different knowledge processes (Bejinaru, 2017; Bratianu et al., 2011; Bratianu & Leon, 2015; Bratianu, Prelipcean, & Bejinaru, 2020).

Knowledge dynamics closely followed the metaphorical evolution of the knowledge concept. For knowledge as an object or a stock, knowledge dynamics means especially the variation in time of the content of knowledge. Bereiter (2002) uses for explaining that process the container metaphor. According to it, knowledge can be accumulated like any substance and the level of that substance reflects the level of knowledge one possesses. For knowledge as a fluid or fluid flow, most of the authors use the metaphor of stock-and-flow (Bolisani & Oltramari, 2012; Nissen, 2006; Nonaka, Toyama, & Hirotaka, 2008). For the energy metaphor, Bratianu (2011) uses the idea of knowledge transformation. We will discuss all of these interpretations in the next sections.

Knowledge variation in time

At the individual level, knowledge is a result of the learning process. Therefore, the level or content of knowledge one may have will vary as a direct result of learning (Bereiter, 2002; Illeris, 1999), or as a result of unlearning (Cegarra-Navarro & Wensley, 2019; Cegarra-Navarro, Elridge, & Martinez-Martinez, 2010). At the organizational level, the level of knowledge varies as a result of one of the following processes: knowledge creation, knowledge acquisition, knowledge forgetting, and knowledge loss. Organizational learning and unlearning are the main mechanisms through which individual knowledge integrates into organizational knowledge (Argote, 2013; Beitler, 2010). In the first case, learning is viewed as "the development of new insights through the revision of assumptions, causal maps or interpretative schemas" (North & Kumta, 2018, p. 17). In the second case, learning is conceived as an integration process between knowledge creation and action, leading to behavioral change. Regardless of the approach, organizational learning contributes directly to the increasing level of knowledge over time. Knowledge acquisition is introducing knowledge from external resources into an organization and integrating it into the existing one. Knowledge managers play the role of knowledge integration.

From a different perspective, many authors prefer to discuss about intellectual capital (Andriessen, 2004; Ricceri, 2008; Stewart, 1997), or knowledge capital (Garcia-Perez, Gheriss, & Bedford, 2020; Lafayette et al., 2019). Intellectual capital represents the integration of all intangible resources from an organization that can create value for society. Intellectual capital is a potential at a given time and for a given organizational context. In time, it varies as a result of the multiple processes discussed above. Kianto performed several analyses of the intellectual capital dynamics in time (Kianto, 2007; Kianto et al., 2017), but considering only quantitative changes. Knowledge variation in time may also refer to a transformation of one form of knowledge into another one that induces a qualitative variation. For instance, tacit knowledge can be transformed into explicit knowledge through mental processes that is a qualitative knowledge variation in time.

Knowledge loss contributes to the reduction of knowledge or intellectual capital levels (Bratianu, 2014; DeLong, 2004) with grave consequences on organizational performance. "As applied here, 'knowledge' is the capacity for effective action or decision making in the context of organized activity. Thus, lost knowledge means the decreased capacity for effective action or decision making in a specific organizational context" (DeLong, 2004, p. 21). Knowledge managers can reduce the negative consequences due to lost knowledge by developing strategies for intergenerational learning and knowledge retention (Bratianu & Leon, 2015; Bratianu et al., 2011), and stimulating strategic conversations (Spender & Strong, 2014).

Knowledge variation in time and space

Any variation of knowledge in space implies time. Thus, it is a variation in time and space, but for us, it is important the space dimension. Knowledge dynamics in space is based on Newtonian mechanics because it is conceived as a fluid flow or stock-and-flow system. Therefore, we can use for this type of knowledge dynamics the well-known expression of *knowledge flow* (Leistner, 2010; Nissen, 2006). Starting with knowledge transfer within an organizational context and analyzing its structure and dynamics, Zieba (Zieba, 2018) defines knowledge flow as "the movement of knowledge between people" (p. 27). Thinking that knowledge is created in the people's body as tacit knowledge and in their mind as explicit knowledge, one may enlarge the above definition to reflect also the motion of knowledge with people.

Knowledge flow can be considered as a synchronous knowledge transfer using communication between people. If the knowledge transfer is asynchronous, then the analogy with fluid mechanics does not work anymore. Knowledge flow assumes a continuous motion of knowledge from one individual to another one or to a group of people. When researchers refer to knowledge flow, they have in mind explicit knowledge that can be transferred using natural or symbolic languages. For the transfer of tacit knowledge, the metaphor of fluid flow becomes inadequate because people transfer tacit knowledge through imitation and body language (Nonaka & Takeuchi, 1995).

