Cognitive Sciences Strategies for Futures Studies (Foresight)

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Abstract. Developing the conceptual model of the origin of the idea of future scenarios leads to explore Cognitive Sciences (CS) strategies for Futures Studies (FS). This research will try to answer how scenario planning would benefit from CS by reshaping mental models? In other hand, how these explored strategies could develop the future oriented intelligence's machine? This is a vast amount of work to be considered. Modeling via abduction, chance-seeking via intervention on tacit knowledge, Acquiring useful information via causality grouping, Intelligence increase over time and idea blending are just the first examples, so we have a long way to go.

Keywords: Cognitive Science; Futures Studies; Mind Structure.

1 Introduction

This is a very abstract and theoretical paper that lays out a range of ideas about Cognitive Science (CS) and Futures Studies (FS) on the basis of previous argumentations. This paper intends to solidify and explore relations between CS and FS. In particular, it discusses how concepts and developments within CS could be deployed in FS and attempts to discuss how CS and FS can be meshed to together in order to create new cognitive strategies for doing foresight. The paper tries to identify qualitative relationships among key variables across of CS with FS. This is a vast amount of work to be considered and we have only sighted the first examples, and so have a long way to go.

Anticipation is increasingly at the heart of urgent contemporary debates, from climate change to economic crisis, bringing researchers together from across disciplines. The ability to anticipate in complex environments may improve the resilience of societies under threat from a global proliferation of agents and forces by articulating insecurities through anticipatory processes (Poli, 2015).

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Popper (2008) shows that three qualitative methods include Literature Review, Expert Panel and Scenarios are dominant methodologies tools to do foresight. Scenario thinking uses longer and broader views of possible futures to more clearly appreciate a world clouded by information overload, rapid change and uncertainty (Oxford Scenarios Programme, 2015). Human's epistemological basis shows natural scenario building ability to tell stories about human life in the future (Rhisiart, 2006) and a cognitive link to the time-oriented structure of the brain for perception. Our decisions about the future depend on how we think the world works. Scenarios are based on intuition, but crafted as analytical structures. We use Scenario planning artful via learning process to overcome barriers of creative thinking (Chermack , 2011) via changing mental models for decision making. Scenarios are just different ideas about the future. We use them to guide us in exploring the future, widening perspectives (Bentham, 2008), confronting assumptions, reshaping mental maps, etc.

Recently author developed the conceptual model of the origin of the idea of future scenarios by studying; idea ontology, the origin of creative thinking, idea nurturing in organizations, shaping the future time, scenario planning and idea's social network (global brain). Hence based on mind structure's role in causality blending of environmental and innate ideas based on copy principal and personal intelligence tools' attempts to use the benefits of the global brain via network collaboration the new question emerged as following;

The research question that this proposal is trying to answer is the following; How Scenario planning would benefit from Cognitive Science by reshaping mental models? In broader area, what will be Cognitive Science Strategies for Futures Studies? In other hand, how these explored strategies could develop the future oriented intelligence machine?

2 Methodology

This paper is a fundamental research type that makes theories for an applied science. Its analysis approach has been based on intuition-rational philosophy to explore new area of an interdisciplinary science by descriptive manner. According to qualitative approach this study because of its data references to valid resources will be valid and due to experts continuous supervisions will be reliable. Based on Knowledge Management spiral model (Keenan, 2007, p. 20) (Eerola & Jørgensen, 2002, p. 12) this research is going to extract tacit knowledge from literatures and expert's intuition then combine as explicit knowledge in order to socialize to benefit all players especially policy makers and business mans. In other way we are going to make information from data and creating wisdom from this knowledge hierarchy.

3 Literature Discussion

3.1 Cognitive Science (CS)

The scope of the study of cognition is broad; perception, mental representations, learning, mechanisms of reasoning, problem solving, intelligence and social psychology (COGNITIVE PSYCHOLOGY, 2015). CS emerged in the aftermath of World War II, driven by the invention of what we now recognize as information processing technologies (Ohlsson, 2015). Today it also draws from fields such as philosophy, neuroscience, and anthropology (Department of Linguistics & Cognitive Science, 2015), economics, epistemology, and the social sciences generally.

Intelligence is closely related with adaptively with problem solving, learning, and evolution (SIMON, 1980). The central issue in cognitive science is how the mind works. The central conception in the field is of the brain as a biological information processing device (Interdisciplinary major in Cognitive and Brain Science, 2007).

