DEVELOPING EXECUTIVE FUTURE THINKING SKILLS

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Abstract

Strategic planning and technology management have become part of executive training on a global scale, but very few opportunities are available to prepare executives for imagining the future. The future lies beyond strategy and Future Thinking shapes the landscape on which to navigate the management of the enterprises of tomorrow. The future is not predictable; neither is it pre-determined. This opens the possibility of designing a desired future by being able to project one's thoughts ahead and experience what could be.

It is important that executives be at ease with the increasingly complex world and fast change in which business is conducted and to think at a holistic level. This paper describes the development of such an executive course on Future Thinking. The course is the result of a gap identified world-wide in specialisation training in Future Thinking and a need that was expressed by several industry and research groups.

The objective is to structure a course that would not only include the theories that make up the body of knowledge of Future Thinking, but to also integrate a number of existing future tools such as trendspotting, scenario planning, strategic foresight, road mapping, ideation and the ability to communicate the future. The first part of the course is knowledge transfer through teaching and the communication of shared experiences and the second part a practical workshop where application of the new knowledge is demonstrated in the participant's own environment. Coursework is complemented by case studies and video material to stimulate facilitated discussion in contact mode.

Ultimately Future Thinking is shaped by looking at the world through a multidimensional lens, taking emerging technologies, that often include disruptive technologies; human behaviour, in the marketplace and in the workspace; and major events, natural or man-made, into account.

The content includes the history of future thinking, taking it from prophesy to forecasting and prediction, foresighting, fiction, the visual arts and film. The human dimension of future thinking is rooted in neurology and psychology. Understanding how the human brain, through theory of mind, makes it possible to do mental time travel, and how episodic memory, spatial navigation and future thinking enables us to do futuristic scene

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construction of what should be leading to executive function and ultimately problem solving and execution. The course takes the participants through integral theory, holism, complexity and chaos.

Tools and methodologies are selected to enable the user to develop multiple futures and to select probable and preferred futures. Ideation techniques for designing processes, products and services for selected futures are covered. A variety of other qualitative and quantitative methods are introduced such as social network analysis, systems engineering, technology assessment and cross-impact analysis. Being able to describe a future and visualising it is essential. To this extent subjects covered include narratives, future modelling, gaming, immersive participation and visualisation.

In this paper a comprehensive approach to executive training will be described based on an actual course under development and the research that led to it. Teaching Future Thinking as an emerging discipline alongside Technology Management leads to a well-rounded executive to take on the challenges of a complex and dynamic evolving future landscape.

Keywords: Future Thinking, Executive Skills Course, Mental Time Travel, Technology Management, Strategic Foresight, Road Mapping, Holism, Complexity

Introduction

Executives are well trained in strategic thinking and planning through business schools and technology management schools and specialist courses. However, they will very seldom talk about "future thinking" when strategic discussion takes place. Foresighting is well practiced to estimate what future markets, technologies, macro-trends and influences are, but the main focus is on horizon scanning. More and more the question is asked: "what lies beyond strategy?" The future cannot be predicted, yet it is also not predetermined, and the future landscape can be shaped through present influence.

We have developed a course for executives to introduce multidisciplinary and multi-faceted Future Thinking. This course is to be presented as a specialists course and focused on executives that have to manage very dynamic environments where fast change is evident and where new influences are critical to business success. It is presently embedded in Technology Management and based on several other disciplines and thought processes, including Systems Thinking, Future Studies, Neurology, Social Studies, Cosmology, Economics, Physics and others. Future Thinking is believed to be an emerging discipline, very much like Technology Management was in the early 1980s. Future Thinking in the literature is mostly viewed as a state of mind, the ability humans have to project themselves into the future and "pre-experience' events that enable them to prepare for that future. It is also addressed as "futures thinking", "futures studies" or "strategic foresight". We choose to use the term in its singular form to avoid any confusion with financial futures trading,

but at the same time subscribe to the fact that multiple futures are almost without exclusion the norm when contemplating the future.

Objectives of this Paper

In this paper we address the various components incorporated in a newly developed course that build the body of knowledge for Future Thinking. We consider the history that led to Future Thinking; discuss the human dimension and our capability to do mind-time travel; outline elements of existing theoretical frameworks such as the Integral Theory of Everything and Holism that lead to capability in Future Thinking and borrow from them to develop our own approach to applying Future Thinking; touch on complexity and chaos, since the future is not known or directly knowable; develop a triangular lens that span emerging technology, human behaviour, and major events; use the model of this lens to take us into the future, supported by some well known existing tools such as trendspotting, technology foresight, technology roadmaps, systems behaviour, social network analysis, technology assessment and scenario planning. We outline generic future thinking aids such as anticipatory thinking, the futures wheel, environmental scanning, backcasting, fractals, ideation, lateral thinking, probability for multiple futures and the communication of possible futures. There is a strong relationship between Future Thinking and Systems Thinking. Since most of this thinking takes place in the complex and chaotic domain, we look at the behaviour of systems under such conditions and relate that to thinking about the future. To conclude this journey into the future, we suggest a new way of measuring the capability maturity levels in organisations through developing a framework for Future Readiness Levels and a Future Readiness Index.

Conceptual Method

The course was developed following a need that was expressed by industry for skilling executives in Future Thinking, interest exhibited for a more academic approach and theoretical foundations for foresighting and future studies and practical experience that emerged from consulting in the field over many years. A literature study was undertaken on various theories, approaches and methodologies used in future studies, foresighting, systems engineering, scenario planning and other tools used to approximate the future. Original thinking is reported in the development of a Future Thinking space and future readiness measurement. This course represents a novel approach to viewing the future as a strategic landscape to manoeuvre on and on acquiring awareness about the future.

Course Outline and Discussion

The discussion in this paper follows the outline and roadmap for the course which is illustrated in Figure 1. Following a futurist presentation on Future Thinking that highlights trends that will change or disrupt the future and create a climate for a new way of viewing the future, the course delegates are guided along this course outline. Study activities include attending lectures,

individual reading, group discussions, case studies, viewing of video extracts and facilitated debate.

