EVOLUTIOSoc: A Meta-Framework for Complex Social Systems

Francisco J Navarro-Meneses

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Table of contents

Abstract

This paper presents a data-driven, meta-framework to support evidence-based decisions for researchers and practitioners when designing, investigating and implementing social complex systems: the EVOLUTIOSoc framework.

EVOLUTIOSoc was developed through a two-stage process.

Stage one comprised a large-scale bibliometric review and thematic grouping of topics based on natural language processing of over 18,403 positive psychology studies.

Stage two involved action-research with ten schools testing the practical validity of the well-being themes identified in stage one with educators.

The result of these two stages identified six overarching pathways to wellbeing that formed the SEARCH framework: 1) strengths, 2) emotional manage- ment, 3) attention and awareness, 4) relationships, 5) coping and 6) habits and goals.

The **aim** of this current review paper was to examine the existing educational and psychology literature for evidence ofwhether each SEARCH pathway has been found to successfully foster student wellbeing. Seventy five peer-reviewed studies (total student N= 35,888) were reviewed from North America, Europe, the United Kingdom, Asia, Australia and New Zealand.

Results demonstrate the value and applicability of the SEARCH framework. The comprehensive review conducted in this paper is then used to discuss current gaps in positive education research as well as present the utility of SEARCH as a framework to support positive education science and practice.

Keywords: Evolutionary analysis, meta-systhesis, framework, complex systems, social science

1 Introduction

1.1 Research question

One of the key questions that an evolutionary analyst can try to answer is what are the **mechanisms** that explain or direct the escalator of progress, whether this is the "struggle for existence" between individuals, nations, races, etc.

Another question that the evolutionary analyst can try to resolve is whether the individual **permits the struggle** to take place and, if not, to what extent this weakens the individual and, therefore, that the individual enters into a process of degeneration that leads to a replacement by another individual.

1.2 History

The concept of evolution, in the sense of a gradual development or change over time, has been a subject of contemplation and inquiry for civilizations throughout history. While ancient civilizations may not have had access to the scientific methods and knowledge that underpin modern evolutionary theory, they did observe and speculate about patterns of change in the natural world. For example:

1. **Ancient Greece**: The ancient Greek philosophers contemplated the origins and development of life, the diversity of species, and the process of change in the natural world, proposing early ideas that laid the groundwork for later theories of evolution. The pre-Socratic philosofer Anaximander proposed a theory of evolution where life originated from a primordial substance, the "apeiron", which evolved over time through a process of spontaneous generation and transformation. He speculated that simpler forms of life gave rise to more complex organisms, anticipating the idea of a progression or development of species. Almost one hundred years later, Empedocles in his *Theory of the Four Elements* proposed that all matter was composed of four fundamental elements - earth, air, fire, and water. He suggested that living organisms arose from combinations of these elements, hinting at a process of transformation and change over time.2. **Aristotle (384 – 322 BCE)**: Aristotle proposed a scala naturae (Great Chain of Being), which depicted a hierarchical order of existence with all living beings arranged in a graded scale from simple to complex. While not a theory of biological evolution, Aristotle's ideas influenced later thinkers and shaped medieval and early modern views of nature.

Atomist philosophers such as Leucippus and his student Democritus proposed a materialistic view of the universe, suggesting that all phenomena could be explained in terms of interactions between atoms. While their ideas differed from modern evolutionary theory, their emphasis on naturalistic explanations contributed to humanity's ongoing quest to understand the origins and development of life on Earth, and opened the possibility of variation and change in living organisms.