Computers' Binary logic was introduced by George Boole in 1854 to describe what he called the laws of thought. But the brain is far from a binary logic device. Biological systems use symmetry and interaction to do things that even the most powerful computers cannot do, like surviving, adapting and reproducing. Understanding how living things and brains use interaction-based computations, which are all around us, may radically reshape not only our computers and the internet, but the existing models of the brain and living organisms (Nehaniv, 2016).

3.2 Futures Studies (FS)

Futures Studies or Strategic Foresight as its synonym is an interdisciplinary new generation of scientific attitude toward future that includes continuum from physical and biological issues to social and humanities subjects with most focus on technology's future and social changes in order to make desirable and sustainable future. Although some assume that FS is just a methodology, but based on more than thousands projects that successfully have been done in this field to represent a better understanding of future situations and taking appropriate actions in present (e.g., RAND and Shell (Borch, Dingli, & Jørgensen, 2013), we can demonstrate FS in 6 dimensions; Presuppositions of the future time, Goals and objectives, Methodology, Outputs' materials, Futurists characteristics and Foresight horizon.

FS assume that the time is like a farm where we can plant capabilities of the past as a core on the basis of the power of the current practices and the direction of visions in order to produce the future. In this farm successive appearance and fall of the future and the past regularly occur in the spectrum of time and it reveals that the time is like a river of events going on. In the methodology we can reconstruct the process of building the future inspired by knowledge management's cycle through extracting hidden knowledge of experts throughout the history. Then, by socialization and internalization among stakeholders achieve a collective wisdom to build the future. Past role in building the future as the core indicate the need for in-depth review trough the causal layered analysis and on the other hand because of the role of time as priori part

of mind perception it will be necessary to collapse paradigms in order to prevent any misunderstanding of facts. The outputs of the FS more than ever should be also emphasis on practices in the present because the future will be built based on our current activities. Many of human actions such as roads and building works over than one hundred years on the environment that is the origin of subsequent changes. Therefore, according to the eternal nature of time, the time horizon of FS should be extended to eternity based on the phased planning because matter of time of involves a sequential chain of events.

4 CS Strategies for FS

4.1 Modeling could help Foresight to be Affordance via Abduction

Humans continuously build models, representations, and other various mediating structures, that are considered to aid thought. In doing these, humans are engaged in a process of cognitive niche construction. This can turn to be useful especially for all situations that require to transmit and share knowledge, information, and, more generally, cognitive resources. In dealing with the exploitation of cognitive resources embedded in the environment, the notion of affordance is extremely relevant. In order to solve various controversies on the concept of affordance we could take advantage of some useful insights that come from the study on abduction. Abduction may also fruitfully describe all those human and animal hypothetical inferences that are operated through actions which consist in smart manipulations to both detect new affordances and to create manufactured external objects that offer new affordances/cues (Magnani & Bardone, 2008).

The concept of manipulative abduction is devoted to capture the role of action in many interesting cognitive situations: action provides otherwise unavailable information that enables the agent to solve problems by starting and performing a suitable abductive process of generation or selection of hypotheses. Many external things, usually inert from an epistemological point of view, can be transformed into epistemic mediators. Geometrical diagrams are external representations that play both a mirror role (to externalize rough mental models) and an unveiling role (as gateways to imaginary entities). They could described as epistemic mediators which able to perform various explanatory, non-explanatory, and instrumental abductive tasks (discovery of new properties or new propositions/hypotheses, provision of suitable sequences of models as able to convincingly verifying theorems, etc.). Also they can be exploited and studied in everyday non-mathematical applications also to the aim of promoting new trends in artificial intelligence modeling of various aspects of hypothetical reasoning: finding routes, road signs, buildings maps, for example, in connection with various zooming effects of spatial reasoning (Magnani, 2013).

In the current epistemological debate scientific models are not only considered as useful devices for explaining facts or discovering new entities, laws, and theories, but also rubricated under various new labels: from the classical ones, as abstract entities and idealizations, to the more recent, as fictions, surrogates, credible worlds, missing systems, make-believe, parables, functional, epistemic actions, revealing capacities.

Scientific models in a static perspective (for example when inserted in a textbook) certainly appear fictional to the epistemologist, but their fictional character disappears in case a dynamic perspective is adopted. (Magnani, 2012).