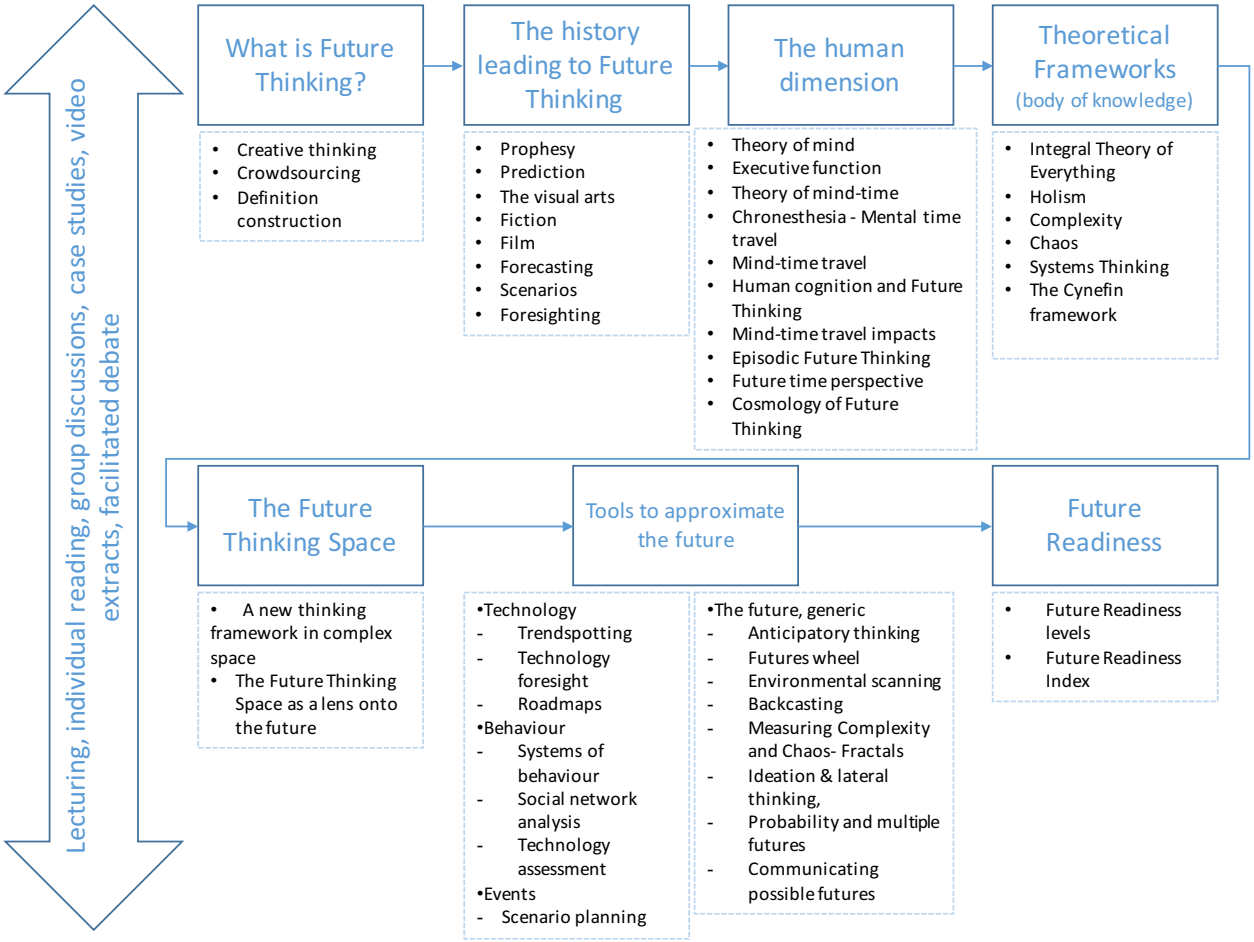

Figure 1: Outline and content of the Future Thinking Course

What is Future Thinking?

The very first task by course delegates is to draw their own perception of what Future Thinking is. There is a deliberate deviation from writing a definition down in words, given the confinement of language in describing thought. The primitive creativity of transferring knowledge through drawing (as in rock-paintings) is stimulated. The lecturer then asks the delegates to show and describe their picture to the class and to discuss its meaning. Key aspects of the visual output by the delegates and their context are then summarised. This is collated into an understanding of the collective wisdom (or wisdom of the crowds) of the class and serves as the baseline and point of departure for further discussion.

The History Leading to Future Thinking

There are many well known ways of engaging with the future. These range from prophesy to prediction, to the visual arts, fiction writing, film (often science fiction), forecasting, scenario planning and foresighting. Prophets in ancient times were usually associated with religion, where a prophet is an individual who has been contacted by the supernatural or the divine, and to speak on their behalf, serving as an intermediary with humanity, delivering this newfound knowledge from the supernatural entity to other people. Examples in The Bible are Isaiah, Eliah, Nathan, etc. The Quran many of these prophets are shared, including others such as Salih, Ayyub, Musa, and others. Their prophesies are well known in religious debate and theology. More modern day prophets such as Michel de Nostredame, or also known as Nostradamus that lived in 16th century are still second guessed when large world events take place. A prophesy has all the necessary ingredients for predicting the future, except for time. Their exact fulfilment time is normally not stated. A prediction, on the other hand, is a statement about what will happen at an estimated time in the future, normally based on experience or knowledge. Predictions, though have the habit of often being wrong. The classical visual arts are known to portray images or visions of the future as understood by scholars of the classics. Dante's Divine Comedy has been captured by several artists, such as Sandro Botticelli (Botticelli) and Gustave Doré (Doré, 2013) to illustrate the different worlds. Modern day illustrations of future cities and space travel highlight science fiction writing. Although the science fiction literature is superfluous, one writer deserves mention. That is Jules Verne who wrote several books in the 19th century that became partially true in the 20th century. The best known of these is "From the Earth to the Moon" (Verne, 1865). The moon landing in1969 show remarkable similarities with what was predicted (and calculated) in the book written a century before. This is then also used as a case study in the course and a discussion is led around what inspired Jules Verne to write the book, what he got right and wrong, speculation is done on how this book could have influenced the real moon landing and this is extended to thinking about what is said in the book that can still guide space travel and space tourism today.

