A Novel Proactive Meta-Level Approach to Configuration of Soft-Computing Modeling

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Abstract

This paper presents a novel mediating configuration paradigm and delineates its application to business planning. Thus it grasps the future challenge of Soft Computing presented by Professor Lotfi Zadeh in the recent conference of "FORGING NEW FRONTIERS - 40th of Fuzzy Pioneers (1965-2005)". He suggests that in the future we should rather provide new questions and find solutions for new problems than do better the things which we have done before. Our process approach to the concept of paradigm positions and the paradigm discussion and gives us a tool for approaching configuration. It also provides the guidelines for modeling human learning, intelligence, behavior and related areas in practice as well as it gives us an access to proactive and innovative solutions in Soft Computing modeling.

Keywords: Paradigm, Soft Computing, configuration, business planning.

1 The Configuration Paradigm and Its Application Areas in Soft Computing

In order to better understand our configuration approach, we first consider the meaning and origin of the concept *paradigm*.

As a concept, "paradigm" is an outcome of an intensified discourse of the dynamics in science that has gained strength, especially in the latter decades of the 20th century. A tremendous growth of scientific knowledge has generated different suggestions about its nature, its relationship to surrounding reality and, on the other hand, to propositions on how this issue, or relevant and valid knowledge in general, is supposed to be acquired or created [1,9,12,21,22]

A larger context for this debate is the philosophy of science that is centered, on the one hand, on methodology closely related to the theory of knowledge, and on the other hand, on the meaning and content of the posited scientific results closely relating to metaphysics.

The philosophy of the social sciences in this field consists of social phenomena as distinction from natural phenomena. It considers what is a good social explanation, i.e., is there a distinctive method for social research and, for example, what is the relationship between social and individual facts? This relationship has both descriptive and prescriptive qualities, e.g. [1].

In order to study the nature of a paradigm, we can learn from this dynamic debate of the development of scientific inquiry that basically has challenged the view of empiricism towards the theory change as an ongoing smooth and cumulative process in which empirical facts, discovered through observation or experimentation, forced revisions in our theories and thus added to our ever-increasing knowledge of the world. [1] Thus it gives us the keys to approach the configuration.

Popper [21] examined this problem in his famous book "The Logic of Scientific Discovery". He claimed that, from the epistemological standpoint, science is not a system of certain, or well-established, statements; nor is it a system which steadily advances towards a state of finality. Our science is not knowledge (episteme) because it can never claim to have attained truth, or even a substitute for it, such as probability. According to him, the old scientific ideal of episteme – of

absolutely certain, demonstrable knowledge – has proved to be an idol.

Popper used the expression *a theories theory* describing the advance towards theories of an ever-higher level of universality. As a theory of rules for scientific method he applied the term "quasi-inductive". It refers to a sort of interplay between a deductive and an inductive method. The idea of a theories theory and a quasi-inductive process are his proposition of scientific dynamics and structure [21].

Popper's main point in this context is the idea of science as a dynamic open-ended and open-minded process. Somewhat different, and perhaps an even more dynamic approach, concentrating more on the nature of the process, can be depicted in the writings of one of Popper's earlier contemporaries, Gaston Bachelard (1884-1962), a French philosopher of science and a literary analyst. In his books "The New Scientific spirit", 1934, and "Rational Materialism", 1953, he generated a dialectical and cyclical approach. For him, scientific knowledge proceeded through a dialectical process of reason and experience. He claimed that new scientific knowledge may lead to a fundamental reformulation of reality [7]. He viewed science as developing through a series of discontinuous changes (epistemological breaks). Such breaks overcome epistemological obstacles: methodological and conceptual features of common sense or outdated science that block the path of inquiry [1].

Bachelard offers us a dialectical process with reason and experience. The problem is how can we identify the criteria for those phenomena in this cyclical process that are valuable enough to be further investigated, unless the experience itself defines it?

These discontinuities were moulded in Kuhn's hand, years later, into the idea of a revolutionary development of paradigms. For Kuhn, the paradigm is a key component in the development of scientific knowledge. In his world-famous book, "The Structure of Scientific Revolution", he argues that scientific work and thought are defined by paradigms consisting of formal theories, classic experiment and trusted methods. Paradigms are conceptual world-views or outlooks. Kuhn [12] was the scientist who first formulated the idea of a paradigm.

As regards the configuration paradigm for constructing Soft Computing models, to date it seems to include two central methodological principles.

First, at meta-level configuration, in which we should provide new ideas and innovations, carry out planning, evaluate our ideas, implement our ideas to concrete models and re-evaluate the usability of these models, we too often only seem to focus on the implementation and re-evaluation stages.