2. **Ancient India and China**: Ancient Indian and Chinese philosophies also explored ideas related to the origins and development of life. For instance, Hindu and Buddhist cosmologies include concepts of cyclical time and reincarnation, which imply a process of change and evolution, and they are early attempts to understand the natural world and humanity's place within it. While not explicitly addressing biological evolution, Daoist texts such as the "Zhuangzi" and the "Dao De Jing" contained passages that reflected a cyclical view of time and the continuous transformation of the natural world. Central to the Chinese cosmology is the Yin-yang theory, which posited the dynamic interplay between opposing forces. This concept of balance and change informed Chinese views of the natural world, including notions of growth, decay, and cyclical renewal. While early Buddhist texts did not discuss biological evolution, the idea of continual change and the cycle of birth and rebirth suggested a broader understanding of evolutionary processes. Hindu cosmology, as outlined in texts such as the "Puranas" and the "Bhagavad Gita," described cycles of creation, destruction, and rebirth spanning vast epochs of time. The concept of "yugas" or cosmic ages implied a process of change and evolution within the universe.

3. **Islamic Golden Age**: During the Islamic Golden Age, scholars like Al-Jahiz in the 9th century proposed a rudimentary form of natural selection in his work "Kitab al-Hayawan" (Book of Animals), where he speculated about how organisms compete for resources and adapt to their environments, suggesting that those best suited to their surroundings are more likely to survive and reproduce. Muslim philosophers such as Al-Kindi, Al-Farabi, Avicenna (Ibn Sina), and Averroes (Ibn Rushd) engaged in philosophical speculation and inquiry, drawing upon Greek, Persian, and Indian sources. They explored concepts such as the eternity of the universe, the nature of causality, and the possibility of spontaneous generation. Islamic scholars, including physicians, astronomers, and natural philosophers, observed and studied the natural world, including plants, animals, and celestial phenomena. While their inquiries focused primarily on practical and empirical aspects of nature, they contributed to a broader understanding of the diversity and complexity of life.

4. **Indigenous Cultures**: Indigenous cultures around the world often developed rich and diverse cosmologies, creation myths, and oral traditions that reflected their understanding of the origins and development of life, and about the diversity of species. These stories usually include elements of change, adaptation, and transformation over time, and offer unique insights into humanity's relationship with the natural world. Many indigenous cultures viewed time as cyclical rather than linear, with recurring patterns of creation, destruction, and renewal. This cyclical perspective encompasses the idea of continual

change and transformation in the natural world, including the evolution of species over time. Some indigenous cultures have interpreted fossils, geological formations, and natural phenomena in ways that reflect their cosmological beliefs and spiritual worldviews. These interpretations differ from Western scientific explanations but provide cultural perspectives on the history and diversity of life on Earth.

While these historical perspectives on evolution greatly differ from modern scientific understanding, they reflect humanity's curiosity and attempts to make sense of the natural world and its processes of change. The development of modern evolutionary theory represents a culmination of centuries of scientific inquiry, observation, and experimentation, building upon and refining earlier ideas and insights.

In the centuries preceding Charles Darwin's formulation of the theory of evolution by natural selection, several thinkers proposed ideas and concepts that contributed to the development of evolutionary thought. Some of the main thinkers of evolution in pre-Darwinian times include:

3. **Lucretius (c. 99 – c. 55 BCE)**: A Roman poet and philosopher, Lucretius wrote "De Rerum Natura" (On the Nature of Things), in which he espoused a form of atomism and proposed ideas about the origins and development of life through natural processes.

4. **Georges-Louis Leclerc, Comte de Buffon (1707 – 1788)**: Buffon, a French naturalist, proposed theories of transmutation and transformation of species in his work "Histoire Naturelle" (Natural History). He suggested that environmental influences could lead to changes in organisms over time.

5. **Jean-Baptiste Lamarck (1744 – 1829)**: Lamarck, a French naturalist, proposed a theory of evolution based on the inheritance of acquired characteristics. He suggested that organisms could change over time in response to environmental pressures, and these acquired traits could be passed on to offspring.

6. **Erasmus Darwin (1731 – 1802)**: Erasmus Darwin, an English physician, naturalist, and grandfather of Charles Darwin, proposed evolutionary ideas in his work "Zoonomia" and other writings. He suggested that life evolved from simpler to more complex forms through a process of gradual transformation.

