IT WAS AGILE AND FLEW

Ricardo Barrera

Centro Patagónico de Estrategias Sistémicas para el Desarrollo
(Patagonian Center of Systemic Strategies for Development)
School of Economics
Universidad Nacional de la Patagonia
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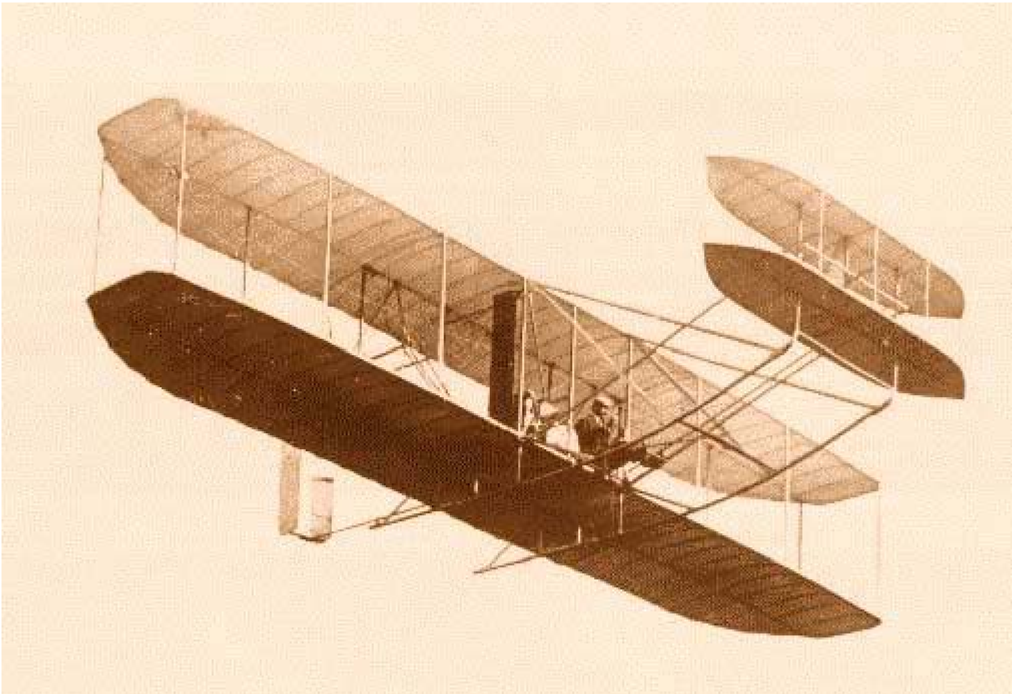

ABSTRACT

Scientific methods have been applied not only to the development of science but also to technological developments. Moreover, science and technology often progress hand in hand. In both cases adequate strategies are required to ratify the knowledge sought after. These strategies include the aspects related to the methodologies employed for organizing the whole project, intending to attain the proposed goal effectively and efficiently.

In spite of the scientists' alleged lack of interest in material benefits and their characterization of their research efforts as a search for knowledge beyond reward and time limits, it is not uncommon to see a competitive attitude in them and the urgency to be (either individually or as a team) the first to achieve success.

This has been particularly seen in the computing technology field where an arduous discussion has taken place with regard to suitable methods for producing new quality systems in reasonable time periods.

During the last few years of the twentieth century a group of methodologies sprang up in the software area which were initially identified, not quite accurately, as "light". In the year 2001 the promoters of such methodologies met and changed the word "light" for "agile", thereby constituting the "Agile Alliance", for the purpose of

disseminating the principles and the methodology. A few years sufficed to prove that the new approach obtained significant results in various technological spheres.

Curiously enough, the best example of such methodologies is found in 1899, when Orville and Wilbur Wright started to develop the project that ended up, four years later, in the first mechanically propelled manned flight. We narrate this fascinating adventure of knowledge and human inventiveness comparing the different phases they went through to the agile scientific methodologies of today.

INTRODUCTION

In 1985, the US intelligence agencies discovered a new Soviet air-to-air missile which was much more advanced than any or those kept in their own arsenal. This implied a serious challenge for the plans concerning aircraft combat situations. The Israelis, who employed the American technology, responded to the threat with a new missile whose design and deployment process took the whole of six years. The Soviet development was estimated to have lasted five years. The Defense Department "plan" was conceived for a 17-year development cycle. And, given the nature of very lengthy projects, it could extend to a 24-year period [Goranson].

Moreover, out of a total budget of 37 thousand million dollars per year, 75% of the projects undertaken by the US Defense Departament either failed or were never used and only 2% were used without significant modifications being actually required [Jarzombek, 1999].

In view of such a setback, of which the foregoing is just an example, the need arose for an urgent thorough revision , particularly as regarded the manner of facing new projects, starting with the methodologies. And this was not, in the opinion of the interested parties, a mere technological issue.

Only for didactic purposes can a difference be markee between pure science and applied science, between science and technology. Thus, pure science would be altruistic whereas applied science would be under the sway of economic interests. While pure science could be deemed to be on a level with a philosophy of nature, applied science would be a rational form of technique [Kourganoff,1959].

Should the reader not feel convinced, let us remind him that it was the study of the miners' lamps what led Lavoisier to research into the combustion phenomena, or that the appearance of steam engines aroused the interest in thermodynamics[1], and trying to fight the silkworm diseases led Pasteur to observe so small living organisms that they could not be seen but with the aid of a microscope.

And such a connection between science and technology appears many a time as the stage for hard fighting where scientists and technologists seem to take part in a violent sport. The reason for this may be that, since science has no objective values, only priority grants merit to a new outcome. In view of this apparently shameful expression of scientific activity, many of its participants react by alleging that such competition is imposed on them from outside the scientific ambit.

I do not believe it. Pasteur was capable of donating to humankind the formula for preparing vaccines but, at the same time, he knew how to "*check himself, not to let*

[1] The theoretical study of the heat/work relationship.

out the slightest confidence" [Vallery-Radot, 1932]. And the fights for priority between Newton and Leibniz, concerning the infinitesimal calculus, or between Leverrier and Adams, on the discovery of Neptune, are too well known. Not to mention Lord Rutheford, who wrote in 1902, in the course of the so-called "race for the search of X-rays nature": *"The great object is to find the theory of the matter* ***before anyone else****, for nearly every Professor in Europe is now in the warpath."*.

This is not, of course, just a sports competition. Since the XIXth century, many politicians understood that their countries could benefit if they took possession of the scientific application results. This is how the Germans, the Americans, the Soviet Union, the Japanese … and we could keep counting, built their power. The above mentioned Pasteur had already said, on the date the carbuncle vaccine discovery was announced: *"I would be inconsolable if this discovery we have just made with my assistants, had not been a French finding"*. And an Arrowsmith character said: "*These are the times of competition, competition in the art and the science. Just as in the trading activity, cooperation with one's own group, but cutthroat competition with outsiders."*[2].

On the other hand, during the '80s, deep changes in cultural and political paradigms took place which can be symbolized by the fall of the Berlin Wall in 1989. The decadence of the structuralist paradigm could be observed, particularly in relation to social sciences. And not only in the sciences. In the software field, for instance, "structured" programming languages were being spoken of, and the versatile Ed Yourdon published his best-seller "Analysis and Structured Design". The repeated failures in application developments, especially when they required the creation of large teams involved in far-reaching projects, brought about a logical outcome: the methods being then used lost their glamour and the new proposals appeared.

In this context, AT&T Bell laboratories proposed in 1991 a new ambitious project. The so-called "Pasteur Project". The objective was to analyze the culture of the organizations that developed software, employing the social science methodologies. They tried to know, in this way, how those organizations were capable of designing software in a more productive manner. The starting point was the assumption that such organizations, like every organization, handle processes that permit them to attain a higher productivity rate. And, consecuently, the properties of those organizations generating productivity increases, in a given order of magnitude, could be correlated.