Second, from the methodological standpoint, various phenomena of the real world are still problematic for computer modeling. In particular, phenomena related to human beings and animate world are still black boxes or at least more or less grey boxes. This is due to the fact that these phenomena include complicated entities and they can constitute of networks which include several nodes with various causal and teleological interconnections as well as with other interrelationships. In addition, their nodes may include non-numerical, imprecise or uncertain entities.

In human sciences the two principal methodological traditions are quantitative and qualitative approaches [19]. The former assumes that we can apply similar methods to both animate and inanimate world and these methods usually have their origins in natural sciences. In philosophy, this idea of methodological monism is particularly maintained in the positivistic approaches.

The qualitative tradition, in turn, presupposes that studies on human beings should apply additional methods that better take into account features characteristic of people such as their intentional behavior. The Geisteswissenschaften ("Spiritual sciences", e.g. hermeneutics and phenomenology) usually provide a philosophical basis for this approach.

In Soft Computing model configurations the quantitative approach has prevailed and this state of affairs has based on two facts. (i) Most models only apply fuzzy mathematics whereas actual fuzzy systems with their own precisiated languages, linguistic values and linguistic reasoning are still quite rare. (ii) Most applications

are devised to control, robotics and decision making and they apply methods of systems theory and engineering sciences, more generally, the quantitative approach.

It is our goal to introduce a novel proactive approach to meta-level configuration of Soft Computing modeling. Our approach considers this configuration as a holistic process and network in which idea generation, design, planning, implementation, follow-up and evaluation stages constitute a comprehensive network with various interrelationships between its nodes.

In addition, we also apply qualitative approach and actual fuzzy linguistic systems with linguistic values and reasoning when we consider these networks.

Our approach thus aims to provide more usable, user-friendly and versatile meta-level constituents to Soft Computing model configuration.

In Section 2 we sketch our configuration approach. Section 3 provides an application example of a Learning Business Plan system. Section 4 considers the usability of Soft Computing in our configuration. Section 5 concludes our examinations.

2 Providing Questions for a Novel Proactive Configuration Approach

Professor Lotfi A. Zadeh summarized in the recent conference of "FORGING NEW FRONTIERS - 40th of Fuzzy Pioneers (1965-2005)" the future challenge for Soft Computing by first dividing the aims of configurations roughly into two questions:

1. Is our aim to do better the things which we have done before?
2. Is our aim to provide new questions and find solutions for new problems?

The first question has dominated development during past forty years, but in the future we might benefit from focusing more on the second question.

According to the aim of the BISC Group, the role model for Soft Computing is the human mind and it assumes that Soft Computing represents a significant paradigm shift in the aims of computing – a shift which reflects the fact that the human mind possesses a remarkable ability to store and process data and information which is pervasively imprecise, uncertain and lacking in categoricity.

Even though storing and processing information is an important aspect, more challenging is to take a role model from the innovativeness of human mind and the ability of human being to proactively change reality based on these innovations.

These are the problems that might draw a distinction to future configurations and provide a new approach to the future. In addition Soft Computing shares these problems with the fields of science studying human behavior such as education and business, which today also claim to experience paradigm shift that relates to complexity and not only uncertainty but insecurity [16, 25].

By adopting this proactive configuration approach we can also provide the guidelines for modeling human learning, intelligence, behavior and related areas in practice by applying the paradigm which mediates between philosophical bases and the actual behavior of the human being.

As was mentioned above, the starting point for Kuhn was the problematic connection between the natural and social sciences, and this connection also seems to arouse problems in Soft Computing.

The problem with Kuhn's concept of a paradigm is that his explanation of the dynamics of science excludes the role of technological advance or of external social, economic and intellectual conditions that might make a difference in a paradigm discussion [12]. It could be argued that this might be an important aspect especially the case of such phenomena which seem to emerge under or create certain economical and social conditions.

Even though these representatives of the dynamic approach to a scientific inquiry and a

paradigm development have different views, all of them still believe that there is not only one true and stable knowledge or one way of achieving that knowledge, but rather the reality and hence the way to inquire knowledge about it changes. Thus *the core of the paradigm seems to relate to the complex interplay between scientific inquiry and its relationship to knowledge creation, i.e., epistemology, and to our ideas of the world and existence in it, i.e. ontology.* As Niiniluoto [17] suggested, it is a larger concept that seems to gather, on the one hand, the philosophical bases for the phenomenon or a field of science being studied. Thus, it seems *to deal with both, the very basic ideas of the world, human existence and knowledge, and methodological considerations that are deduced from these assumptions*.