These thinkers and others contributed to the development of evolutionary thought in pre-Darwinian times, laying the groundwork for Charles Darwin's theory of evolution by natural selection in the 19th century. While their ideas differed from modern evolutionary theory, they reflected early attempts to understand the origins and development of life on Earth.

In the centuries preceding the formulation of Charles Darwin's theory of evolution by natural selection, various ideas and concepts about the origins and development of life were proposed by philosophers, theologians, and naturalists. These pre-Darwinian ideas laid the groundwork for later evolutionary theories. Some of the main ideas about evolution in pre-Darwinian times include:

1. **Great Chain of Being**: The concept of the Great Chain of Being, prevalent in ancient Greek, Roman, and medieval Christian thought, posited a hierarchical order of existence, with God at the pinnacle and all living beings arranged in a graded scale from simple to complex. While not a theory of biological evolution, it implied a continuum of life forms and the potential for change over time within a fixed, predetermined framework.

2. **Transformational Theories**: Some ancient philosophers, such as Empedocles and Anaximander, proposed ideas of transformation and change in the natural world, suggesting that living organisms arose from combinations of fundamental elements or evolved from simpler forms over time.

3. **Vitalism**: Vitalism, a prominent idea in the medieval and early modern periods, proposed that living organisms possessed a vital force or essence that distinguished them from inanimate matter. While not explicitly evolutionary, vitalistic concepts contributed to debates about the nature of life and its origins.

4. **Spontaneous Generation**: Spontaneous generation, the belief that living organisms could arise from non-living matter under certain conditions, was a widespread idea in antiquity and the Middle Ages. This notion suggested a form of continuous generation and transformation of life forms but did not imply a process of biological evolution as understood today.

5. **Transmutation of Species**: Some naturalists in the 17th and 18th centuries, such as Jean-Baptiste Lamarck, proposed theories of transmutation or transformation of species. Lamarck's theory, for example, suggested that organisms could change over time in response to environmental pressures and that acquired traits could be passed on to offspring.

Overall, these pre-Darwinian ideas about evolution reflected early attempts to understand the diversity and complexity of life on Earth. While they did not constitute a comprehensive theory of biological evolution, they contributed to the intellectual foundations upon which Darwin later built his groundbreaking theory of natural selection.

1.3 Role Biology

The introduction of Biology has these forms, el conjunto de las cuales muestra una línea creciente de aportación a la profundidad del análisis económico y al papel más ligero o pesado en el que interviene en la resolucion de problemas ccomplejos:

- **Biology as a theoretical framework**, sienta las bases conceptuales y relacionales sobre las que iniciar un análisis complejo en ciencias sociales y en economía. Se trata de un marco teórico que sirve de inspiración para afrontar una primera explicación o una ampliación de la explicación de un problema social complejo sin tener que recurrir a un largo proceso de construcción teórica. Esto no significa que la teoría biológica sea siempre asimilada por la económica, sino que esta última sirve como espejo sobre la que construir un andamiaje teórico de forma más robusta y rápida.

- **Biology as a metaphora**, esto nos permite mejorar la explicación de los fenómenos económicos y reforzar nuestros argumentos al utilizar cadenas causales que ya están investigadas y demostradas en biología
- **Biology as a paradigm**, nos permite enfrentar el análisis económico teniendo delante un marco causal ya demostrado que podamos usar como referencia, tanto en el uso de los conceptos como en los flujos de interacción entre ellos. Digamos que el análisis económico no parte de cero ni necesita inventar un adamiaje metodológico y conceptual cada vez, sino que podemos recurrrir a la biología para que nos aporte un marco de reflexión y pensamiento (que podemos ir adaptando a las estructuras y comportamientos que vamos descubriendo en economía) y que nos ahorra mucho tiempo y esfuerzo.
- **Biology as a canvas** to draw computational methods directamente aplicables a los procesos de resolución de problemas, i.e. captura de datos, modelos lógicos, procesamiento y funcionamiento de la información e interpretación de los resultados. Esto facilita y amplia nuestras capacidades a la hora de recurrir a herramientas que ya están diseñadas y han sido probadas en la resolución de problemas complejos y que podemos manipular y hacer crecer en un entorno computacional.