The Pasteur Project research was directed to find a way of generalizing certain existing approaches in order to solve the recurrent problems appearing at any level in software development. It was based on empirical studies to try and understand how the theoretical approaches existing on the matter actually worked. In this way, it was assumed, new paradigms could be established for software production. It was supposedly possible to model processes in such a way that part of them could be automatized.

It was proved, during the course of same that reality, even for simple management configuration processes, was to complex to allow thinking of any automatization, and that it was, in fact, also more chaotic than it had been supposed; therefore, it was not possible to think of establishing ideal task structures for any type of development. In short, observing just the structure was a mistaken approach.

[2] Arrowsmith is a novel by Sinclair Lewis, published in 1925.

As it happens in many a case, unforeseen consequences resulted from the research according to that process knows as *serendipity*. *"That sudden surge of perceptions, intelectual structures and visions into the conscience that would undoubtedly not have revealed themselves to the conscious mind had the latter not been occupied, but the gestation of which went unnoticed to us. The word serendipity was invented in 1724 by Horace Walpole who based himself on the oriental tale of Pricess Serendib who had three suitors and gave each an almost impossible task to do; all three failed but, in the course of their heroic efforts each accomplished something that was even more wonderful"* [White, 1973].

It was thus decided to start studying other properties of the organizations trying to find something that could correlate with the successes they achieved. Communication networks were jointly studied as prompted by the Conway Law[3], and also examining first-hand experience through the parties involved. It could then be established that there might exist certain correlations between communication patterns and organizational effectiveness. There appeared, on one hand, the so-called software patterns in 1993. And on the other, organization patterns appeared in 1994 [Coplien et al, 2005].

Finally, ten years later, in 2001, the findings converged on what was called "agile methods". A group of researchers, several of which had collaborated with the Pasteur Project, formalized and assembled their points of view giving rise to the "Agile Alliance" and publicly announced the Agile Statement, as well as the Interdependence Declaration. We will see what they consist of and also that, curiously enough, the best example of these methodologies is found in 1899, when Orville and Wilbur Wright started to develop the project that ended up, four years later, in the first mechanically propelled manned flight. We narrate this fascinating adventure of knowledge and human inventiveness comparing the different phases they went through to the agile scientific methodologies of today.

SYSTEMIC THINKING

A system can be defined in a simple way by expressing that it is a complex totality whose operation depends as much on its parts as on the interaction among said parts. Thus expressed, it is then possible to identify different types of systems:

- physical, as a river;
- biological, as any living organism;
- designed, as a car;
- abstract, as a philosophical system;
- social, as a family;
- entrepreneurial, as a system ensuring the product quality.

The traditional method employed to study this type of systems was reductionism. Reductionism considers the parts as the most importan element, it tries to identify, understand and work on them assuming that, through the knowledge of parts, the totality can be understood. The problem with this approach is that it often presents forms that it is not possible to recognize from their parts. Totality emerges

[3] The Conway Law stipulates that if n persons participate in a compilator development, this will consist of ***n*** steps. This arises from the need of every person to be a protagonist and have a participation niche; therefore, for a team to be cohesive, the objective or process is divided into as many steps as there are members in the team. Sometimes, this rule is mentioned among Murphy´s laws.

from the interaction among the parts affecting each other through complex relation networks. And it is from such totality that the knowledge which can lead to the understanding of both the parts and the interrelations emerges.

One cannot then be surprised by the fact that an alternative to reductionism came up for the study of systems. It is known as "holism". "Holism" considers that a system is more than the sum of its parts. It is of course also interested in the parts and not only in the relations therebetween, but the search for the identity of the totality predominates.

"Holism" has gradually become one of the pillars of many different academic disciplines by benefiting from the reductionism mistakes when dealing with complexity, diversity and change in complex systems. We will find it, for instance, in philosophy, biology, engineering, organization and management theory, physical sciences. In this aspect, the meeting between biologists and control engineers, that took place in the '50s, was fruitful in giving rise to systemic thinking as a transdiscipline[4].

The ancient Greek philosophers, Plato and Aristotle, proposed some important ideas regarding systems. Aristotle reasoned that the parts of the body only make sense if we take into account the function they perform in sustaining the whole organism and used this metaphor when considering the role of human beings and the State[5]. Plato, on his part, was interested in the notion of control, the navigator's art (*kibernetes*), and how it could be used both for ships and the State[6].

However, "holism" lived in the outskirts of the philosophical debate during many centuries. It was only in the eighteenth and nineteenth centuries that the interest in this approach and what it could offer came up. Both Kant and Hegel had a lot to do in this respect. Kant estimated that we cannot know reality but considered it convenient to think in global terms, assuming that each totality emerges and is sustained by its parts' self organization. As for Hegel, he introduced the process concept into the system thinking. The understanding of totality, or truth, could be approached through the systemic display of thesis, antithesis and synthesis. Every movement made through this cycle, with synthesis generating a new thesis, gradually improves our management of totality[7]. It was these contributions that helped to impact on the scientific disciplines where they were later on developed with much more exactness.

The organization and management theory wedded the systemic one as soon as the latter made its debut halfway through the '50s, in the last century. At the beginning, it incorporated the basic concepts, intending to optimize the engineering approaches being applied to business, since Taylor and Farol founded the so-called "scientific administration". Upon the appearance of computers, in the following decade, systems engineering was born and took possession of the field. There subsequently appeared, though only in the administration area, the biological analogies, particularly those introduced by von Bertalanffy [Bertalanffy, 1968],

[4] Trans comes from the Greek language and means "beyond". Transdisciplinary is then what goes beyond the limits of such discipline.
[5] Aristotle, in Ethics to Nicomaco and Politics.
[6] Plato, The Republic, especially when referring to the "Royal Art".
[7] Lately, at the first ALAS meeting held in Buenos Aires, on August 7 to 9, 2006, Matias Mulej explained his approach to systemic thinking as enriched by what he calls "systemic dialectics", clearly referring to Greek dialectics later on revitalized by Hegel. See Mulej (1976).

improving the organizational system models by emphasizing the importance of subsystems as well as that of the environment influence.

However, these approaches were not lacking in drawbacks. The most evident one was that the system engineering constructors failed in not incorporating human beings as such and called them purposeful systems.The component systems created by engineers were intended to achieve certan objectives …that were set by those very engineers.

In 1981, Peter Checkland, from Lancaster University, in England, published a work that may be deemed to be the foundation of the modern systemic thinking [Checkland, 1981[8]]. Juan Martín García states, quoting Russell Ackoff,

"... the System Thinking concept is useful to show the system behaviour as a result of the relationships among the elements thereof instead of the result of the traditional vision that a system is equivalent to the sum of its component elements. Thus, the study of the relationships among the elements of a system allows the structure and actual causes of the behaviour and the problems we see to be revealed. This is a non-numerical methodology, unlike Operative Research or System Dynamics. It is therefore very easy to understand and transmit and a useful instrument to share different viewpoints on the same subject among specialists." [García[9]].

According to Checkland, the starting point of Systemic Thinking is to identify the essential purpose of the system activity. This essential purpose is taken as the centre of a transformation process by means of which an element or product is modified (input). The analysis is developed considering six aspects in particular:

C – Clients. The transformation receivers

A – Actors. The people in charge of carrying out the transformation with the available means.

T – Transformation. The process itself.

W – Weltanschauung. Kantian concept, the conception of the people acting in the system.

O - Owners. Those who can either stop or modify the transformation.

E -. Environment. Environmental limitations. These are the elements outside the system which
cannot be decided on but have an influence thereon.

Later on the Systemic Thinking spread in organization management upon the coming out, in 1990, of Peter Senge's book "The Fifth Discipline" [Senge, 1996]. This author identified five necessary technologies to build an intelligent organization:

- Personal control
- Mental models
- Shared vision
- Team learning
- Systemic Thinking

the last one (the fifth discipline) being the keystone in the creation of organizations with a new outlook on management, based on a global vision of the phenomena affecting the business.