Film is the modern day medium to stimulate mental travel to the future. This again is embedded in science fiction. Originally this was driven by major scientific discoveries like, for example, the laser in 1960 that inspired the film "Fantastic Voyage". Unknowingly, the film also introduced the idea of nanotechnology as possible future precision drug delivery and cancer fighting mechanism, a possible replacement for chemotherapy. Other films that are well known include "2001 A Space Odyssey", "Matrix" and "Minority Report". Part of the course group work is to discuss a science fiction film and its impact on the future.

Forecasting became popular in the 1960s, but it did not alert the world to the oil crisis in the 1970s. This type of forecasting was very much based on time series data that was extrapolated according to some mathematical formula. It did not take boundary conditions into account enough and was usually wrong. A popular tool was envelope curves such as those described by Bright (1968). A new era was introduced by Royal Dutch Shell following the oil crisis, using scenario planning. Scenario planning proved invaluable for developing future histories, and are often expressed in narrative outlining key factors and forces, and key uncertainties and assist in the preparation for

possible futures. The course spends significant time to work through a scenario exercise and to evaluate some well-known scenarios in a practical work session.

Foresighting has become a very popular way for governments and companies alike, of looking at the future. It incorporates many methods that Future Thinking also utilises and forms an inherent part of the course.

The Human Dimension

The human dimension of engaging with the future is addressed in the course through highlighting neurological and psychological aspects such as Theory of Mind, Executive Function, Theory of Mind-time, Chronesthesia or mental time travel, Mind-time travel, human cognition and future thinking, episodic Future Thinking and the cosmology of Future Thinking. A few concepts touched upon in the course and their relevance are summarised in Table 1.

Table 1: The human dimension of neurological and psychological aspects of Future Thinking

Aspect	Relevance
Theory of mind	The ability to attribute mental states - beliefs, intents, desires, pretending, knowledge, etc. - to oneself and others and to understand that others have beliefs, desires, intentions, and perspectives that are different from one's own (Wikipedia, Theory of Mind)
Executive Function	Executive function (also known as cognitive control and supervisory attentional system) is an umbrella term for the management (regulation, control) of cognitive processes, including working memory, reasoning, task flexibility, and problem solving (to accomplish a goal) as well as planning and execution (WebMD, Wikipedia, Executive Functions).
Theory of Mind-time	Furey and Furtunato, (2012) state that according to the theory of MindTime, the ability of human beings to dissociate from the present moment and engage in mental time travel gave rise to the development of three distinct thinking perspectives: Past, Present, and Future thinking, and the extent to which individuals utilise the three thinking perspectives, in combination, influences the types of task environments they prefer.
Chronesthesia or Mental time travel	Chronesthesia is defined as a hypothetical ability that allows humans to be constantly aware of the past and the future (Wikipedia, Chronesthesia). Humans adopted chronesthesia as a way to advance their survival and it is a crucial ability for humans.

Mullally and Maguire (2014) describe the role of the hippocampus in the human brain as the seat of episodic memory, but also enabling us to do spatial navigation, scene or event construction or future thinking. It also provides our semantic memory, or our knowledge of the world. The emergence of episodic future thinking in humans is described by Atance and O'Neill (2005). Episodic memory is the system that allows us to remember personally experienced events and travel backwards in time to re-experience those events. We do this not only within context of time, but also space. Spatial navigation depends on our spatial memory which is the part of memory responsible for recording information about one's environment and its spatial orientation. We

further have the ability to do scene or event construction which is based on the mental generation and maintenance of a complex and coherent scene or event. All of these enable us to think forward in time and to do Future Thinking which is the ability to project oneself into the future to pre-experience an event. Mind-time travel takes us from remembering the past, knowing the present to projecting the future and provides the human cognition for Future Thinking.

Furey and Fortunato (2014) outline the key higher-order concepts that emerge from the interaction of Past, Present, and Future Thinking as summarised in Table 2.

Table 2: Mind-time travel impacts

Mind-time Phase	Impact
Past Thinking (Remembering the past)	Evidence, accuracy, proof, trust, caution, validation, authenticity, reflection, truth
Present Thinking (Knowing the now)	Order, balance, harmony, stability, results, completion, continuity, process, organisation
Future Thinking (Projecting the future)	Change, originality, possibility, hope, innovation, ideas, opportunity, curiosity, imagination, vision, flexibility

These can be seen as value impacts that mind-time travel has.

Led by the work of Atance, et al (2005) the link between strategic planning and Future Thinking becomes more clear. We live in the present where we have control over our planning. We can imagine the future through applying Future Thinking. What links the planning phase and the Future Thinking phase is anticipatory thought. Future Thinking thus assists us in problem representation, goal selection, strategy choice, strategy execution, strategy monitoring and optimising our executive function skills.

Existing Theoretical Frameworks

Integral Theory of Everything

An existing theoretical framework that contributes to the body of knowledge of Future Thinking is Ken Wilber's attempt to place a wide diversity of theories and thinkers into one single framework. It is portrayed as a "theory of everything" trying "to draw together an already existing number of separate paradigms into an interrelated network of approaches that are mutually enriching" (Wilbur, 2001).

The implications of Wilber's meta-narrative for futures studies have been outlined in detail by Slaughter (1998). Originally futures studies were founded on notions of prediction, forecasting and control. This broadly reductionist framework has been termed 'flatland' by Wilber. This technology-led approach came to the exclusion of considerations such as economic growth, globalisation, the pre-eminence accorded to science and technology, and man's conquest of nature. In this classical view, the future is less open because it is seen merely as an extension of the present.

Critical futures studies question such assumptions. The Slaughter paper explores how Integral Futures can contribute both to a broadening and deepening of Futures Studies.