2 Theory

- The concept of evolutionary frameworks in the economics/firm/business literature
- Reviews of framework studies

The following section combines several of these aspects, to provide a 'meta-framework' for evaluating STI frameworks.

2.1 What is a Framework?

At a general level, in this paper a framework is understood as an abstraction: a type of mental and communicative construct to help build a coherent world view. A framework is not always visible to the user, but a framework for the use of indicators in a decision making context should be designed in a conscious, communicative process (15). Assmuth & Hildén (16) define frameworks as "the conceptual and procedural constructs that assimilate, process, and give meaning to information". This definition highlights two dimensions to help frameworks do precisely this: 1) the 'conceptual' dimension that aims to capture the substance or essence of what is to be measured and elucidated (for example, frameworks to measure 'sustainability' organized in the Triple Bottom Line (TBL) domains), and 2) the 'procedural' or 'operational' dimension, which refers to more practical concerns – who needs to do what to collect, produce and report the required information? A third important dimension not highlighted by Assmuth and Hilden's definition concerns the purpose of the information, what is termed hereon the 'utilization' function. Cornet and Gudmundsson (2015)

2.2 What is the purpose of a Meta-Framework?

A meta-framework is understood as an overarching frame for what should inform the analysis and eventually the design of STI practice frameworks, meaning frameworks used by or provided for transportation policy and planning bodies to select and apply indicators for sustainable transportation. The meta-framework is not a general theory, nor a master framework to be adopted directly by agencies, but a classification and evaluation device. It should, above all, allow for a structuring of the empirical analysis of frameworks adopted by agencies in practice. Such analysis will review how the conceptual, operational and utilization functions of a case framework are performed, and how the most important criteria for each function are fulfilled.

These criteria should allow a comprehensive analysis of the strengths and weaknesses of different practical frameworks with regard to how well they manage to connect sustainability theory to action.@cornet2015building

3 Methodology

Meta-framework analysis is a qualitative research method used to analyze and synthesize findings from multiple qualitative studies, particularly when those studies employ different theoretical frameworks or methodologies. This approach goes beyond traditional qualitative synthesis methods by aiming to integrate diverse perspectives and theories into a cohesive framework that captures the complexity of the research topic. Framework synthesis offers a highly structured approach to organizing and analyzing a sheer amount of data that presents the challenge for rigorous analysis (Barnett-Page and Thomas (2009)).

They employed an iterative process involving familiarization with the literature, gradually developing a conceptual framework based on concepts derived from the review question and the theoretical and empirical literature, applying the framework systematically to evidence from the studies included in the review, and constructing a chart for each key dimension with distilled summaries from all relevant documents Dixon-Woods (2011).

Framework synthesis is distinct from the other methods outlined here in that it utilises an a priori „framework – informed by background material and team discussions – to extract and synthesize findings. As such, it is largely a deductive approach although, in addition to topics identified by the framework, new topics may be developed and incorporated as they emerge from the data. (...) One of the novel features of their approach is their use of a conceptual model that was used as an initial starting point for coding the evidence from 20 studies. This conceptual model was chosen because of its broad applicability to the area under review, and the authors did not engage in the more lengthy process of model specification that is often more characteristic of framework synthesis. They augmented analysis using this prespecified model with analysis that was more inductive, and ended up generating a revised conceptual model that provided a 'best fit' to the evidence reported in the studies they reviewed. The revised model included some factors that were absent from the original model, as well as adjustments to factors that had been reported in that model.(Barnett-Page and Thomas (2009))

The synthetic product can be expressed in the form of a chart for each key dimension identified, which may be used to map the nature and range of the concept under study and find associations between themes and exceptions to these (Brunton et al 2006). (Barnett-Page and Thomas (2009)).