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[8] Author most referred to in the several hundreds of papers presented at the last two annual congresses of the International Society for System Sciences and at that of ALAS, (my own research).

[9] The following paragraphs of SYSTEMIC THINKING are an adaptation of his notes.

As Senge himself remarked, this book "*tries to aid in building intelligent organizations open to learning. Organizations capable of surmounting difficulties, recognizing threats and facing new opportunities*.

This author proposes, in a language that is understandable for managers, the result of an extended process to break up with mechanicist paradigms, that considered the business as the mere union of material, human and technical means, as separately analyzed, and shows them an integrated, dynamic vision of the complex processes that take place at the organizations. However, although Peter Senge deserves recognition as a competent information disseminator, he lacks entrepreneurial experience and, whereas his thoughts have captivated his readers, they have not had a correlative practical application, precisely on account of the mentioned lack of organizational management expertise[10].

Systemic Thinking proposes, on one hand, the identification of the system "Key Factors", as a means for efficiently modifying the system structure and, on the other hand, the knowledge of the "systemic archetypes" or "Behaviour Patterns", to perceive the basic structures concealed under complex dynamics.

Many process-based approaches rely on the cause and effect models, used to deal with problems, believing that, in this way, they possess the adequate control to introduce the necessary changes. But changing an organizational system requires subtle changes at a deeper level than that of the process, since it is necessary to work on the system structure. This is one of the main reasons that have turned the "agile" approaches into a promising innovation.

ORGANIZATIONAL PATTERNS AND AGILITY

The agile approach is based on the Systemic Thinking fundamentals, both its principles and its practical applicability. Said principles aim at the knowledge and management of an organization structure. A system structure can be expressed by means of relationship patterns among its parts and those very parts may in turn reveal patterns of the recurrent structure.

¿What is meant by Patterns[11]? The thought of assembling in patterns the constants that appear repeatedly in the design was an original idea of architect Christopher Alexander and the definition he offered in said respect seems to be still the best:

"Each pattern describes a problem that happens once and again in our milieu and, consequently, it describes the essence of the solution for that problem, in such a way that you can use this solution a million times and avoid having to do the same twice." [Alexander et al, 1977].

In simple words, a pattern is the problem/solution pair having a name, that is applicable to any similar situation.

Generally, each pattern has four essential elements:

1.The **pattern name** is what is used to describe a design problem. It helps to remember it and represents the highest abstraction level.

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[10] I acknowledge Enrique Herrscher´s confirmation of these assertions, expressed in the conversations we had on this matter.

[11] Adapted from Barrera (2004).

2.The **problem**, which describes when the pattern may be applied. It explains the problem and its context and may represent both algorithms and objects.

3.The **solution**, which describes the design constructive elements, their relationships, responsibilities and collaborations. The solution does not describe a specific design because a pattern is like a diagram that can be used in many different situations.

4.**The Consequences**, that is to say, the results likely to be expected when using the pattern. This is critical because it permits to assess both the design alternatives and the costs and benefits of applying said pattern.

By the time the Pasteur Project started, a large part of the software development work had been improved through the application of ISO 9000 standard, as well as the use of the SEL CMM model (Capability Maturity Model). Each of them had partially improved the software situation by guiding the architectural structure to be used and solving some of the software seminal problems. Since the software discipline is mainly empirical, it was assumed that the Project empirical studies would be adequate for establishing the software patterns.

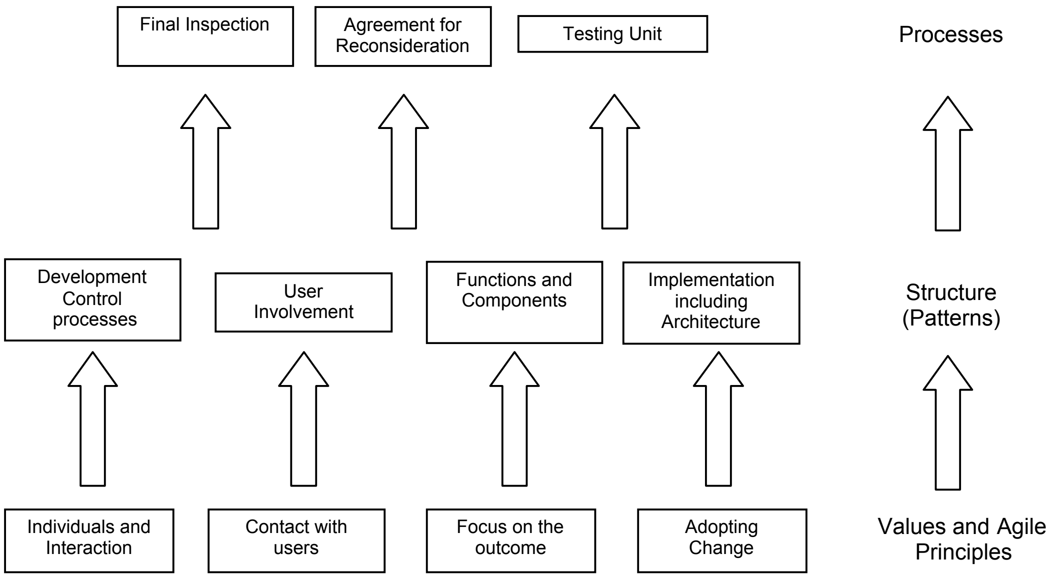
In August, 1993, at a workshop held in Colorado, USA, the discipline involving said patterns was born. It was during this meeting that some of the first structural findings of the Pasteur Project were presented as patterns. This is how the first collection of organizational patterns made its appearance and, by the end of 1994 there already existed a group of approximately 40 patterns.

James Coplien, one of the co-authors, introduced these findings at the first conference on patterns, in Allerton Park, Illinois, where another researcher and well-known advisor, Kent Beck, helped to guide the work, providing the feedback included in the conference summary. Later on, Beck would refer to Coplien as one of the three influences that led him to produce his paper called Extreme Programming [Beck. 2002].

Within a short time there appeared other works on organizational patters, including those which were jointly presented at the above mentioned conference, by Norman Kerth [Kerth, 1995] and Bruce Whitenack [Whitenack, 1995] who started, through software architecture, to examine more thoroughly the way people carrying out these activities acted. On the following year, Alistair Cockburn published "Prioritizing Forces in Software Design" [Cockburn, 1996], and Ward Cunningham did the same with his EPISODES pattern language [Cunningham, 1996]. Cockburn's paper became the keystone of the Agile Alliance as well as the final refinement of the XP structure. All these works focused on the patterns and proceeded from the research community devoted to this matter. In the meantime, Scrum delved into the Pasteur Project roots, particularly into one of the study cases publised in Dr. Dobb's Journal, a research concerning the development of the Quattro Pro project for Windows, made by Borland [Coplien y Ericsson, 1994].

Many branches of the agile movement sprouted from these initial organizational patterns. It took many years to refine those patters, to understand how they worked together in practice, as well as to combine them in sequences that could result in successful organizational software developments. These branches came together in the book Organizational Patterns, published in 2004. The collection was published by the above mentioned James Coplien and Neil Harrison, a work that was as coherent as it was ample, starting with the basic patterns and making it possible to connect, whether in pattern form or not, the threads of the agile movement.

In order to graphically represent the foregoing, it is necessary to go back to the system structure. According to the present systemic thinking, the structure generates its processes, for instance those that have to be implemented when installing ISO 9001. The figure herebelow shows us how Systemic Thinking–based patterns operate in the software development area.



For example, by considering the process of programming systems and encoding inspections at the same time. Why should one have both processes? Because of the relationship occurring between a group of individuals (encoders) and another group of individuals (reviewers or observers), each giving a different outlook on the same design problem. These relationships refer to the organization structure. And why does the structure adopt this? The structure follows the organizational principles from which the organization itself springs up. There are reviewers and observers because it is necessary to possess the skills required to be able to develop a quality product. There are both managers and developers because there must be somebody who manages the encoders, since they have to produce the appliances customers pay for and, at the same time, there must be developers who are not absorbed by the daily management tasks.