The primary dimensions of Integral Theory are outlined in Figure 2. Collins and Hines (2010) state that the distinguishing factor of the integral approach is that it considers the subjective experience and integrates it along with the objective, inter-subjective, and the inter-objective. Effects in one quadrant influence the others. The theory suggests that solutions that include a balanced consideration of all four quadrants will typically lead to more successful outcomes. It gives practitioners a meta- or high-level framework that avoids reductionism, i.e., collapsing the interior experience of individuals and cultures into the tangible and measurable exterior realm. It also guides practitioners to take the broadest possible range of perspectives into consideration.

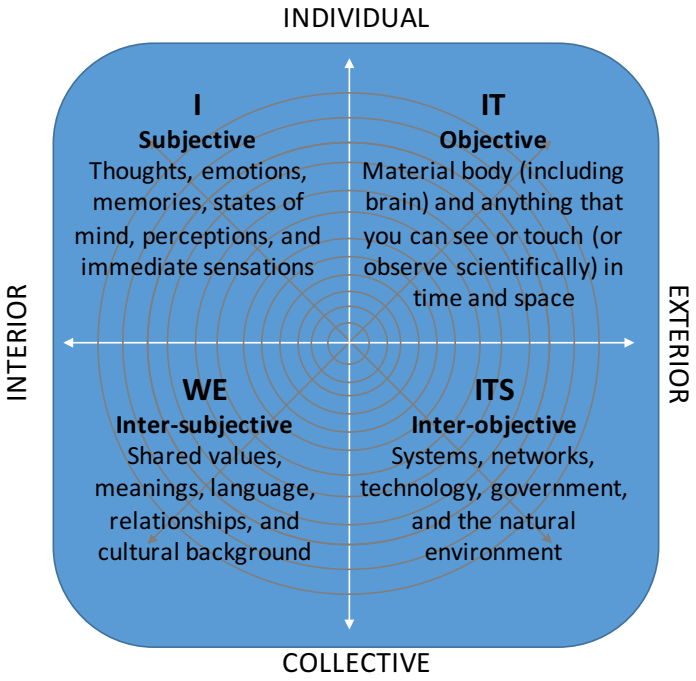

Figure 2: Primary dimensions of Integral Theory. Source: Reproduced from (The Four Quadrants, 2015)

Holism

Led by this thinking, it is obvious that holism plays an important role in Future Thinking. Holism refers to the notion that parts of a whole are in intimate interconnection, such that they cannot exist independently of the whole, or cannot be understood without reference to the whole, which is thus regarded as greater than the sum of its parts. The term "holism" was coined in 1926 by Jan Smuts, a South African statesman, in his book “Holism and Evolution” (Smuts, 1927). Smuts defined holism as the "tendency in nature to form wholes that are greater than the sum of the parts through

creative evolution". In the latter half of the 20th century, holism led to systems thinking and its derivatives, like the sciences of chaos and complexity. Scientific holism holds that the behaviour of a system cannot be perfectly predicted, no matter how much data is available. Holistic Systems Thinking (University of British Columbia) considers the interdependent, inter-relational, and contextual aspects of phenomena and applies an integrated, inclusive mindset to problem solving. Holistic approaches are concerned with the assumptions, knowledge, methods, and implications of various disciplines and treats them as an integrated whole, or system. A holon (Larcombe and Wikipedia, Holon) is something that is simultaneously a whole and a part. The word was coined by Koestler (1967).

Based on holism, holons and the Integral Futures dimensions, we have deduced three holons of importance in Future Thinking. These are shown in Figure 3.

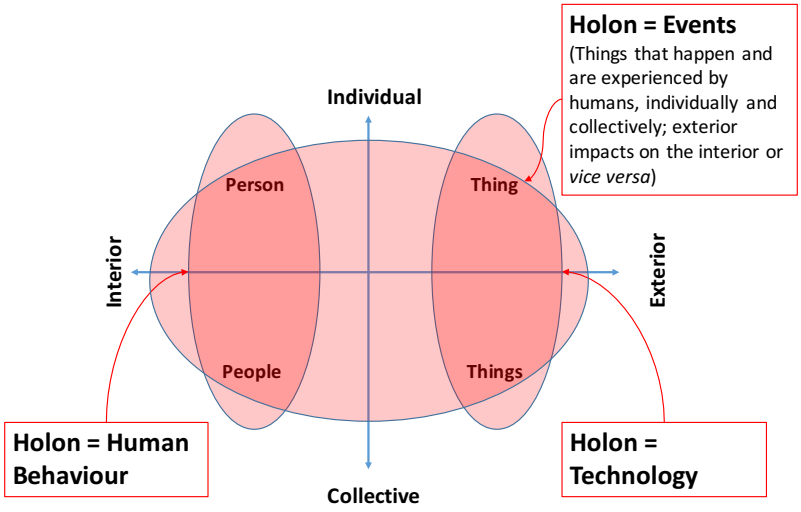

Figure 3: Three holons that determine Future Thinking based on integral futures

These holons are now placed on the corners of a triangle to assist us in Future Thinking. The context of Future Thinking is no spanned by:

- **Technology trends** (not science fiction, but technologies that are recognisable in the research and development phase)
- The **behaviour of people** (young and old, in the workplace and in society, at work or at play)
- **Events that change the world** (geopolitical events, natural events, predictable and unpredictable events, avoidable and unavoidable events).

In this triangle spanned by technology, behaviour and events we can see the future unfolding in the form of possible probabilities. Strategic planning is required to play the game of chess, but Future Thinking assists in determining the shape of the chessboard, in other words, it helps to define the landscape on which business will be done.

Complex and Chaotic Space

To prepare for the future it is necessary to develop a new thinking framework in complex space. Complicated problems originate from causes that can be individually distinguished; they can be addressed individually. In complicated cases, for each input to the system there is a proportionate output and the relevant systems can be controlled and the problems they present admit permanent solutions (Poli, 2013). However, complex problems and systems result from networks of multiple interacting causes that cannot be individually distinguished. These must be addressed as entire systems and not as individual components. Small inputs may result in disproportionate effects and the problems complexity present cannot be solved completely, but require to be systematically managed and typically any intervention merges into new problems as a result of the interventions dealing with them; and the relevant systems cannot be controlled. Understanding chaos can assist in the understanding of the orderly world. Chaos theory is the science of how things change (Strogatz). It describes the behaviour of any system whose state evolves over time and whose behaviour is sensitive to small changes in its initial conditions. It describes the nonlinear and the unpredictable, things that are impossible to predict or control. In this way, chaos theory is a good foundation for describing the future.