Brunton et al applied the approach to a review of children s, young people s and parents views of walking and cycling; Oliver et al to analyse public involvement in health services research. Framework synthesis is distinct from the other methods outlined here in that it utilises an a priori „framework – informed by background material and team discussions – to extract and *synthesise findings. As such, it is largely a deductive approach although, in addition to topics identified by the framework, new topics may be developed and incorporated as they emerge from the data. The synthetic product can be expressed in the form of a chart for each key dimension identified, which may be used to map the nature and range of the concept under study and find associations between themes and exceptions to these (Brunton et al 2006).*

framework synthesis builds on framework analysis,

3.1 Characteristics

In **epistemological terms**, if we consider at two ends of the spectrum, one a highly constructivist vision of knowledge, and at the other, an unproblematized vision of knowledge as an "objective window open to the world," the framework synthesis, although still implies a certain interpretation of the data, shares the attributes of critical realism where knowledge of reality is mediated by our perceptions and beliefs. Furthermore, its synthesis results are reproducible and correspond to a shareable objective reality.

Regarding the extent of iteration during the review process, framework analysis involves an iterative process of searching the literature.

Assessing quality is a key component in the review process of framework analysis. Typically, when performing a framework analysis, quality criteria are set for the selection of literature. Those studies that do not meet a certain number of the criteria are excluded.

Framework analysis focuses on describing and summarising their primary data (often in a highly structured and detailed way) and translating the studies into one another. However, it also seeks to push beyond the original data to a fresh interpretation of the phenomena under review.

With regards of the synthetic product, namely, what is the synthesis for? It is clear that framework analysis views itself as producing an output that is directly applicable to policy makers and designers of interventions. There are a few framework synthesis which involved policy makers and practitioners in directing the focus of the synthesis and used the themes derived from the synthesis to infer what kind of interventions might be most effective in encouraging walking and cycling. Likewise, the products of the thematic synthesis took the form of practical recommendations for interventions (e.g. „do not promote fruit and vegetables in the same way in the same intervention).

3.2 Key steps of meta-framework

Here are the key steps involved in conducting a meta-framework analysis:

1. **Identify relevant studies**: Conduct a systematic search to identify qualitative studies related to the research topic. These studies may employ different theoretical frameworks, methodologies, or perspectives.

2. **Extract data**: Extract relevant data from each included study, including key concepts, themes, theoretical frameworks, and methodologies used.

3. **Code and categorize**: Analyze the extracted data by coding and categorizing the concepts, themes, and frameworks identified in the included studies. This process involves identifying similarities and differences across the studies.

4. **Develop a meta-framework**: Based on the coded data, develop a meta-framework that integrates the key concepts, themes, and theoretical frameworks identified in the included studies. The meta-framework should capture the overarching structure or framework that emerges from the synthesis of the individual studies.

5. **Refine the meta-framework**: Iteratively refine the meta-framework by revisiting the coded data and ensuring that it accurately represents the diversity of perspectives and theories present in the included studies.

6. **Analyze relationships**: Analyze the relationships between different elements of the meta-framework, such as how concepts and themes from different theoretical frameworks relate to each other or intersect.

7. **Interpret findings**: Interpret the findings of the meta-framework analysis in relation to the research question or objective. Discuss the implications of the synthesized framework for theory, practice, and future research.

8. **Report results**: Write up the results of the meta-framework analysis, describing the methodology used, presenting the synthesized framework, and providing supporting evidence from the included studies.

Meta-framework analysis offers a systematic approach to synthesizing qualitative research findings from diverse theoretical perspectives and methodologies. By integrating these perspectives into a cohesive framework, researchers can gain a more comprehensive understanding of the research topic and contribute to the advancement of knowledge in the field.