It is a common mistake to introduce superficial organizational changes at a certain level. If processes are changed without modifying the structure, the change is temporary for the structure will eventually correct it. On the other hand, if the modification is a thorough one and it is done in a very fast way, the risk increases. Changing the values of an organization takes its time; quite frequently, it cannot be done directly and in no case without significant structural changes. And if there is a need to modify structures, patterns may provide an adequate balance between the process and the value and principle levels.

Likewise, patterns offer a uniformed formalism for a wide scope of applications. A pattern may change the organization structure, whether by adding a role, a new relationship between existing roles, altering the size, changing communication means or introducing many other restructuring possibilities. Any of said changes shall be in harmony with the organization basic characteristics and special care shall be taken to find the proper order that will permit every action to extend in the right direction. Although, as it is well known, this is not simple, since complex systems do not always have fully foreseeable behaviours.

AGILITY AND EFFECTIVENESS

To be agile in the present context means to have the capacity to face the unexpected and capitalize flexibility. An organization is a living entity: it can grow and shrink, reorganize itself in response to the environment and respond to such environment. It never remains still. It is said that a good organization shall not be rigid, but it must be capable or resisting the strong winds of change. But if taken to the limit, flexibility turns into weakness. Strength proceeds from its structure. According to its structure, the organization may combine its members to do those things that one member cannot do alone.

Extreme Programming assumed a structure based on programmers, a director, a team of a certain size and, at the beginning, the Smalltalk programming language. Also at the beginning it strongly warned against combinations that did not contain its principles or practices; in other words, it had a relatively rigid structure. And this structure led to projects with a certain degree of agility in certain contexts, it was especially successful for small-sized, simple Smalltalk programming.

However, this XP proposal was not easily adaptable beyond said context: when and to the extent it was adaptable to a context, one had to wonder whether it would adjust to said method. Such adaptation very often involved discarding the most valuable element of the approach: the organization key skills. Organizational developments, to be deemed convenient, have to be based on the existing organization strengths, and this includes the structure, tools, principles and processes.

This was clearly perceived both by Jim Highsmith and Alistair Cockburn, who hold that the agile discipline or the organizational patterns, do not only refer to the agility involved in the organization development task: it also applies to the principles themselves. One does not develop a method for it to be agile. Agility implies an administration style that responds to its environment. Agile patterns are not constructed only on the basis of the feedback responses but they also take into account the empirical evidence provided by managers to the effect that individual improvement has a low risk.

AGILE PRINCIPLES

In February, 2001, a group constituted by the authors and promoters of the so far denominated “light” methodologies, met at the Snowbird Ski Resort, in Utah, for the purpose of considering whether it was possible to develop a series of agreed methodological principles, promoting said methodologies in general and, finally, giving them a better name. While they enjoyed the snow, Alistair Cockburn joined the group and expressed the general sentiment of the present members saying:

“I do not think that the so-called “light” methodology refers to its weight, but I am not sure whether I wish to refer to a lightweight by attending a lightweight

methodology meeting. If somebody thinks this is about a skinny crowd, people obsessed with the lightweight issue will try to remember today's date"[12].

After a brainstorm, in which from 5 to 20 likely names were considered, they quickly coincided on the term "agile" as a substitute for "light". The next thing to be discussed was whether it was possible to come to an agreement with respect to the methodological principles and, obviously, this was not so easy and required much more time. The results of the session included:

- A statement on the agile software development, containing purposes and principles.
- A clear definition of the objectives pursued.
- The decision to start developing the principles (this was completed in April).
- An agreement to establish a website for said methodology: http://www.agilealliance.org
- The group name: Agile Alliance.

The statement was signed by Kent Beck, Mike Beedle, Arie van Bennekum, Alistair Cockburn, Ward Cunningham, Martin Fowler, James Grenning, Jim Highsmith, Andrew Hunt, Ron Jeffries, Jon Kern, Brian Marick, Robert C. Martin, Steve Mellor, Ken Schwaber, Jeff Sutherland, y Dave Thomas. It reads as follows:

"We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

- ***Individuals and interactions*** *over processes and tools*
- ***Working software*** *over comprehensible documentation*
- ***Customer collaboration*** *over contract negotiation*
- ***Responding to change*** *over following a plan"*

That is, instead of what was customary up to that moment, as indicated by the items on the right, they valued the items appearing in bold type on the left.

The methodologies approved by the signers included: Extreme Programming, SCRUM, DSDM, Adaptive Software Development, Crystal, Feature-Driven Development, and Pragmatic Programming.

This statement has some interesting features. First, it admits that the manner of doing things better should be "disclosed", that is, it should be an object of study. Secondly, the group is composed of practical persons who have done and helped others do it. Helped, not told. Thirdly, each proposition has two parts, both are valuable, but some are preferable to others.

For example, nobody can hold that documentation is to be cast aside but it should not be given preference over the work itself, since the aim is to solve as soon as possible the existing problem. Likewise, it is important to plan but not to the extent of following the plan at any cost when the context is a changing one. Actually, in turbulent situations like the present ones, most plans appear inadequate.

¿Are agile methodologies unified? On the contrary, they arise from the conviction that it is necessary to have practice variety and diversity. Each project is different. Each working team is different. And there is not just a single pattern to do it.

Finally, this represented a stage in the progress of these approaches that do not only apply to software development but set a trend as to the administration of projects,

[12] Highsmith, in several advisory notes during 2001.

whether they are of a technological nature or not, while seeking the end product quality.

To continue with the history of this methodological current, shortly after the announcement of the Statement, the Interdependence Declaration appeared in 2005. It expresses:

"Agile, adaptive approaches for linking people, projects and values.

We are a community of project leaders, that are highly successful at delivering results. To achieve these results:

- We increase return on investment by making continuous flow of value our focus.
- We deliver reliable results by engaging customers in frequent interactions and shared ownership.
- We expect uncertainty and manage for it through iterations, anticipation, and adaptation.
- We unleash creativity and innovation by recognizing that individuals are the ultimate source of value, and creating an environment where they can make a difference.
- We boost performance through group accountability for results and shared responsibility for team effectiveness.
- We improve effectiveness and reliability through situationally specific strategies, processes and practices."

The declaration was signed by David Anderson, Sanjiv Augustine, Christopher Avery, Alistair Cockburn, Mike Cohn, Doug DeCarlo, Donna Fitzgerald, Jim Highsmith, Ole Jepsen, Lowell Lindstrom, Todd Little, Kent McDonald, Pollyanna Pixton, Preston Smith and Robert Wysocki.

The title adopted, "Interdependence Declaration", has several meanings. It implies that the project team members are part of an interdependent totality, not a group of disconnected individuals. It also means that the project teams, their clients and their promoters or stockholders are interdependent too. Project teams that do not acknowledge or accept such interdependence are seldom successful.

These assertions also constitute an interdependent whole. Each is important independently from the others, but all six make up a system which provides a new way of managing projects, particularly the complex, uncertain ones. The six clauses –value, uncertainty, clients, individuals, teams and context (specific situations) - define an inseparable totality. Example: it is difficult to give value to something without a client to value it. And it is difficult to keep teams together through time without acknowledging their individual contributions. And it is also difficult to manage uncertainty without applying specific strategies for such a situation

Each of the sentences in the declaration adopts a different form where the item, if important, precedes the description of its validity. Thus, "*we increase return on investment*" happens because focusing on the continuous assessment of value is important. Each sentence emphasizes the importance of a development that is reliable (which is not the same as repeatable) as regards its results, the management of uncertainty, the unleashing of creativity and innovation, the boost of performance and improvement in effectiveness.