Systems Thinking

There are strong parallels between Future Thinking and Systems Thinking as philosophies of approach. An older definition of Systems Thinking (Senge, 1990) is: "A discipline for seeing wholes and a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots." A newer definition by Arnold, et al (2015) is: "Systems thinking is a set of synergistic analytic skills used to improve the capability of identifying and understanding systems, predicting their behaviours, and devising modifications to them in order to produce desired effects. These skills work together as a system." Parallels between Systems Thinking and Future Thinking in particular involve: both take place in the complex regime; relationships among system components are normally non-linear; feedback is an important element; a holistic approach is required; dynamic behaviour is exhibited; they are both massively scalable and people are important whether they are inside or outside the loop. Apart from the disciplinary overlap, both thinking paradigms relate to human behaviour in the following way: they deal with social change; are influenced by generational impact; have human well-being as the ultimate goal; have to initiate paradigm shifts; are crucial to the consumer revolution, are ideal for including crowd-sourcing, have to embrace uncertainty and are reliant on the beliefs, values, morality and ethics of human beings. Events that require both Systems Thinking and Future Thinking include: the rise of the knowledge economy; the quest for diminishing natural resources; global (sustainability) challenges; radical enterprise evolution; prevention and mitigation of natural disasters and political and social discontinuities.

Systems can be classified according to Rickels, et al (2007) as shown in Table 3.

Table 3: Classifying systems

Complex systems are highly composite ones, built up from very large numbers of mutually interacting subunits (that are often composites themselves) whose repeated interactions result in rich, collective behaviour that feeds back into the behaviour of the individual parts.	***Complicated systems*** have many parts, but they play specific functional roles and are guided by very simple rules.
Chaotic systems have very few interacting subunits, but they interact in such a way as to produce very intricate dynamics.	***Simple systems*** have few parts that behave according to very simple laws.

Focusing mostly on complex and chaotic systems, the course takes the delegate through some elementary systems theory, addressing evolving systems in phase space, linear and non-linear systems, determinism in systems, system transients, attractors in systems, attractor types, emergence, system sensitivity to initial conditions, self-organisation in complex systems, open and closed systems, system feedback, robustness of systems and critical phenomena in systems. This understanding is necessary, since the future is seen as a system of many interacting parts.

Cynefin framework

This Systems Thinking then leads to a discussion of the Cynefin framework developed by David Snowden (Snowden et al, 2007). Figure 4 shows how the Cynefin framework is used for Future Thinking, moving away from the world of order to the world of unorder where complex and chaos thinking dominate. The characteristics of the known (simple) world, the knowable or discoverable world (complicated), the complex world and the world of chaos are outlined in the figure. Sensemaking in the world of unorder replaces decision making in the world of order. The course develops this framework further by illustrating how it can be used to progress from cause-and-effect decisions making, adopt different procedures followed in the different domains, knowledge handling in the domains and requirements for different leadership styles in the different domains. Boundary crossing among the four Cynefin framework domains is then discussed. The application of complexity thinking, utilising the framework, to strategic futures and innovation is furthermore outlined.

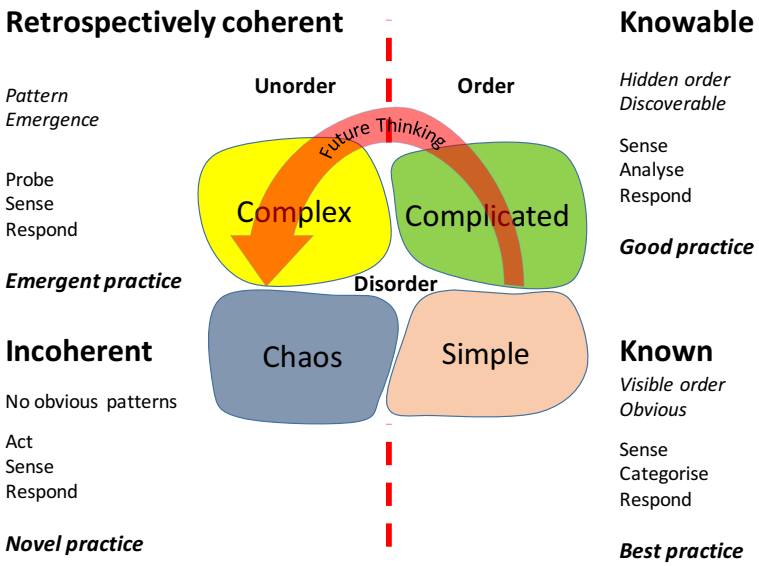

Figure 4: The Cynefin framework in context of Future Thinking

The Future Thinking Space

The Future Thinking Space is now defined by the triangle deduced from holons and the primary dimensions of Integral Theory. The triangle corners signifying technology, behaviour and events are now used as a lens onto the future by "spinning" the triangle. Figure 5 shows how this is achieved by "spinning" the triangle, revealing inter-parameter phenomena and creating the lens by forming a continuum. As the parameters of technology, behaviour and events are moved through space and time, they influence each other through inter-parameter phenomena that are dependent on the direction of spin. For example, a clockwise spin leads to technology influencing events, events influencing behaviour and behaviour influencing technology. An anti-clockwise spin results in technology influencing behaviour, behaviour influencing events and events influencing technology. Future strategic actions that emerge in a clockwise spin of the lens are, for example, the development of new governance systems (between technology and events), introducing change paradigms (between events and behaviour) and reacting to market driven needs (between behaviour and technology). In an anti-clockwise spin lens, strategic actions that emerge include, for example, determinism such as market creation where a need is created (between technology and behaviour), social responsibility interventions (between behaviour and events) and mitigation practices (between events and technology). In the course, examples are now expanded for future environments of interest of the delegate group, for example renewable energy futures and the future of conservation.