Thus, paradigms seem to play a certain role as *a mediator between philosophical bases and actual methods, and individual theories. It contains the theoretical bases defining the very nature of a phenomenon and the rules to gain knowledge about that phenomenon.*

We can also argue for the need to define philosophical bases by looking at the actual content of the paradigm and methodological discussion. There seems to be a tendency to deduce the argumentation from dualism and disregard as a starting point non-dualistic traditions in philosophy. By looking at the whole chain of choices from philosophical bases to actual methods, there might be a less laborious access to the non-dualistic assumption of reality.

In order to go forward with this suggestion, we will make an effort to construct a configuration paradigm which acts as a mediator between philosophical bases and methodological choices.

In this task ontology and epistemology provide our "rules of the game", and we have different games with different rules. These rules are interconnected within each game in the sense suggested by e.g. Stevensing and Harmeling [24].

Ontology is the largest and deepest level. Epistemology is derived from ontology and, further, we have different ways of acquiring knowledge that refers to methodology. These bases also lead us to theories on the phenomenon, thus theories and methodology are interconnected. Further, each methodological choice consists of several specific methods. Within these methods we might have several alternatives for data collection. This structure is delineated in Figure 1.

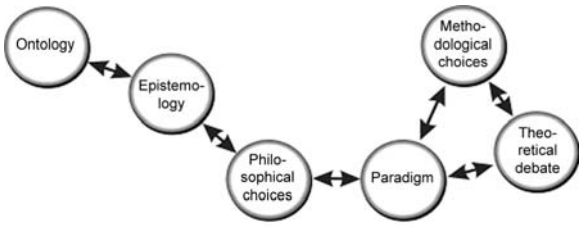

Figure 1 The mediating configuration paradigm [13].

Our process approach positions the paradigm discussion and gives us a tool for approaching configuration. It might also advance the paradigm discussion itself, since it positions and specifies the place and the role of the paradigm in a scientific inquiry thus further developing Kuhn's original idea of its essence. On the other hand, it is a quite simplified view of an utmost complex phenomenon, and thus open to criticism that might further advance the paradigm debate.

Hence, the guidelines for configuration refer to the consistency of the foregoing process approach. If human intelligence is supposed to be creative and capable of creating reality, we should take this as a starting point and make certain that we do not violate this ontological assumption at any stage of modeling. In this manner we can genuinely focus on the second question, i.e., on providing new questions and find solutions for new problems.

3. An Example of Learning Business Plan – Novel Problem Setting

Why need we new configuration to business planning? Business planning is an example of a need to find proactive approach and configuration paradigm since the benefits of planning might actually rather be a myth than a fact.

Planning does not necessarily improve performance. Tomas Karlsson [10] quite convincingly argues for the fact that there is actually only moderate relationship between planning and performance. And further that there is no evidence that the performance of the start-up will improve or be more potential to start if the entrepreneur have done the business plan. Actually this situation can be vice versa as Carter, Gartner and Reinold's [6] study indicated. Those having business plan at their early phase of start-

up tended to stay at the intention phase longer than the others. Thus instead of helping to start the business, business planning rather seems to cause more or less delay in this process. Also Delmar and Shane [8] found out that there was no significant relation between writing a business plan and profitability.

On the other hand there is some evidence that participating business plan competition and actually starting the business had some connection.

So basically it is quite reasonable to ask why do we carry out business planning if it does not help us to start a business or to improve the performance of our business. On the other hand, to be proactive and follow Lotfi Zadeh's challenge for the future, we can ask whether the present strategies are wrong, if they do not yield us better performance.

The latter question is important because the most recent Western reports indicate that the prevailing approach to teach entrepreneurship in universities is business planning. [16, 25].

We suggest that the problem might be in the configuration approach and its paradigm, that rather relies on dualism and linear modeling than innovative and complex human intelligence. Camille Carrier [5] argues that this actually is the problem of business planning; we should be more creative and put more emphases on creating the business idea, not to evaluate imitated ideas. Also Klapper [11] has similar findings from experiments with business planning with 300 Grand Ecole students in France. In order to concretize these problems we take a new approach to configuration of the process of business planning.

Based on the process oriented mediating concept of a paradigm we suggest that the business planning process should start from ontological assumption that a human being is creative and able and willing of exploiting this creativeness. Thus the essential phases and starting points in business planning are developing and evaluating the actual business idea. This part has been neglected in previous linear modeling. Thus the process besides business planning should also contain developing the business idea and evaluating it, that might change the actual idea.

The speed of business cycles has increased which means that also that there is the need to re-evaluate business idea and consequently the business plan more often than previously. Thus the business planning process should also contain as its essential part the follow up or re-evaluation phase.

Thus we have a five-phase model for business planning.