3.2.0.1 Atlas.ti

Process (according to Atlas.ti): Thematic framework: Central to framework analysis is the development of a framework identifying key themes, concepts, and relationships in the data. The framework guides the subsequent stages of coding and charting.

Flexibility: While it provides a clear structure, framework analysis is also adaptable. Depending on the objectives of the study, researchers can modify the process to better suit their data and questions.

Iterative process: The process in framework analysis is not linear. As data is collected and data analysis progresses, researchers often revisit earlier stages, refining the framework or revising codes to better capture the nuances in the data.*

Benefits of framework analysis Conducting framework analysis has several advantages:

Rigorous data management: The structured approach means data is managed and analyzed with a high level of rigor, minimizing the potential influence of preconceptions.

Inclusivity: Framework analysis accommodates both a priori issues, driven by the research questions, and emergent issues that arise from the data itself.

Comparability: Given its structured nature, framework analysis allows researchers to compare and contrast data, facilitating the identification of patterns and differences.

Accessibility: By presenting data in a summarized, charted form, findings from framework analysis become more accessible and comprehensible, aiding in reporting and disseminating results.

Relevance for applied research: Given its origins in policy research and its clear focus on addressing specific research questions, framework analysis is particularly relevant for studies aiming to inform policy or practice.

Implementing Familiarization with the data Before discussing a more detailed analysis, it's paramount to understand the breadth and depth of the data at hand.

Reading and re-reading: Begin by reading textual data such as transcripts, field notes, and other data sources multiple times. This immersion allows researchers to understand participants' perspectives and grasp the overall context.

Noting preliminary ideas: As researchers familiarize themselves with the data, preliminary themes or ideas may start to emerge. Jotting these down in memos helps in forming an initial understanding and can be instrumental in the subsequent phase of developing a set of themes.

Developing a thematic framework As is the case across nearly all types of qualitative methodology, central to framework analysis is the construction of a robust analytical framework. This structure aids in organizing and interpreting the data.

Identifying key themes: Based on the initial familiarization, it's important to identify themes that occur in the multimedia or textual data. These themes should be relevant to the research question. Researchers can begin assigning codes to specific chunks of data to capture emerging themes.

Categorizing and coding: Each identified theme can further be broken down into sub-themes or brought together under categories. At this stage, researchers can continue coding (or recoding) their data according to these themes or categories.

Refining the framework: As the analysis progresses, the initial themes represented by your coding framework may need adjustments. It's an iterative process, where the framework can be continually refined to better fit the data.

Indexing and charting the data Once the framework is established, the next phase involves systematically applying it to the data.

Indexing: Using the resulting coding framework, you can verify that codes have been systematically assigned to relevant portions of the data. This ensures every relevant piece of data is categorized under the appropriate theme or sub-theme.

Charting: This step involves creating charts or matrices for each theme. Data from different sources (like interviews or focus groups) is summarized under the relevant theme. For example, a table can be created with each theme in a column and each data source in a row, and researchers can then populate the cells with relevant data extracts or notes. These charts provide a visual representation, allowing researchers to easily see patterns or discrepancies in the data.

Mapping and Interpretation: With the data systematically charted, researchers can begin to map the relationships between themes and interpret the broader implications. This step is where the true essence of the research emerges, as researchers link the patterns in the data to the broader objectives of the study.

Framework analysis is an involved process, with intentional decision-making at every step of the way. As a result, implementing structured qualitative methodologies such as framework analysis requires patience, meticulous attention to detail, and a clear understanding of the research objectives. When conducted diligently, it offers a transparent and systematic approach to analyzing qualitative data, ensuring the research not only has depth but also clarity.

Whether comparing data across multiple sources or drilling down into the nuances of individual narratives, framework analysis equips researchers with the tools needed to derive meaningful insights from their qualitative data. As more researchers across disciplines recognize its value, it stands to become an even more integral part of the research landscape.