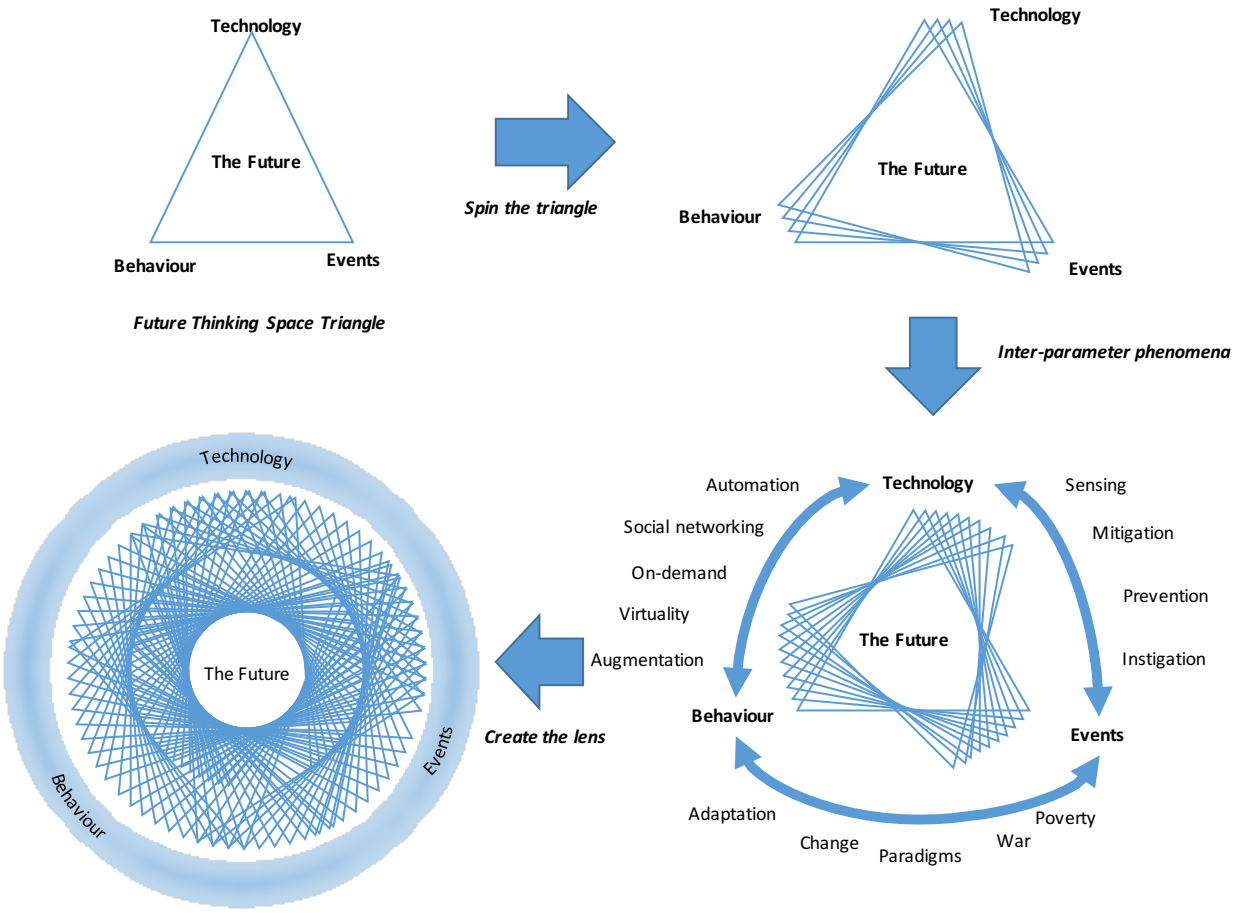

Figure 5: Creating a Future Thinking lens

In the case of looking at conservation futures, emerging and disruptive technologies that may be identified include: remote sensing through drones; implants are increasingly used to mark exotic game; big data from longitudinal studies becomes available, and complex management algorithms are readily available. Behavioural changes may include: personal pride is taken in conservation; eco-tourism increases; and traditional medicine is valued. Events that determine conservation may include: increase in wildlife crimes; encroaching urbanisation threatens biodiversity conservation parks; high demand exists for food security; traditions and rituals are upheld; and industrial expansion has a severe impact on environmental management. Spinning the triangle counter-clockwise creates a lens that yields inter-parameter impacts between technology and behaviour, such as the deterministic market creation for: incorporation of citizen science; involvement of rural communities in conservancies; and the introduction of mobile game tracking devices. Between behaviour and events, social responsibility impacts are seen of: open-minded conservation treaties; finding global legislation balances; introducing community-based policing of conservation areas; and medicinal plants and rare animals are protected by communities. The inter-parameter impacts between events and technology include mitigation aspects of: developing integrated planning systems; big data about wildlife crimes is made available; geospatial monitoring is introduced; and advanced sensing strategies are followed.

Tools to Approximate the Future

The three parameters of the Future Thinking lens are now connected to some standard tools and methodologies used in futures research and foresighting. These are indicated in Figure 6.