4.1.1 **Modeling should not be very complicated although optimum level of stress is required for acquire attention in cognitive processes.**

Human Performance under Stress depends on multiple factors related to the individual performer and to specific attributes of the situation in which he or she must perform. Research in CS reveals a continuum of outcome, ranging from no effect on cognitive processes to extreme dysfunction. Because attention is a critical gateway to other cognitive processes, it is among the most widely studied phenomena in CS. Understanding that cognitive performance may otherwise suffer under stress, it is important to encourage system and human-machine interface designs which support efficient task prioritization, tools to enable task simplification, and options to support information and resource management (Bolton, Yaroush, Staal, & Bourne, 2008).

The optimum stress level, also guide us that FS methods should not be very complicated. Using some simple ways to describe scenarios and trends could make them more performance by acquiring more attention. For example four advantages of Visualization include (Duijne, 2015);

1. Visualization to speed up the thinking process,
2. Open up sensory modalities beyond our analytical reasoning,
3. Visualization to make the future tangible,
4. Build an integral framework, combining pictures, numbers and words.

4.1.2 **Mathematical language could reduce models ambiguity**

The success of mathematical thinking relies in great part on the creation of a language for expressing precise ideas. This language contains in the simplest cases notions like disjunction, implication, and the concepts of calculus, and in most complex cases the vocabulary of group theory or the entire Principia Mathematica. Mathematics must create its own language because natural language is not up to the task natural language is loaded with ambiguity, vagueness, and conceptual representations that decades of effort in CS have yet to adequately formalize. Even when mathematicians borrow natural language terms, they must redefine the meanings in order to leave no uncertainty about what was intended. Mathematical language explicitly distinguishes, for instance, \if" vs. \i_", \or" vs. \xor," and a meaning of \some" that ignores the awkwardness in natural language of using it when \all" is also true (Piantadosi, 2015).

4.1.3 **FCM as a sample structure of modeling that could benefit FS**

Fuzzy Cognitive Map (FCM) modeling is highly suitable for the demands of future studies (Jetter & Kok, 2014): it uses a mix of qualitative and quantitative approaches, it enables the inclusion of multiple and diverse sources to overcome the limitations of expert opinions, it considers multivariate interactions that lead to nonlinearities, and it aims to make implicit assumptions (or mental models) explicit. Despite these properties, the field of future studies is slow to adopt FCM and to apply the increasingly

solid theoretical foundations and rigorous practices for FCM applications that are evolving in other fields.

FCM are signed directed graphs: they consist of nodes, so-called ‘‘concepts’’ that are connected through arrows that show the direction of influence between concepts. A positive (negative) arrow pointing from concept A to concept B indicates that concept A causally increases (decreases) concept B. Concepts are verbally described and can contain hard to quantify concepts, such as ‘‘environmentalism’’ or ‘‘cultural identity’’. To reflect the strength of causal links, weights are assigned to the arrows. FCM have several properties that make them useful for FS.

FCMs are based on causal cognitive mapping, which provides an efficient way to elicit, capture and communicate causal knowledge and help respondents to become better aware of their own mental models.

Maps can be based on interviews, text analysis or group discussions and can be easily modified or extended by adding new concepts and/or relations or changing the weights assigned to causal links. Inputs from large, diverse, and even dissipated groups can thus be easily integrated in order to overcome the limitations of expert opinions and group-think.

In contrast to cognitive mapping, FCMs furthermore allow a quantitative analysis of the quasi-dynamic behavior encoded in the FCM models to aid decision making: planners can agree on plausible combinations of input values for independent FCM variables and calculate the states of depend variables to assess the impact of input variation (e.g. particular policies) and alternative system description (e.g. different mental models of a complex problem). This, in turn, can be linked to a future state that is internally consistent because it is the result of a calculation that simultaneously considers all direct and indirect connections between all concepts.

4.2 Chance-Seeking could benefits Foresight to find Wildcards and Weak Signals via Intervention on Tacit Knowledge to maximize Abducibility

The notion of chance-seeking, will help illustrate and stress the forward-looking dimension characterizing the notion of intervention. Intervention is about what a researcher does with either an explicit or implicit intention to generate new hypotheses and views around a certain issue as well as to try to reach a better understanding of it (Bardone, 2016).