The most researched process of knowledge flow is *knowledge sharing* (Balle et al., 2019; Hejase et al., 2014; Vătămănescu et al., 2022). Knowledge sharing is a voluntary process of an individual to transfer some of his experience and expertise to other people aiming at helping them to solve problems and increase their level of knowing. Knowledge sharing is based on trust and a certain perception of usefulness. "Fundamentally, a lack of trust between individuals is likely to inhibit the extent to which people are willing to share knowledge with each other. This is because the lack of trust creates uncertainty and risk for the perception of a risk that all parties may not participate or benefit equally and that due to opportunistic behavior, someone may lose out from sharing their knowledge (for example, by getting nothing in return)." (Hislop, 2005, p. 51). Because of the risk involved in knowledge sharing, there is a general tendency for knowledge hiding (Connelly et al., 2012; Ruparel & Choubisa, 2020). If we realize a knowledge flow within an organizational context, at the individual level, there is a dynamic between knowledge sharing and knowledge hiding that has psychological and behavioral roots. That knowledge dynamics depend on the organizational culture and leadership style of the decision makers.

We learn from fluid mechanics that the driving force of any flow is the difference between the pressure fields existing at both extremes of the pipe or the difference between the altitude levels existing for natural flows like those in rivers. For knowledge flow, the literature lacks research on these driving forces. Also, there is a need for more efforts to understand knowledge dynamics in space related to the inertial phenomena known as knowledge *stickiness* (Szulansky, 1996, 2000), and the capacity of knowledge absorption existing at the endpoint of the flow (Mariano & Walter, 2015; Zahra & George, 2002). Zahra and George (2002) define absorptive capacity (ACAP) "as two subsets of potential and realized absorptive capacities. Potential capacity comprises knowledge acquisition and assimilation capabilities and realized capacity centers on knowledge transformation and exploitation" (p. 185).

Knowledge transformation

Knowledge transformation can be defined as a process of transforming one form of knowledge into another form. Knowledge transformation is a time dynamics. This transformation can be defined at individual, group, and organizational levels. The first author who developed a coherent model of knowledge dynamics based on knowledge transformation was Nonaka (1994). The model conceives a cycle composed of four processes: socialization, externalization, combination, and internalization. Socialization and combination are processes of knowledge transfer, while externalization and internalization are processes of knowledge transformation from tacit to explicit forms and from explicit to tacit forms (Nonaka & Takeuchi, 1995, 2019; Nonaka, Toyama, & Hirotaka, 2008). All of these transformations need time for their realization.

Socialization is the process of transferring tacit knowledge between individuals within an organizational context. This process is important especially in industrial contexts where workers can learn one from another through socialization. Knowledge is transferred using body language and imitation. *Externalization* is the process of transformation of tacit knowledge into explicit knowledge in the mind of a certain individual. This transformation is possible using the natural language or a given symbolic one (Pinker, 2008). It is difficult to explain how this process is done because tacit knowledge is processed by the cognitive unconscious while the explicit knowledge is processed by the conscious brain (Damasio, 2012). Externalization uses analogies and metaphors to create semantic domains for abstract concepts. *Combination* represents a transfer of explicit knowledge between people within an organizational context. Combination is an emergent process of collective knowledge formation as a result of possible contributions from those who participate in that process. It is a social process of knowledge construction starting from an initial individual's idea. *Internalization* is the reverse of externalization. It is a transformation of explicit knowledge into tacit knowledge in the mind of individuals. The whole cycle of socialization, externalization, combination, and internalization (SECI) creates a knowledge spiral that emerges in time and constitutes the key process of organizational knowledge creation. Thus, the SECI model refers to organizational knowledge creation dynamics (Nonaka & Takeuchi, 1995, 2019). In the first version of the SECI model (Nonaka, 1994) time was an implicit variable, while in the new formulation (Nonaka & Takeuchi, 2019) time is an explicit variable and contributes in transforming the two-dimensional process into a three-dimensional one.

The theory of knowledge fields (Bratianu, 2011; Bratianu & Bejinaru, 2020) advances the field model of knowledge that goes beyond Nonaka's dyad of tacit and explicit knowledge. The theory defines three fundamental fields of knowledge: rational, emotional, and spiritual knowledge. According to the second law of thermodynamics, each form of knowledge can be transformed into another form of knowledge in a continuous and random way. Thus, knowledge dynamics in this model is more comprehensive and approaches the complexity of real cognitive dynamics (Kahneman, 2011; LeDoux, 1999). The model offers a better explanation for knowledge sharing and innovation because it contains distinctively emotional and spiritual knowledge fields and their influence on decision making (Bratianu et al., 2021; Vătămănescu et al., 2020; Vătămănescu et al., 2022). Emotional knowledge becomes a critical factor in building up a stronger motivation for innovation and achieving competitive advantage, and spiritual knowledge is essential in developing an adequate vision for the organization and developing knowledge strategies (Bratianu, 2002; Nonaka & Takeuchi, 2019).