Each expression in the Declaration indicates what that group thinks about the most important aspects of modern project administration. Moreover, it intends to distinguish the adaptive agile style of the project manager. For instance, in the last sentence, "*situationally specific strategies, processes and practices*" implies that these items should not be standardized or become static, on the contrary, they have to be dynamic to meet the project and the team needs.

Rick Dove said: *"Agility is not contained in a package. A single size does not meet everyone's requirements. There is no fixed number of steps to be complied with."*[13].

Without detriment to the foregoing, the common issues in the Statement and the Declaration, may be conveniently integrated. According to James Highsmith[14] nine "principles" can be established for the agile system design methodologies. We will try to summarize this approach [Barrera, 2002]:

First Principle: Interactive. "Face to face" communications constitute the fastest and cheapest channel for obtaining information. With the present virtual communication technology, that "face to face" is more easily attained and informal communications, as well as collaborations, provide greater effectiveness in a shorter time period. Of course, this is not always possible and the nature of organizations and the projects involved must be taken into account, but equivalent communications may be attempted as far as possible.

Second Principle: Large teams require stronger methodologies. A methodology strength is measured by the number of elements (processes, practices, tools, etc.) multiplied by its ceremonial (details and formalities). For instance, a methodology having 3 roles, 12 practices and four levels of products is lighter ("more agile") than one with 9 roles, 25 practices, 6 processes and 57 levels. A group of four people may interact very well with a light methodology, whereas another group of 20 people requires many more elements and greater ceremonial, though without exaggerating.

Third Principle: Methodological excess is costly. A factor that should always be taken into account to mitigate the work of large groups is that every document, every model, every additional revision process adds project costs and time. Designers shall balance the first and second principles in order to attain the level required to apply each methodology, adjusting the same to each particular case.

Fourth Principle: An important ceremonial is needed insofar as the project is a critical one. The design of a computer game, a web page, an application for transaction processes in a supply chain or the software to operate vital surgery equipment have different levels, according to how critical their results are. Even when the group is a small one with a high degree of experience and knowledge, if the surgery equipment is involved, it will require independent checks and very strict tests. The most meticulous "agile" methodology will require greater clarity, more details and carefully pondered control requirements for that specific case. Every project change shall be exhaustively monitored. In any case, developers, managers and clients will agree that the cost must be much higher than that of developing a videogame.

We can summarize these first four principles by saying that close communications are the best, and that this depends on the group size since the former grow exponentially as the latter increases. The required tools are costly (in terms of methodology elements), and additional costs are justified in accordance with the nature of the products involved.

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[13] Rick Dove. Response Ability. Quoted by Jim Highsmith (previous note).
[14] James Highsmith, advisory notes, october and november, 2001. These ideas were part of his work [Highsmith, 2002].

Fifth Principle: Discipline versus formality, skill versus processes, and comprehension versus documentation. Confusion is a permanent issue in this three areas of a methodology design. Formalith refers to the terms used whereas discipline is related to behaviour. The fact than an organization may possess a very formal methodology does not mean that the people there work in a disciplined way. And on the other hand, there may be very disciplined teams that work without formalities. Likewise, one of the present "agile" methodologies is extremely disciplined with respect to the fifteen minutes that have to be devoted to group meetings daily, although it is generally characterized by its informality.

There is also confusion between skill and process. Processes do not guarantee individual capacity or competency. Processes may help competent people to work more effectively but they are not a substitute for building skills. A large part of the bulky material of a great many methodologies covers preliminary training tasks and should not be considered part of the "process"since it actually is reference material.

Finally, documentation itself does not imply comprehension, especially when taking into account its complexity. Organizations make an effort to have everu requirement recorded and then it happens that they suppress the analists in other projects where developers, auditors and documentation specialists strive to achieve what said analists actually need. Comprehension requires both interaction–conversations- and documentation.

Sixth Principle: The increase in feedback and communications reduces the need for intermediate action. Highsmith points out that he worked in a company where both functional specifications and design technical documentation were used. Functional specifications provide, beyond any formalities, a means of recording and discussing the interaction between the company analists and users. Technical documentation, however, is invariably created *after* the application has been developed and tested and only for the purpose of complying with internal audit procedures. Analists and developers work together and only require a minimum of informal documentation.

Seventh Principle: Efficiency tends to disappear when critical activities are involved ("bottlenecks"). Goldratt [Goldratt y Cox, 2001][15] has explained the difference between understanding and efficiency, and how by focusing efficiency on every activity (or on a machine, if a manufacturing process is involved), the whole system is made to do additional work and understanding is reduced. A part of the solution to increase knowledge and reduce the process inventory is to consider that inefficiency around bottlenecks may be good. For instance, if a team includes a member having a specialized, unique knowledge, it is advisable that others work in non-specialized areas, and that the support of the area constituting the bottleneck receive the team full attention.

Eighth Principle: Think in a flow, not in batches. Whenever a process stops for need of approval, information, other area requirements or executive decisions, the flow is interrupted, the waiting periods grow and queues are formed. Once a queue is formed, delays occur and people – those who try to be efficient – start to work on other things. And once people begin other tasks, they need time to concentrate again on the original project. Womack y Jones [Womack y Jones, 1996] consider that the

[15] Likewise, Critical Chain, North River Press, 1997. They deal, as regards the matter that interests us, with the restriction theory.

process fluency is to be maintained by reducing the number of "approvals" required for the development team.

Ninth Principle: The requirement for certain ceremonial methodology may proceed from legal considerations. Highly detailed formal documentation is often required to meet government regulations or those of certain organizations. But, even if methodologies have to provide said information, they should not be created to meet those restriction but to attain the proposed objectives. For instance, in the case that authorization is required for a new medicine, a very detailed list of specifications will surely be requested and it could be possible that a sequence or cascade development be required. But when we are persuaded that an iterative development cycle is much better for attaining the set goals, a way should be found of convincing the authorities to permit the use of such alternative methods.

The agility concept has a long history, particularly in the manufacturing world. In response to the effective use of Japanese manufacturing practices, especially in the 1980s, a group of American manufacturers started agile research programmes, many of which were supported by the Defense Departament.

Agility thus understood is dynamic, specific for the context, aggresively involved in change and growth-bound. It does not have to do with improving efficiency, reducing costs, or destroying businesses alleging competitivity "storms". It has to do with success and gains, with coming out of the competition arena with flying colors, obtaining benefits, markets, more customers, fearless of new challenges. All of this was said by Steven Goldman, Roger Nagel and Kenneth Preiss, in a book for industrialists[16].

But it can be succinctly expressed as follows.

Agility is the ability both to create and to respond to changes.

To create change is to innovate, to develop new products, to excel the existing solutions. To respond to changes is to be able to adjust oneself, be flexible, fast. It is not a capitalistic issue, as stated by the above mentioned authors. This is valid for any context. It is implicit in the sustainability concept which is currently in fashion although scarcely implemented.

We are living in fast changing times. Technology changes so quickly that it is impossible to get to master it. The attention focus moves from one place to another, from one country to another, more and more rapidly. It is not a matter of being super agile but of keeping abreast of one's time.

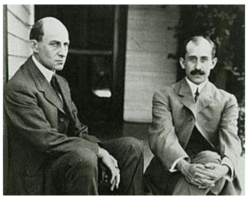
If the point is not just to survive but also to improve the surroundings, it is necessary to change not only the processes but the expectations as well. And how can one do it? By having, among many other things, a very clear idea of the ultimate goals, the visions and the ethical values involved. It is more of an attitude than a process, more of a definition of the environment than a methodolog. Agility does not proceed from a top management planning, it preferably arises from below, setting its own objectives, organizing itself. This involves a higher degree of independence, with all its implications.

Another author also quoted by Highsmith, Goranson, in "The Agile Virtual Enterprise" takes Hollywood as an example, with its movie industry and its peculiar way of doing things. Large contracts are signed with very few formalities. They

[16] Agile Competitors and Virtual Organizations. Quoted by Highsmith.

promise, however, to observe the legal frameworks seeking ways to operate quickly and assemble filming teams that may perform their work in the best possible conditions. It is not worth elaborating on something everybody knows and has even been the subject matter of some movies. Let us move on to another example.