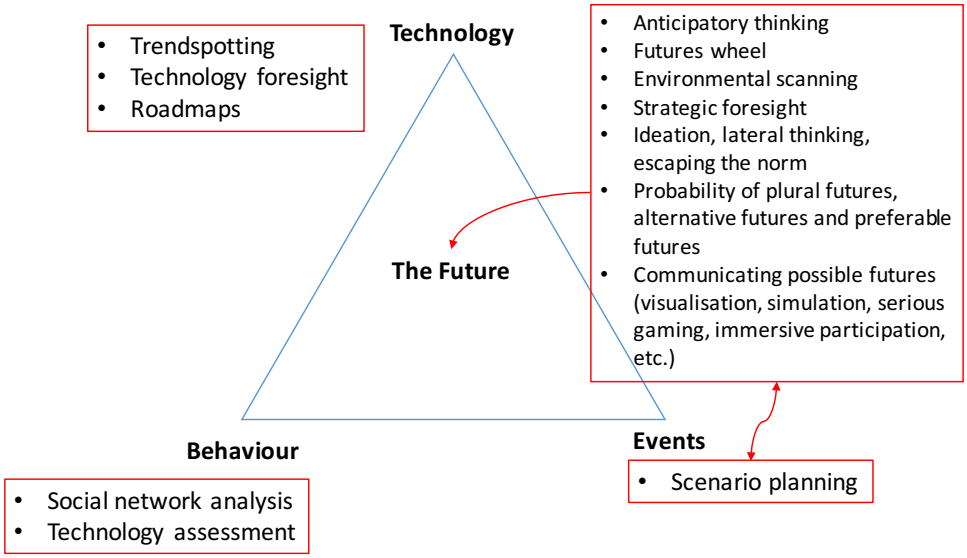

Figure 6: Tools used in the Future Thinking space

Technology-related tools

Trendspotting

Trendspotting is about seeing the future in the present (Rehn, 2013). It evolves from scanning the environment and informs in the following ways:

- Nanotrends: A noticeable alignment is exhibited, but the signals are weak and the impact is uncertain
- Microtrends: A clear indication of direction is observed, signals are weak and trends are often only fads that have a limited lifetime
- Macrotrends: These are often in the form of aggregated microtrends, the trends are norm changing with far reaching effects and signals are strong
- Megatrends: These are often aggregated macrotrends, they are boundaryless, long lasting trends and they dictate the norm.
- Gigatrends: These trends are disruptive, they are long range and ubiquitous, appear at a global level and are contemporary

Essential processes for trendspotting are dealt with in the course and examples are given, followed by a group based discussion and practical exercises.

Technology foresight
The course contains a content-rich section on technology foresight in the context of the broader aim of identifying emerging generic technologies likely to yield the greatest economic and social benefits. It focuses on a shared vision of the future as an outcome. Conditions for foresight are laid down. The various levels of technology foresight, being national, industry and enterprise are outlined. A variety of foresight methods are introduced, including among others, environmental scanning, trend extrapolation, brainstorming, genius forecasting, expert panels, cross-impact analysis, analytical hierarchy processes and the identification of critical or key technologies.

Technology roadmapping
Technology roadmapping (Phaal, 2004)is discussed in the context of the business venture space, represented as a pyramid, spanned by the market; products and services; technology and processes; and resources, including knowledge, people and innovation. Roadmapping deals with the current, medium and long term time scales, and links the market and business aspects, products and services and technologies and resources to a vision and to each other, showing inter-dependencies. Roadmapping can be done at national level, industry level, enterprise level, product level and technology level.

Behaviour-related tools

Behavioural systems
Course discussions involve ideology as well developed systems of thought; memes as an element of a culture or system of behaviour that may be considered to be passed from one individual to another by non-genetic means, especially imitation; human complexity (perceptions, needs, spirituality, race, beliefs, language, culture, ethics, origin, gender, knowledge and orientations); panarchy as specific forms of governance; and meta-organisation.

Social network analysis
The behaviour of people, both as consumers in the marketplace and as knowledge contributors in the workspace can be understood by applying social network analysis. Social network analysis is the process of investigating social structures by looking at networks in terms of nodes (individual actors, people, or things within the network) and their connections (relationships or interactions).

Technology assessment
A critical component of understanding the future is to know how technology impact on people. Technology assessment, different from technology testing, is about the reaction people may have to future technology. It typically uses an approach that includes the analysis of policy options.

Event-related tools

Scenario planning

Scenario planning, being a very effective way of looking at multiple futures, is dealt with in great depth in the course. It is emphasised that future scenarios cannot predict, but only map out a possibility space to inform present day decisions in an attempt to influence a future. Different types of futures (Conway 2007) are highlighted, including: possible (what might happen) futures; plausible (what could happen) futures; probable (likely to happen) futures and preferable (desirable to happen) futures. A scenario planning process is introduced with the following components: identifying the focal question; identifying drivers of change (key factors and forces); identifying key uncertainties; building a scenario structure; scenario development, scenario presentation and deciding on strategic implications. The course delegates are then taken through a scenario planning example (future health care), asking the question: "What are the possible futures for health care over the next 50 years?" Drivers of change are listed according to the three parameters of the Future Thinking space (technology, behaviour and events). These drivers are categorised according to their political, economic, social, technological, environmental and legal impacts. A likelihood and impact rating for these key factors and forces are subsequently done. Scenario axes are defined in terms of key uncertainties and four scenarios are created, with a fifth, wild card scenario. Each of these scenarios are then narrated. A scenario presentation in terms of a visualised photo story is furthermore developed. The strategic reaction to each scenario is subsequently discussed and guidelines for successful scenarios are given.

Future-related tools

Anticipatory thinking

Related to generic future skills and the ability of humans to do mind-time travel, anticipatory thinking is introduced in the course. According to Klein, et al, anticipatory thinking is the process of recognising and preparing for difficult challenges, many of which may not be clearly understood until they are encountered. It is a type of sensemaking. Sensemaking often takes the form of retrospectively explaining events and diagnosing problems. It can also take the form of formulating expectancies about future events. It is this future-oriented aspect of sensemaking that is anticipatory thinking. Anticipatory thinking tools are discussed in the form of pattern matching, trajectory tracking and convergence. Complicating factors for anticipatory thinking are complexity (and not knowing how to deal with it), multiplicity, ambiguity, flux, cultural variation, interdependence, speed and subjectivity.

Futures wheel

The futures wheel or consequence wheel (Emergent Futures, 2009) is a structured brainstorming method used to organise thinking about future events, issues, trends, and strategy. It is applied to think through possible impacts of current trends or potential future events; to organise thoughts about future events or trends; to identify potential consequences of a strategy; to show complex interrelationships and to develop multi-concepts.

Environmental scanning
Many different approaches to environmental scanning exist. These could be physical or virtual attempts to gain insight on trends. It is part of a cycle of searching, observing, learning, selecting and debating elements that would influence the future. It can be done superficially or in depth, narrowly or widely. It depends on whether a quick view is required, whether the net should be widened, whether immersion in detail is required or whether context should be included.