Kahneman (2011) presents a wonderful psychological experiment done in a British University, in the kitchen office, showing how the transformation of emotional knowledge into rational knowledge and spiritual knowledge leads to a change in the students'

behavior. For years, in that kitchen students could have a tea or a coffee serving themselves and paying according to a list with suggested prices by dropping money in a "honesty box". "One day a banner poster was displayed just above the price list, with no warning or explanation. For a period of ten weeks a new image was presented each week, either flowers or eyes that appeared to be looking directly at the observer" (Kahneman, 2011, p. 57). Each evening the money put into the box was counted and recorded. The final chart obtained after that experiment showed clearly that during that experiment the money dropped into the box compared with the consumed products and the price list varied from one week to another. When the poster contained eyes, the sum of money increased and when there were posted flowers, the sum of money decreased. The conclusion is that the presence of eyes induced an emotional state of increased attention and responsibility with respect to the price list that changed the students' behavior. According to the knowledge dynamics model, emotional knowledge transformed into spiritual knowledge and rational knowledge and influenced the decision-making process. These kinds of transformations happen currently in our brains, but they are difficult to be explored because of the cognitive unconsciousness involvement (Damasio, 2012; LeDoux, 1999).

The rational, emotional, and spiritual knowledge (RESK) model is important in change management because it explains the role of emotional knowledge in triggering the change and the role of spiritual knowledge in transforming organizational culture (Kotter, 1996). "Changing behavior is less a matter of giving people analysis to influence their thoughts than helping them to see a truth *to influence their feelings*. Both thinking and feeling are essential, and both are found in successful organizations, but the heart of change is in emotions. The flow of see-feel-change is more powerful than that of analysis-think-change" (Kotter & Cohen, 2002, p. 2). Leaders who create visions and motivate people for change must understand that decision making that triggers change is driven by the emotional field of knowledge, not the rational one as considered in the industrial management. The RESK model is also important in developing knowledge strategies for a business environment disrupted so frequently by unexpected crises, like the recent Covid pandemic.

Knowledge dynamics in knowledge networks

A network is a physical or functional structure of interconnected elements characterized by a shared purpose and some well-defined emergent characteristics. The fundamental components of any network are nodes, links, and holes (Borgatti & Halgin, 2011; Brass et al., 2004; Westaby, Pfaff, & Redding, 2014). When the purpose of the network is to exchange and create knowledge, then we discuss about a *knowledge network* (Vătămănescu et al., 2023). Today, as a result of the exponential development of information technology, we may identify knowledge networks almost everywhere. Their nodes are generators and receivers of knowledge, and the links are the communication channels between nodes. "The secret to understanding how knowledge is produced, consumed, and flows through communities, organizations, or societies is by observing how it flows through and affects knowledge networks" (Bedford & Sanchez, 2021, p. 3). When all the components of the network work online, then we discuss about online knowledge networks. The COVID-19 pandemic accelerated the transformation of many physical networks into online networks, a phenomenon that increased in multinational companies and international business enterprises.

Network *nodes* represent the stocks of knowledge and the functional agents which send and receive knowledge from other nodes. Also, the nodes contribute to the co-creation of knowledge. Nodes can be individuals, groups of people, or organizational entities of any

type. In nodes there is a variation of knowledge in time. That can be an increase in the level of knowledge, a decrease of that level, or a transformation from one form of knowledge into another form. *Links* connect nodes and constitute the communication channels that become knowledge flow pathways. Links may have different strengths, and they allow knowledge to flow in all possible directions. The direction of the flow is given by the inverse direction of the knowledge gradient between the connected nodes. Along the links there is a variation of knowledge in time and space (Bedford & Sanchez, 2021). In all knowledge networks the strength of the links depends of the motivation of people to share their knowledge and to collaborate in knowledge cocreation. *Holes* result from the architecture of the network. They can be closed or open. The last ones are also called structural and they show some barriers in knowledge flow distribution. Understanding their role in the network knowledge dynamics, knowledge managers can search for solutions to enhance the network knowledge entropy (Bratianu, 2019).