THE WRIGHTS



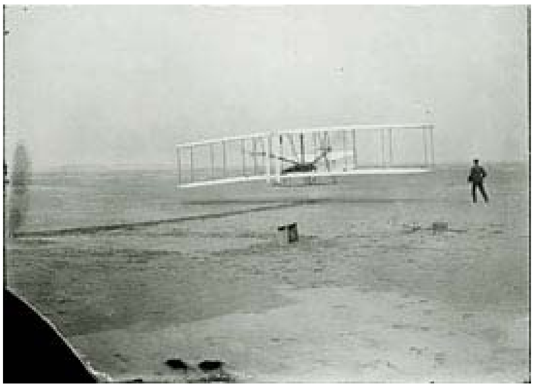
Buenos Aires "La Nación" published in its issue of March 13, 1904, the following news:

"Among the many imitators of Dédalo and Ícaro, and more fortunate than said Hellenic engineers who paid very dearly the attempt to fly like birds, we can mention the Wright brothers, from Clayton (Ohio).

The machine is an airplane carrying only one man who, apparently, helps to propel it. It soars into the air as pushed by hand from the top of a hill.

During the experiments carried out in Kitts, North Carolina, U.S.A., this device could remain twenty-five minutes in the air, approximately covering one league, at a speed of 12 kilometers per hour against a wind that blew at a rate of nine meters per second."[17]

This news, strangely enough, did not travel around the world. It was picked up by journalists of Norfolk, a then small town situated 65 kilometers north of Kitty Hawk, from declarations of not very reliable witnesses, and the Chicago Tribune repeated a very plain information released by Associated Press, based on a telegram sent by the Wrights' father, bishop Milton Wright. In fact, four flights were made on that day, the longest lasting 57 seconds, at a speed of 50 kilometers per hour, against a wind that blew at 33 kilometers. The journalists gradually modified the short news with their imagination. But a large part of the media considered that it was probably a fantasy and did not publish it.



Possibly the best-known image in the history of aviation. With his brother running beside, Orville Wright, lying face down, pilots the plane in the first of his four flights made on December 17, 1903. Please note the device shadow on the ground which clearly indicates that the plane had taken off.

Let us see how and when this story started. On a Sunday in May, 1899, Wilbur (on the left of the picture), the elder brother, who was then 32 years old, wrote a letter addressed to the Smithsonian Institute in Washington, in the following terms [Tobin, 2003]:

"Dear Sirs,

I have been interested in the mechanical and human flight issue since I was a boy and I have built a series of bats[18] *of different sizes. My observations since that time have only persuaded more strongly that the human flight is possible and practicable. It is but a matter of knowledge and skills like every acrobatic prowess.*

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[17] La Nación, private collection.
[18] "Bats" were kites, as inspired by Otto Lilienthal´s designs. See herebelow.

Birds are the best trained gymnasts in the world and they are particularly able for their task, and maybe man will never equal them but nobody who has observed how a bird chases an insect or another bird can doubt that they achieve prowesses requiring efforts three or four times more demanding than the ordinary flight. I think that the mere flight at least is possible for man and that the experiments and research carried out by a large number of independent workers will result in the accumulation of information, knowledge and skills that will finally lead to the consummation of flight."

And he wrote on, pointing out that he was an "*enthusiast*",

"…though not a maniac, since I have some theories concerning the correct construction of a flying machine. I am about to start a systematic study of this matter in preparation for the practical work I plan to devote myself to in the time left free by my usual duties. I would like to get some articles such as those published by the Smithsonian Institution on the matter and, if possible, add my bit to help future workers to attain the final success. I do not know on what conditions you deliver your publications, but if you inform me about their cost, I will send you the money.
Sincerely yours,
Wilbur Wright"

At that time, and in the United States, the Smithsonian Institute was the appropriate place to seek for information. Something likes the present Google. As required in the will of its founder and benefactor, James Smithson, every legitimate inquiry should receive a careful answer. And this is what happened; on June 2, 1899, the Institute secretary answered him providing a list of works on the subject as well as several brochures. Interestingly enough, another secretary - Mr. Samuel Pierpoint Langley – was at the time involved in the flying machine subject. He was supported by hiw own background since he was deemed to be one of the most important scientists of his time, had been experimenting for several years and had been granted the largest assignation the War Department had ever given for scietific research. But Langley was in Europa at the time and did not find out about Wilbur's letter.

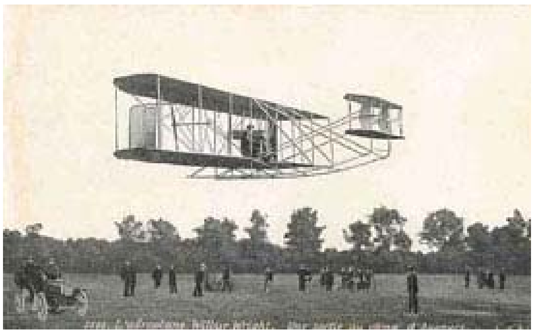
Langley's methodology consisted of trying something, testing it, facing the problems that might arise and trying again. Each failure was, inasmuch as it indicated another problem, an advance for it could be solved with effort and persistence. However, the project management responded to the preconceptions of the time. Only the leaders meditated, and the team members obeyed without being acquainted with the scope of their work. As a result, after many years and a large expenditure, they could not fulfil their purpose.

The Wrights, on the other hand, possessed no formal university training, although they had studied trigonometry, Greek, had read quite a lot for their time and were said to be able to remember details of any book they had read as boys. The sons of a protestant bishop, they had an extensive library and were extremely methodical. They lived in Dayton, a city of 60,000 souls at the time, situated to the south of Lake Michigan, in the center of the territory. Before setting up a bicycle shop, they worked at a printing shop belonging to their father's congregation where they also manufactured part of the required machinery and edited a maganize containing scientific articles.

Wilbur's letter may be considered as a succinct correct enunciation of an orderly research. In the first paragraph, he defines his hypothesis: "*human flight is possible and practicable*". And he adds: "[it is] *a matter of knowledge and skills like every acrobatic prowess*". And in the remaining paragraphs, he defines the work plan: "*the experiments and research carried out by a large number of independent workers will result in the accumulation of information, knowledge and skills that will finally lead to the consummation of flight... I have some theories concerning the correct construction of a flying machine. I am about to start a systematic study of this matter in preparation for the practical work*.

The Wrights' agile method started when they decided to approach the problem by dividing it into three parts:

- Aerodynamics (how to fly).
- Propelling (engine and propeller).
- Control (ascent, descent, turns)



They considered control as the greatest uncertainty and they consequently approached this problem in the first place. Many other inventors had worked on the aerodynamic aspects and propelling but the Wrights reasoned that it was necessary to have enough wing lift surface so that the wings could bear a person's weight as well as that of the engine. What they could not clearly see was how to control the ascent, the descent and how to fly to the right or to the left. But by focussing first on the most difficult, uncertain aspect of a problem none of the other inventors had approached, the Wrights used a key "principle" of the Interdependence Declaration:

"We increase the return on investment by making a continuous flow of value our focus"

To this end, the greatest obstacle is to be identified, approached and solved first, in order to generate the highest value in relation to the resources used.

Secondly, the brothers worked on annual iterations during the initial years, trying to solve the control problem prior to other problems. They spent the whole year developing their best ideas for making a flying structure, with controls, which they later carried by train from their house in Dayton, Ohio, to Kitty Hawk, in New Carolina, a 1,000 kilometers away, where the wind and the environmental conditions (dunes and soft sand beaches) were most favorable for the testing. To that end, they wrote in May, 1900, to Octave Chanute, in Chicago. He was an outstanding, wealthy French born professional and the chairman of the American Society of Civil Engineers who was, at the time, 68 years old.