3.3 Benefits

Putting more time into specifying the model, using a wider range of literature, and gaining the views of a wider range of stakeholders may all be important in improving the legitimacy and validity of any ensuring synthesis Dixon-Woods (2011).

- A meta-framework is understood as an overarching frame for what should inform the analysis and eventually the design of STI practice frameworks, meaning frameworks used by or provided for transportation policy and planning bodies to select and apply indicators for sustainable transportation. The meta-framework is not a general theory, nor a master framework to be adopted directly by agencies, but a **classification** and **evaluation** device. Cornet and Gudmundsson (2015)

- Comparative analysis based on the meta-framework could identify common features and gaps, and be used as **a basis for testing hypotheses** regarding how indicators influence decisions on option generation, design, operation, maintenance and other aspects of transportation systems. Eventually it should help evolve sustainability measurement in transportation planning from a position as a niche, ad hoc, or add-on activity into something like an "Organizing Principle for Transportation Agencies", as it has recently been formulated (21). Cornet and Gudmundsson (2015)

3.4 The pearl-growing technique

It is a method used in qualitative research to identify additional sources of information or relevant studies based on the references, citations, or recommendations found in already identified sources. The name "pearl-growing" metaphorically refers to the process of gradually accumulating valuable "pearls" of information as researchers expand their search based on leads found in the initial set of sources.

Here's how the pearl-growing technique typically works:

Initial search: Researchers begin by conducting an initial literature search using databases, search engines, or other sources to identify relevant sources related to their research topic.

Review of references: Once relevant sources are identified, researchers carefully review the reference lists or bibliographies of these sources. They pay particular attention to the sources cited within the papers, as well as any recommended readings provided by the authors.

Identification of additional sources: Researchers then use the references found in the initial set of sources to identify additional studies, articles, books, or other materials that may contain relevant information or contribute to their understanding of the topic.

Iterative process: The process of reviewing references and identifying additional sources is iterative, meaning that researchers continue to expand their search based on the leads found in each round of searching. This process may involve reviewing the references of newly identified sources and repeating the search until saturation is reached, meaning that no new relevant sources are being found.

Evaluation of relevance: As new sources are identified, researchers evaluate their relevance to the research question or objectives. They consider factors such as the alignment of the content with the research topic, the quality of the source, and its potential contribution to the overall understanding of the topic.

Incorporation into the analysis: Finally, researchers incorporate the findings from the additional sources into their analysis or synthesis of the literature. They integrate these new insights with those obtained from the initial set of sources to develop a comprehensive understanding of the research topic.

The pearl-growing technique is valuable for ensuring that researchers identify a diverse range of perspectives, theories, and findings relevant to their research topic. By systematically expanding their search based on the references found in already identified sources, researchers can enhance the depth and breadth of their literature review and increase the likelihood of identifying important insights and contributions to the field.

The methodology uses the bases of a meta-theory and meta-history, parting from a seminal work in that of Marshall. From there the author draws and follows a timeline with which a progress in the motivations and contributions made by biology in economics and business studies can be traced. - How a seminal work is defined? - How the author decides to entertain around a certain seminal work and the works around it?

The meta-analysis is nit exhaustive not complete, The conclusions are extracted once saturation is achieved Barnett-Page and Thomas (2009).

Paterson et al described meta-synthesis as a process which creates a new interpretation which accounts for the results of all three elements of analysis; however, they do not make it clear exactly how all three components of analysis are brought together to achieve this „new interpretation .