Phase 1: Business idea	**Phase 2:** Developing idea	**Phase 3:** Evaluating idea through business planning	**Phase 4:** Implementing business plan	**Phase 5:** Following, and updating Re-evaluating business plan and business idea
According to the degree of innovativeness		According to the phases of business planning	According to the phases of business planning	According to the phases of business planning
Creating (innovating)		1. Evaluating Demand and competition	1. Testing business idea: demand and competition	1. Re-evaluating business idea: demand and competition
Recognising (innovating/imitating)		2 Evaluating business environment, industry and clients	2. Testing business environment, industry and clients	2. Re-evaluating business environment, industry and clients
Depicting (imitating)		3. Developing goals and strategy	3. Developing goals and strategy	3. Re-developing goals and strategy
		4. Developing operational plans	4. Operational plans	4. Evaluating operational plans
Question 2		Question 1	Question 1 or 2 or both depending on phase 1 and 2	
Is our aim to do better the things which we have done before? Is our aim to provide new questions and find solutions for new problems?				

The problem is that the focus in business planning has been at the phase three and thus it has been based on calculating tools for feasibility studies rather than an actual tool for taking into account the whole venture process. Thus modeling it by using Soft Computing only gives us access to the first question provided by Lotfi Zadeh above.

By starting from phases one and two instead might give us an access also to Zadeh's second question and then phases four and five might

benefit from our assumption that we apply the new configuration paradigm since the current approach to do business planning gives us access only to the first question. Hence, the access to the second question presupposes that we start the modeling from the foregoing basic philosophical problemacy as our guiding principle.

Our ambitious aim is to develop a simulation tool that covers all five phases and additionally let us study the process and meta-competences of learners in order to help learners to learn how they learn business competences. For that purpose next we sketch how to apply the opportunities of soft computing.

4. The Role of Soft Computing in Novel Configuration Approach

From the Soft-Computing standpoint [26,27] our aim is to apply computer modeling for such complicated phenomena as above. In this task we can use concept maps, cognitive maps and fuzzy systems to a great extent and then we can simulate the behavior of these phenomena in a computer environment [2-4,18,20,23].

Various numerical cognitive map configuration approaches are already available in the literature but they can be problematic because they usually are linear models which only use numerical values and simple monotonic causal relationships. They are also unable to take time delays into account. On the other hand, in addition to configurations only based on human expertise, by virtue of neural networks and evolutionary computing we can also construct these configurations more or less automatically with given data sets if necessary.

In order to construct more usable, proactive and versatile cognitive maps for configurations, we should use *linguistic* fuzzy cognitive maps. These maps can use linguistic variables, approximate linguistic values, more versatile interrelationships and non-linear modeling because fuzzy linguistic variables, fuzzy rule sets and fuzzy reasoning can be applied. Our maps can also apply both qualitative and quantitative methods. However, we still lack automatic methods based on data sets when we construct these maps. Neuro-fuzzy systems, regression analysis and analysis of variance seem to resolve this problem at least partially if data is available.

Hence, fuzzy linguistic cognitive maps of this type can enhance computer model construction in both quantitative and qualitative research and they also allow us to construct models in several such conditions in which this type of work was impossible before.

As regards the two questions provided by Lotfi Zadeh in Section 2 and our five-phase business plan model delineated above, we can approach this problemacy at two levels, at the meta and object level.

At object level we can construct linguistic cognitive maps for each phase according to expertise, data collected with quantitative questionnaire forms and information based on open or semi-structured interviews, inter alia. We can also apply statistical methods or concept maps. In this context we can thus enhance the existing configurations by utilizing user-friendly computer modeling more effectively. In addition, our computer modelings allow us to find new problems when we simulate such phenomena which were impossible for simulation before.

For example, configurations at phases 1 and 2 principally base on qualitative methods whereas at phase 4 quantitative methods seem essential.

At meta level we can construct configurations which supervise, tune, modify and control our object-level configurations. By virtue of linguistic cognitive maps we can thus both enhance the performance of these tasks and replace manual tasks with proactive computer systems. At meta level computer modeling also provides us new questions and problem-settings.

5. Conclusions and Challenges for the Future

Our proposition of the mediating process paradigm approach for proactive configuration of soft computing most certainly is open to critics and also to future challenges. They concern both the conceptual issues and their operationalisation necessary for modeling.

To keep consistency in modeling throughout the process is hard, since it assumes that we combine concepts from two different worlds, that of soft computing and philosophy. To apply this combination to learning process and actual modeling can easily get lost and requires expertise at the same time from philosophy, soft computing and education. Thus it is not enough to combine these but to create the combination of them.

To enhance learner's creativity and find right questions for that is another challenge, since it is easy is to kill creativeness before learners has a change to use it.

Finally to construct the simulation tool requires that we also success to give it the external representation that follows consistently the paradigm, which means that the expertise group needs talented and creative programming and on-line graphical and animation members. But as the core of entrepreneurship assumes, we are ready to create opportunities for that.

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