Chanute was a famous bridge designer and knew the effect of wind on large flat surfaces. Since the 1880s, he had gathered plenty of material on the flight issue, carried out some experiments and poured all of it in his book *Progress in Flying Machine*, published in 1894. He had reached the conclusion that fixed flat wings were, like those of prey birds when they glide in the air, the adequate surfaces. He tested several glider designs, some of them quite bizarre, and observed that the model having two flat surfaces – a biplane – was the most promising one. Moreover, he transcribed the works of another pioneer, the German engineer Otto Lilienthal, who in 1890 had glided with wings, from which he hanged by the arms, that were abundantly photographed[19]. He had likewise carefully measured all his tests and his numerical tables were, at the time, a full aerodynamics treaty. It should be mentioned that the Wrights had read about his achievements and tests and had published an article describing them in 1894. Unfortunately, two years later, in 1896, the German died in an accident during one of his experiments.

The letter addressed to Chanute divided Lilienthal's work into three parts: scientific principles, experimentation methods and the device itself. Wright assumed that his principles were closest to the truth and that his unfortunate end was due to the experimentation method and the machine. He estimated that all through a five-year period, he had not spent more than five hours in the air and "*not even the simplest intellectual or acrobatic action can be approved of on such a short practice*". The brothers had a plan in that respect in order to carry out much more extensive and also less dangerous tests. They planned to build a tower or crane on which to hang a glider, very similar to Chanute's double-decked one although of their own design. "*The wind will push the machine from the tower base and the weight will be borne partly by the upward tug of the rope and partly by the wind ascensional drive [...] The objective will be to practise [..]. with a wind capable of supporting the operator at a level with the tower higher portion*." He knew that the experiment would not fully simulate a free flight, "*but the plan allows me to remain in the air for hours instead of seconds*".

And here Wilbur comments on one of his fundamental ideas: his observation of birds had persuaded him that "*they recover their lateral balance, when partially tilted by a gust of wind, by twisting the wingtips. If the rear edge of the right wingtip is twisted upwards and the left one downwards, the bird becomes an animated windmill and starts turning immediately, the axis being a line running from head to tail, [...] I think that, generally, the bird also maintains its lateral balance in part by presenting its wings to the wind at different angles, and in part by withdrawing one wing and reducing the area thereby. I would believe that the former is the moret important and usual method.*". They would use that "*torsion principle*" –twisting the wingtips to change the angle at which the received the air current in their machine.

Finally, what they asked the Chicago engineer to do was to give them suggestions based on his ample experience as well as advice on "*an adequate spot where I could count on having winds of approximately 25 km per hour, no rain or too harsh weather*". Chanute answered immediately, he advised him to change his mind regarding the tower, in view of the possibility of suffering accidents due to the tearing of the rope, and considered it better instead to use a sand hill. He told him that adequate winds might be found in Pine Island, Florida, and San Diego, California, although neither of said places had sand hills. Maybe better sites could be found on the Atlantic coast of South Carolina or Georgia. As from that moment, they maintained a constant letter exchange and became friends, said friendship ending when Chanute considered that the brothers were his disciples and owed everything to him.

[19] The photograph of a moving object in a frozen image was first obtained on that very year (1890).

Accepting the suggestion concerning the Atlantic coast, they wrote to the meteorological stations located in the mentioned states, asking for topological data and hotel information. They had an answer from Kitty Hawk not only assuring them they had steady winds but offering them lodging at their houses since there was no hotel there but you will "*[...] find here a sandy land strip of some two kilometers by eight, with a 24 m high bare hill in the center of same [...and] not a single tree or bush to interrupt the uniformity of the wind current, [...] always constant, generally at a speed of 15 to 30 kilometers per hour[...]and a good site for putting up tents*". It was what they needed, although quite a long way from where they lived.

They had to design their glider. They had Lilienthal's diagrams and Chanute's drawings, although the former had lost his life because of them and Chanute stopped experimenting when he was overcome by uncertainty. They also had a small library on air flight library. But they had to solve the wing size, the upper shape, the curvature or bend, the angle at which it would receive the wind and the rest of the structure. This required an enormous amount of iterative tests to attain their objective. At this point, they demonstrated another "principle" of the Interdependence Declaration:

"We expect uncertainty and manage for it through iterations, anticipation and adaptation."

Then, they employed specific strategies, processes and practices for that project. They were fully aware that they were simultaneously working on more than one project. It should be remembered that they owned a bicycle shop that had to be properly tended for it was the source of income that allowed them to handle this parallel pluriannual project. That is to say, the first project –the bicycles- had to sustain the second one.

Furthermore, although they were neither engineers nor had pursued any equivalent course of studies, their detailed records show us today how they conducted, in a very disciplined and thorough way, their studies on flight and the corresponding dynamics. They revised Lilienthal's tables and demonstrated that they were useful only for the German's prototypes their conclusions not being suitable for general application. They had to remake all the aerodynamic calculations of the time for which they had to test innumerable designs and variations. They even developed the engine and its corresponding propeller to which end they built an ingenious wind tunnel in the first floor of their shop. They correctly assumed that the aerodynamic observations made on a scale model could be transferred to the life-sized device. Thus, they demonstrated another "principle" of the Declaration:

"We improve effectiveness and reliability through situationally specific strategies, processes and practices for every situation".

So far back in time, the Wrights demonstrated that there is nothing new under the sun, and that the Agile Alliance precepts are as old as any.

Once they considered that they had solved the control problem, (by bending the wings to maintain the angle of attack high in the middle of a turn[20]), the following iteration consisted of joining the wing design to the control system and the propelling system. That is how they came to make what is now acknowledged as the first flight

[20] This is what gave rise to the development of the present aileron.

of man in a heavier-than-air device. They then started a new phase in their project: learning how to fly and, at the same time, applying for patents for their inventions. As it may be supposed, they learnt to fly long before their patents were filed. This took years and there was no agile methodology that could solve it. And this is the reason why they refused to fly in public until they could be sure that nobody would ‘snitch their girl-friend’. In other word, have the patents duly filed with the corresponding Register.

On reaching this point, the brothers changed their focus and started to worry about how to commercialize their achievement. They contacted several potential clients telling them that they had solved the flight problem and offering their designs for a significant sum while continuing to wait for the patents. This client-centered strategy finally bore fruit, the patents negotiation was successfully completed and they could then repeatedly demonstrate how they flew and pirouetted in the air in increasingly larger and longer trips, as well as the military and commercial applicability of their flying machine. Here the Wrights proved another “principle” of the Interdependence Declaration:

“We deliver reliable results by engaging customers in frequent interactions and shared ownership.”

It should not be forgotten either that the brothers partnered in the programming and used other forms of team work. Neither would have made it alone. It was the combination of two minds. Thus, they engaged in impassioned discussions to prove the logic of a certain hypothesis and changed positions in the middle of an argument, each adopting the other’s position to review, from that new perspective, their reasoning and the logic thereof[21]. Here again we have another “principle” of the Interdependence Declaration:

“We boost performance through group accountability for results and shared responsibility for the team effectiveness.”

They also used their inventiveness to keep the bicycle shop operating during the frequent occasions they were both absent. They hired a blacksmith for the invention and development of the engine they needed or used the help of Kitty Hawk fishermen and workmen to move the airplane, taking it out and putting it away in a shed every day, during the test period. All of them were fully informed of the objective and the advances and the brothers paid due attention to the observations they made, although submitting them to severe analysis. There is an anecdote regarding the day on which they finally flew for the first time. They had instructed one of the helpers to record, with a camara, the historical event. But he was so amazed by what he saw that he forgot to shoot. But it was demonstrated any way that they used another “principle”:

“We unleash creativity and innovation by recognizing that individuals are the main source of value, and creating an environment where they can make a difference.”