Backcasting
Backcasting is a method to develop normative scenarios and explore their feasibility and implications (JRC). It normally connects long term (50 years and more) future scenarios to the present situation by means of a participatory process. Backcasting is used in complex situations with many stakeholders, where although there is a desired future vision, it is often unclear how to reach it. Since it is of a long term nature, it leads to research plans for implementation of the actions needed. It entails a social learning process and the long term perspective makes it possible to address a variety of specific social needs.

Measuring complexity and chaos
Fractal mathematics describe dimensionality that is not determined by integers (e.g. one, two or three dimensional objects). Fractal geometry and the science of chaos are based on complex numbers (R.C.L.). Unlike the natural numbers one through nine, complex numbers do not exist on a horizontal number line. They exist only on an x-y coordinate time plane where regular numbers on the horizontal grid combine with so called "imaginary numbers" on the vertical grid. Imaginary numbers are simply numbers where a negative times a negative creates a negative, not a positive, like is the rule with all other numbers. The complex numbers when iterated produce fractal scaling. Fractals also have the property that when magnified, they still look much the same. This is called self-similarity. Fractals are the pictures of chaos (Fractal Foundation). Fractals are not static geometric shapes, but represent erratic processes in time, such as fluctuating stock prices, Internet data bursts, or earthquakes. Their gyrations are wilder and more frequent than conventional statistical methods. In a sense, they provide the basis for new statistics in chaotic and complex futures. Fractals also describe the geometry of life, from lungs to nervous systems to nutrient supply systems of plants. Fractal mathematics and simulation form an important aspect of Future Thinking.

Ideation and lateral thinking
To project oneself into the future requires a new way of thinking and looking at the world. Here lateral thinking becomes essential. The ability to get rid of inhibition or fear of being ridiculous and escaping the norm is a critical skill. Lateral thinking methodology was introduced by Edward de Bono (De Bono, 1993). Sometimes new ideas arise through experience, or innocence, mistake or accident. In most cases we have to create a provocation, where we force our ideas to be side-lined from the norm. This is what lateral thinking is about. The process is to extract an obvious

principle, and escape from it (get rid of it). The focus is then placed on the difference, and a moment-to-moment analysis is done around the new set of circumstances. Positive aspects are identified and value is extracted under special circumstances. The challenge lies in getting rid of something so obvious, that it would never have been thought that the future system can operate without it. The course presents exercises in lateral thinking to come up with alternative future systems.

Probability and multiple futures

Several future types exist. These include parallel or plural futures. They are totally independent, never touch each other and a choice has to be made which future to pursue. Then there are alternative futures which may overlap, co-exist for a while and that can be altered. Divergent futures are initially together before they fly apart. Convergent futures are initially apart, then become one, or are staying close together. Embedded futures are n-dimensional futures that contain others and are part of other futures. Future choices are to be made in terms of probable futures where there are several options and then one becomes very likely; or preferred futures where the choice of future is influenced by intervention or acceleration of that future. The Bayesian model (UNIDO, 2005) is a method used to examine the probability of occurrence of a number of scenarios and thus the probability of a certain future realising. The Bayesian model is not a technique to facilitate the construction of future scenarios, but one which allows us to understand which of the possible future scenarios will become a reality, based on observed evidence. It is a powerful tool for anticipating tendencies in a specifically determined scenario. The technique serves as a decision-making support tool that alerts us to what might occur in the future. An example of the Bayesian methodology is part of the course.

Communicating Possible Futures

The ability to transfer knowledge of a possible future after applying the Future Thinking lens and its supportive tools is crucial. The outcome has to be communicated to stakeholders of that future, including nations, industries, corporates, societies, communities and individuals. A variety of communication methods are presented in the course, including storytelling, essays (narratives), demonstration, simulation, modelling, visualisation (virtual worlds), serious interactive gaming and immersion in virtual futures.

Future Readiness

The course contains very new concepts about future readiness. Building on Technology Readiness Levels (Straub, 2015), Manufacturing Readiness levels (DoD, 2011), and the Capability Maturity Model Integration (CMMI), Future Readiness Levels and a Future Readiness Index are proposed. The Future Readiness Levels (FRL) are based on readiness at the technology, behaviour, event and future levels in line with the Future Thinking space. Several readiness parameters are defined for measurement. An assessment is then done through facilitation and surveying on each of the parameters identified for the FRL at the three corners of the Future Thinking lens. Their importance

is determined and their state of application is quantified. A FRL factor is subsequently calculated. A Future Readiness Index (FRI) is then provided based on the entire Future Thinking space.

Course Format

The course, of which the layout was given in Figure 1, is designed to have a well-balanced mix of lecturing, group discussions, case studies and individual work. The examples are dictated by the mix of delegates, their interest fields, the markets where they operate, their technologies and the seniority of their management positions. The course is aimed at executive level and runs over three consecutive contact days, with a break of four weeks, followed by a workshop where the delegates present applications in their own environments. They are to select from the variety of methodologies and approaches in the course that which applies to their own environment and do a presentation to the whole group. The presentation must be on "The Future of X", where X could be their industry, their enterprise, a product or service or a work environment.

Summary and Conclusion

In this paper we have outlined a course on Future Thinking which was developed by the author to prepare executives to understand the future landscapes that will determine strategy in their enterprises and organisations. The course is building on existing theories and the body of knowledge in Future Studies. It introduces a novel approach to Future Thinking, which defines a Future Thinking space, spanned by technology, behaviour and events. The space provides a lens that reveals impacts on the future based on the interplay between technology, behaviour and events. It opens thinking for operating in the complex and chaos domains, and assumes a holistic systems approach. It is building on the parallels between Systems Thinking and Future Thinking. A large variety of future oriented tools exist. A selection of these tools are associated with the Future Thinking space and form part of the content of the course, now structured in a unifying platform, that of Future Thinking. Ultimately the course provides a way of measuring future readiness in organisations, using a very novel approach.

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