According to Polanyi any act of cognition has a tacit component that we cannot fully access or explicitly specify. Tacit knowledge is that kind of knowledge that people do not know they know, but that nonetheless has an impact on the way people solve problems and make decisions. How tacit knowns as instances of tacit knowledge can be shared. Tacit knowns cannot be communicated, but they can be shared. But docility could enable people to discover what cannot be told. This activity of discovering what one cannot be told is a chance-seeking one. chance-seeking as an adaptive process characterized by incremental, hypothetical, and open-ended modifications of the environment, which leads one to his/her goal by means of successive approximations (Bardone, 2013).

Epistemic luck is cognitively relevant insofar as it contributes to affording human beings to generate or select the correct hypothesis solving a problem. Luck can be neither predicted nor planned. But, it can actively be sought and domesticated by seeking those chances maximizing abducibility, which will be described as the opportunity of being afforded by lucky events – events that are out of one's control (Bardone & Magnani, 2011).

4.3 Acquiring Useful Information via the Grouping based on Causality

Research on human perception and cognition, with an emphasis on visual perception of objects, involves psychophysical experimentation and computational modeling aimed at understanding how perceivers extract information from their environment and derive representations of objects (Kellman, 2015). One of the critical challenges in FS is recognizing Weak Signals and Wild Cards. There is an awful lot of information in the world (Oppenheimer, 2015). Humans often paradoxically succeed in making inferences from inadequate data. How can an intelligent system cope? (Lu, 2015). Social networks, website traffic, cellphone usage data, academic collaboration networks, health records, power grids, and observations of ecosystem food webs yield abundant data, and promise great insights into the patterns of interaction they record. The insights that stands to gain from understanding big data brings powerful theory and algorithms to bear on datasets in ecology, economics and anthropology (Big Data, 2015).

One of the major themes in CS is the way in which analogy serves as a psychological mechanism for learning that underlies causal learning, and deduction of knowledge (Holyoak, 2015). How does our visually perceived world differ from the physical world? We selectively amplify certain details in the world and ignore others. We organize these important perceptual details into categories and encode them into memory so that we can recognize objects effortlessly including face recognition. (Liu, 2015). The origin of mental representations can divide into two parts (Cheng, 2015);

I. The first is causal induction. How do people come to know that one thing causes another?

II. The second issue is category formation. Objects in the world can be partitioned in an indefinitely large number of ways (e.g., objects that move in the wind, objects that have legs, objects to be avoided, and so on).

These issues shows that our brain selectively amplify certain details in the world and ignore others based on their causality relationship to our needs and then categories them. But what will be happen about some other useful information such as Weak Signals and Wild Cards that may don't have any explicate related experiment with our mind? We may have forgotten their history or they actually are new but in real situations sometimes after some events it seems they are very familiar for us!

4.4 Intelligence increase over time indicate improved Foresight by spending more time and use of collective intelligence as a Global Brain

Today, human and social scientists are asking themselves whether they should turn their sciences upside down and reshape them from primarily past-oriented sciences to primarily future-oriented ones? First and foremost, anticipation is a feature characterizing the behavior of complex systems (Poli, 2015). Many biological and social systems appear to increase their complexity in time. Natural selection offers a mechanism for the evolution of intelligence, acting through the environmental landscape (Complexity , 2015). By understanding the processes at society, we may learn to design systems that maximize beneficial outcomes and frustrate unwanted ones (Kallus, 2015). But what govern on the natural selection? Is the world floundering or has she a vision? (Natarajan, 2015). Does CS show belief in god to be irrational? Scientists of the CS of religion (CSR) do not show that belief in god is irrational (Thurow, 2013).

In deeper investigation, history of communities or individuals raises the question, why some societies have survived despite historical events? Driving Force of Life makes a deal with external environmental factors and help increase the life of the person or society acts. This power to implement its function uses Gene pool. Although the performance of genes with respect to food, sports and psychological factors can be increased, but the gene pool itself can be strengthened with the mixing of genes in human societies. Marriage between two powerful sides can make people more resistant than former relatives.

Understanding the collective intelligence that arises in schools, flocks and swarms may yield solutions to many technological and social challenges (Berdahl, 2015). By determining which activities we reward and which interests dominate, by shaping our social networks and by affecting how we communicate and deliberate, institutions structure all our collective endeavors. Understanding how institutions affect dynamics of beliefs and of norms could help us build more sustainable societies (Dumas, 2015).