CONCLUSION

It can be observed through all this that agility and leadership go hand in hand and that there is nothing new in it. In any case, the novel feature of the agile approach

[21] A practical variation of the dialectic systemic thinking mentioned in note 7.

is the increase in the opportunites that come up when this is applien on a larger, duly organized scale.

Besides the agile approach, the brother's work shows how a research project is conducted, as regards the validation of the successive steps. Each hypothesis is a proposition the truth or falsehood of which is to be verified. When formulated it is naturally deemed to be true but it is necessary to see what happens with the consequences of the assumption.

Therefore, one tries to pose adequate hypotheses, derived from "good theories", as their inspirers put it. And they call good those theories that have been sufficiently proven.

In this way, hypotheses and theory may be compared by means of observation and experimentation. The truth or falsehood of the results obtained from the observation of said hypotheses or theory shall be judged.

In other words, the researcher poses, based on intuition or any other grounds, a hypothesis-like postulate regarding some aspect of nature or what he considers his "outside". Then he tests it, compares it to such nature by means of observation and experimentation, trying to find anomalies that may cause his hypothesis to stagger. If he does so, he shall give it up or, at least, modify it and produce a better idea. But if it works, he shall keep on trying to refute it. If after thrashing it many times, as many as he can, the hypothesis holds, he will say "Oh, good, it has got stamina", and use it as if it were correct.

Apparently science begins when the hypothetically assumed structure of a piece of nature does not coincide therewith. This poses some problems. In this confrontation between theory and facts, it may happen that it is not the theory that fails but what we consider the "fact". ¿How can this happen? Scientists know, based on their own experience, that many a time it is difficult to make observations, experiments and comparisons that turn out to be what they should.

There are many examples of assumed "facts" being rejected while maintaining the supposedly refuted theory. Popper [Popper, 1999] holds that those observation results which have already been repeated and confirmed by other researchers are to be used. He calls them "basic" enunciations. And he warns that care should be taken with those which are still waiting for confirmatory iterations.

This raises the less-than-clear notion that a hypothesis may not be conclusively refuted because the proofs made to that effect do not produce absolute or at least reliable results, being thereby perfectible.

On the other hand, reviewing the history of scientific discoveries, even recent ones, it can be seen that many nowadays hardened theories faced proofs that contradicted them, yet they held their ground until they managed to succeed based on subsequent favourable comparisons. And they could demonstrate that those contradictory proofs were either wrong or the result of the technical limitations of the time and circumstances in which they took place.

Besides, we must point out that there are no "pure" observations, without a previous theory. There is always a scheme, a hypothesis or a theory on which it is based, from where it launches into the unknown. Popper proposes this by asking ¿what comes first, the hypothesis or the observation? And he answers: a prior or primitive type of hypothesis. This should be looked at somewhat carefully since it can bring about an infinite hypothesis regression. To avoid it, Popper says that man possesses a series of a priori expectations, that is, prior to any experience. That urge him to look for regularity around him. We think that we are formulating here another theory which shall be compared, etc., by the psychologists.

By the way, the need to respond quickly to changes is not a purely academic point related to the species survival. But it is not advisable to grope in the dark. The union between the scientific method rigorousness and a correct research project management allows proper responses to be produced in the presence of storms caused by frequent changes. The Wrights showed us, over a hundred years ago, how to do it.

BIBLIOGRAPHY

Alexander, Christopher, Sara Ishikawa, y Murray Silverstein, con Max Jacobson, Ingrid Fiksdahl-King, y Shlomo Angel (1977). A Pattern Language: Towns, Buildings, Construction. Oxford University Press.

Barrera, Ricardo (2002). El Proceso de Desarrollo de un Sistema. En Análisis de Sistemas I, Trelew y Ushuaia, www.economicasunp.edu.ar/02-EGrado/materias/trelew/analisis_sistemas%20I/

Barrera, Ricardo (2004). Nuevas Herramientas para Diagramar Procesos. En Anuario 2004 de la Facultad de Ciencias Económicas, Universidad Nacional de la Patagonia, Trelew.

Beck, Kent. The Metaphor Metaphor. http://oopsla.acm.org/oopsla2002/fp/files/spe-metaphor.html.

Bertalanffy, Ludwig von (1968). General System Theory. Penguin. Harmondsworth. Traducida al español: Teoría General de Sistemas. Fondo de Cultura, México, 1986.

Checkland, Meter(1981). Systems Thinking, Systems Practice. John Wiley and Sons, Chichester. Traducida al español: Pensamiento de Sistemas, Práctica de Sistemas. Limusa-Noriega, México, 1993.

Cockburn, Alistair (1996). Prioritizing Forces in Software Design. En Pattern Languages of Program Design 2, John M. Vlissides, James O. Coplien, y Norman L. Kerth (eds.). Addison-Wesley.

Coplien, James O., y Jon Erickson (1994). Examining the Software Development Process. Dr. Dobb's Journal, Vol. 19, No. 11, octubre, pp. 88-95.

Coplien, James O., y Neil B. Harrison (2005). Organizational Patterns of Agile Software Development. Prentice Hall.

Coplien, James O., Neil B. Harrison y Gertrud Bjørnvig (2005). Organizational Patterns: Building on the Agile Pattern Foundations. Agile Project Management Advisory Service. Executive Report, Vol. 6, No. 6.

Cunningham, Ward (1996). EPISODES: A Pattern Language of Competitive Development. En Pattern Languages of Program Design 2, John M. Vlissides, James O. Coplien, y Norman L. Kerth (eds.). Addison-Wesley.

Goldratt, Eliyahu y Jeff Cox (2001). The Goal: A Process of Ongoing Improvement, North River Press.

Highsmith, James. Agile Methodologies. http://www.cutter.com/consortium/consultants/jhbio.html.

Highsmith, James (2002). Agile Software Development Ecosystems: Principles, Problems, and Practices", Addison Wesley.

Jackson, M. C. (2003). Systems Thinking: Creative Holism for Managers, Wiley, Chichester.

Kerth, Norman L. (1995). Caterpillar's Fate: A Pattern Language for Transformation from Analysis to Design. En Pattern Languages of Program Design, James O. Coplien y Douglas C. Schmidt(eds.). Addison-Wesley.

Klimovsky, Gregorio y Hidalgo, Cecilia (2001). La inexplicable sociedad. A-z editora, Buenos Aires.

Kourganoff, Vladimir (1959). La Investigación Científica. Eudeba, Buenos Aires.

Mulej, Matjas (1976). Towards the Dialectical Systems Theory. En Trappl, R., Hanika, P., Pichler, F., eds, Progress in Cybernetics and Systems Research, vol. 5. Viena. Austrian Society for Cybernetic Studies (publicada en 1978).

Popper, Karl R. (1999). La lógica de la Investigación Científica. Ed. Tecnos, Madrid.

Prendergest, Curtis (1994). Los Primeros Aviadores, tomo I. En Julián Viñuales Solé (ed.). Grandes Épocas de la Aviación, tomo 3. Ed. Folio, Barcelona.

Senge, Peter (1996). La quinta disciplina. Ed. Granica, Buenos Aires.

The Wright Stuff (2005). www.pbs.org/wgbh/nova/wright/

Tobin, James (2003). Los hermanos Wright. La conquista de los cielos. Ed. El Ateneo, Buenos Aires.

Vallery-Radot, R. (1932). La vie de Pasteur. Hachette. París.

White, Lynn (1973). Machina Ex Deo. La Tecnología y la Cultura. Ed. Asociados, México, pág. 32. Citado en Sorokin, Lazarsfeld y Otros (1977). La Investigación social. Centro Editor de América Latina, Buenos Aires.

Whitenack, Bruce (1995). RAPPeL: A Requirements Analysis Process Pattern Language for Object-Oriented Development. En Pattern Languages of Program Design, James O. Coplien y Douglas C.Schmidt (eds.). Addison-Wesley.

Womack, James and Daniel Jones (1996). Lean Thinking, Simon & Schuster.