Kodama (2011) remarks that within large networks of people and companies emerge strategic communities (SC) which are formed cross-functionally by practitioners from different organizations. "SCs are small-world networks comprising groups of practitioners with diverse specialties who achieve new innovations aimed at solving problems, discovering new tasks, and implementing creative strategies. Small-world networks feature short connections between nodes (people being the smallest node unit) and local clustering" (Kodama, 2011, p. 11). These emergent microstructures contribute to the intensification of knowledge exchange and innovation process. When the knowledge networks cross different cultures, then all the knowledge flows are dependent on the level of cultural intelligence of the knowledge managers. Cultural intelligence represents the capacity of understanding other cultures and of performing across them. "Cultural intelligence refers to the skills and abilities to relate and work efficiently and effectively in a cultural context different from one's own, and of a nonlinear field of knowledge, especially in a learning organization" (Paiuc, 2021, p. 365). Different cultures imply different cultural values, traditions, life philosophies which generate different spiritual knowledge fields. Therefore, understanding them is a prerequisite for managing people from different culture working together and creating a powerful motivation for innovation.

Organizational knowledge dynamics

Organizational knowledge is a construct that reflects the property of individual knowledge to evolve in a social context and to become through an integration process a collective knowledge. As Nonaka and Takeuchi explain (1995), "Organizational knowledge creation is a spiral process, starting at the individual level and moving up through expanding communities of interaction, that crosses sectional, departmental, divisional, and organizational boundaries" (p. 72). There are two semantic approaches in explaining organizational knowledge. In a restrictive way, organizational knowledge is that integrated collective knowledge that detached from their owners and became specific for the organization. For example, in any organization there are different working procedures which have been designed by individuals but once they became a common good they lost their initial ownership. In the same category we may include organizational regulations, patents, innovations, and organizational culture. In a large semantic acceptance, organizational knowledge comprises all the individual and collective knowledge existing at a given time in organization.

The transformation of individual knowledge into organizational knowledge through the integration process implies *codification* (Massingham, 2020; Nonaka & Takeuchi, 1995). Codification is the process of transformation initial knowledge of different contributors

into a common language based on a certain code. A simple example could be using English as a common code for people of different cultures working in a multinational company. Codification allows organizational communications and strategic conversations as means of combination and construction of the knowledge spiral (Nonaka & Takeuchi, 2019).

Organizational knowledge dynamics refers to the variation in time of the level of knowledge within the organization's boundary. Because physical boundaries become more and more fuzzy for the new types of organizations, we will consider their operational boundaries. The knowledge balance is influenced by all the knowledge flows crossing the boundaries in both directions creating knowledge gains and knowledge losses. These knowledge flows can be generated in the supply chains or through participation in knowledge networks. Knowledge losses are generated by retired people, by those employees who decide to leave the company for different reasons or by intentional unlearning. Knowledge gains results in increasing the organizational knowledge level, while knowledge losses contribute to the decrease of that level. An important factor in increasing the level of organizational knowledge is knowledge creation or co-creation. Knowledge sharing does not create knowledge but it has an important role in the variation of organizational knowledge distribution leading to increase innovation (Bratianu, 2019).

Conclusions

Knowledge dynamics is a complex phenomenon that reflects the knowledge variation in time and space, as well as knowledge transformation from one form into another one. Time is a fundamental variable that is involved in any type of dynamics. Understanding knowledge dynamics is bound to metaphorical thinking to understand the power of metaphors used for explaining both concepts of knowledge and knowledge dynamics. The simplest metaphors lead to portraying knowledge as finite objects or stocks and knowledge dynamics as the variation of knowledge in time. Here, we may include intellectual capital because it is, by definition, a potential of any organization.

We get a better understanding of knowledge dynamics when the metaphors for knowledge become fluid flow or stock-and-flow. These metaphors based on the phenomena of fluid mechanics are very intuitive for understanding knowledge dynamics as a variation of knowledge in space as a flow. The organizational phenomena which can be explained within the new semantic framework are knowledge transfer and knowledge sharing. While knowledge transfer is a general concept for organizational communication, knowledge sharing is based on the willingness of a certain individual to explain some of his experience and expertise to other people whom he trusts. Knowledge sharing contributes directly to changing the organizational knowledge distribution such that its entropy is increasing. However, knowledge sharing creates the adverse phenomenon of knowledge hiding as a protection against losing some positional power in an organization. Knowledge dynamics in this specific situation become the dynamics between knowledge sharing and knowledge hiding.

Knowledge transformation represents the most complex phenomenon of knowledge dynamics. Its complexity depends on the knowledge spectrum considered for knowledge. In the SECI model, Nonaka (1994) considered only explicit and tacit knowledge, while in the thermodynamics model, Bratianu (2011) considered rational, emotional, and spiritual knowledge. Transformations are irreversible processes creating premises for knowledge entropy increase. Knowledge dynamics become even more complex within the knowledge networks. Understanding knowledge dynamics is essential for knowledge management and knowledge strategy creation. Change management is based on the RESK model due to

the role of emotional knowledge and emotional intelligence in creating a powerful motivation, and of need of an attractive and desirable vision based on spiritual knowledge.

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