One of the most interesting findings of CS is that for the decision-making, different brain regions compete with each other. For decisions with a short time horizon, the limbic system, which governs the emotions, is often involved. But the custodian of long-term decisions related to the front of the cerebral cortex that is usually seen as a logical and reasoning. So it can be said every human being has two types of personality, quick short character and long-term patient character. When you make decisions fast, you have tethered to short-term personality, because long-term personality, need time to analyze. So time is a determining factor. By spending time the excitement subsides and complex analysis will be replaced. Whatever you think to the future and then come to the present, such as back-casting method, your long-term personality will be strengthened and also your action will quick up.

This issues shows that our brain's productivity will be better if we can use more time. May be by using a solution from project management strategies if we can use group creativity intelligence that is based on society network by internet facilities we can have a Global Brain and as a result in a short time we can acquire more productivity than individual how should think for a long time. As well as today's progress speed for example in the accelerating of technology development shows rapid chang-

es than previous. We need to get benefit from others, because individual thinking process takes too much time so by sharing problems we can reduce time's cost and improve quality.

4.5 Idea Blending and Interdisciplinary view could facilitate intuition of the Future Scenarios

Creativity can be better understood if it is studied in the context of CS. Mental processes are the essence of creative endeavor (Smith, Ward, & Finke, 1995). The study of human intelligence was once dominated by symbolic approaches, but over the last 30 years an alternative approach has arisen. Symbols and processes that operate on them are often seen today as approximate characterizations of the emergent consequences of sub or non-symbolic processes, and a wide range of constructs in CS can be understood as emergent (McClelland, 2010). In 1908 mathematician Henri Poincare described (Turner, 2015) the creative process as a collision of ideas rising into consciousness. Soon after, some psychologist, behaviorist and others began studying how ideas and behaviors combined, and in the 1980s, in laboratory research with both animals and people, it showed that the combinatorial process was orderly and predictable and that it could be modeled on a computer. Humans are innovative and good at creative thinking due to the ability of our brains to blend two or more ideas and create a new idea. Blending is the pivotal feature of the human mind and innovation will be a necessary product of the blending mind.

5 Conclusion

Ideas and subjects that explained here are just introduction to this research main goal. We hope by wider and deeper investigations of CS Strategies for FS, the efficiency and the effectiveness of the present efforts to make better futures could be more productive. However some explored strategies of CS for FS could help us to develop machines that are able to planning for future and doing foresight.

Modeling could help foresight to be affordance via abduction but it should not be very complicated although optimum level of stress is required for acquire attention in cognitive processes. These developed models of FS could use as algorithms in artificial intelligence machines by facilitation of mathematical language. Using big data and also social network's recorded data by chance-seeking could benefits foresight in finding wildcards and weak signals via intervention on tacit knowledge to maximize abducibility and acquiring useful information via the grouping based on causality that today by ontological search engines is more easier. Then by collective intelligence as a global brain and blending ideas future scenarios could be narrated.

Thus these artificial intelligence machine could do actions for future in the present. This future oriented machine could use big data mining and global brain to get actions in the present in order to make better futures or prevent hazards of future uncertainties. So we can ask them to show us what is required to do now for future. Gaming

software and Econometrics programs can be a simple example of present potential to achieve this future oriented intelligence machine as a science fiction idea.

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Biographical Sketch

Ahmad Mahdeyan is a junior scholar of Futures Studies (Strategic Foresight), which is an interdisciplinary new generation of scientific attitude toward future that includes continuum from physical and biological issues to social and humanities subjects with most focus on technology's future and social changes in order to make desirable and sustainable future.

He has over ten years' experience in teaching business, management, economy and marketing and nearly two decades of work experience as customs expert. During these years he mentored and coached people to establish their own businesses and work with different cultures, he himself was also CEO at an online shopping center. Recently, he designed the Future Time Creation model during his Ph.D. theses and is planning to develop the conceptual model of the origin of the idea of future scenarios.

Based on his experience, training is successful only when it leads to the behavioral changes. Our decisions about the future depend on how we think the world works. Opportunities are fleeting like clouds, so we should discover and seize the good ones. The idea of yesterday is the vision of today and the reality of tomorrow. So learn from the past, live for the present, and work for the future.