3.5 Differences with systematic review

Meta-synthesis and systematic literature review are both methods used in qualitative research to synthesize findings from multiple studies, but they differ in their objectives, approaches, and synthesis techniques. Here are the key differences between meta-synthesis and systematic literature review:

1. **Objective**:
    - Meta-synthesis: The primary objective of meta-synthesis is to integrate and interpret qualitative findings from multiple studies to develop new understandings, theories, or conceptual frameworks. Meta-synthesis aims to generate insights that go beyond the individual studies and provide a deeper understanding of the research topic.
    - Systematic literature review: The primary objective of a systematic literature review is to provide a comprehensive overview of the existing literature on a particular topic. It aims to summarize and critically evaluate the findings of relevant studies, identify gaps or inconsistencies in the literature, and provide a synthesis of the current state of knowledge.
2. **Approach**:

- Meta-synthesis: Meta-synthesis typically involves a qualitative analysis approach, where researchers extract, analyze, and interpret qualitative data from multiple studies. It often involves thematic analysis, constant comparison, or other qualitative synthesis techniques to identify common themes, patterns, or concepts across studies.
- Systematic literature review: Systematic literature reviews can involve both qualitative and quantitative research methods, depending on the nature of the research question and available literature. They follow a systematic and transparent process for searching, selecting, appraising, and synthesizing studies, often using predetermined criteria and structured data extraction forms.

3. **Synthesis technique**:

   - Meta-synthesis: In meta-synthesis, researchers synthesize qualitative findings from multiple studies to develop new interpretations, theories, or frameworks. This synthesis may involve identifying common themes, patterns, or concepts across studies, as well as exploring relationships, contradictions, or divergent perspectives within the data.
   - Systematic literature review: In a systematic literature review, the synthesis may involve summarizing and categorizing the findings of included studies, identifying trends or patterns in the data, and providing a narrative or descriptive synthesis of the literature. The focus is on summarizing and synthesizing existing knowledge rather than generating new interpretations or theories.

4. **Output**:

   - Meta-synthesis: The output of a meta-synthesis is often a synthesized framework, model, or theory that integrates findings from multiple qualitative studies. This output provides a deeper understanding of the research topic and may generate new insights or perspectives.
   - Systematic literature review: The output of a systematic literature review is typically a comprehensive summary of the existing literature, including key findings, trends, gaps, and recommendations for future research. It provides a snapshot of the current state of knowledge on the topic and may inform practice, policy, or further research.

In summary, while both meta-synthesis and systematic literature review involve synthesizing findings from multiple studies, they differ in their objectives, approaches, synthesis techniques, and output. Meta-synthesis aims to develop new interpretations or frameworks based on qualitative data, while systematic literature reviews provide a comprehensive overview of the existing literature on a topic.

4 Description

It is important to clearly establish the differences that distinguish an evolutionary process from another of change or transformation. Although these are related concepts in evolutionary theory, they actually denote different processes that act on different agents, which is why they tend to be confusing even among some specialists.

Evolution is an overarching process that drives change in populations over generations. This means that evolutionary processes do not operate at the level of a specific individual or organism, which would only change or transform. Evolution therefore represents the cumulative effect of the inherited changes made by the characteristics of the individuals of a population, on which a selection process operates affecting the frequency of traits within a population over time. Change encompasses a broad spectrum of morphological or behavioral alterations within individuals from a variety of factors, including environmental pressures and reproductive patterns. Transformation suggests more profound or significant shifts in form, structure or function of individuals.

The idea of individualism is confronted with that of populationism. Darwin's theory is a mix of both: natural selection operates at the level of the individual organism, regulating the frequencies of traits within a population over time. Populations are the units of evolution.

Another important approach to take into account is the one that confronts the idea of evolutionism with that of progressionism. The first refers to a change that is non-directional, while the second implies a direction in evolution, usually following a teleological change.

4.1 Evolution

A simple evolutionary framework works like this:

Sudden or slow changes in the environment trigger a response in the organism that involves an adaptation, which means the loss, modification or creation of new individual traits. When the new traits are incorporated into the genetic variation of the population, the process of natural selection operates to favor some over others and derive a greater or lesser reproductive advantage to those individuals that have incorporated those new traits. This favoring or penalizing process carried out by the environment determines the greater or lesser ability of an organism to survive. This favoring or penalizing process carried out by the environment determines the greater or lesser ability of an organism to survive. At the end of the process

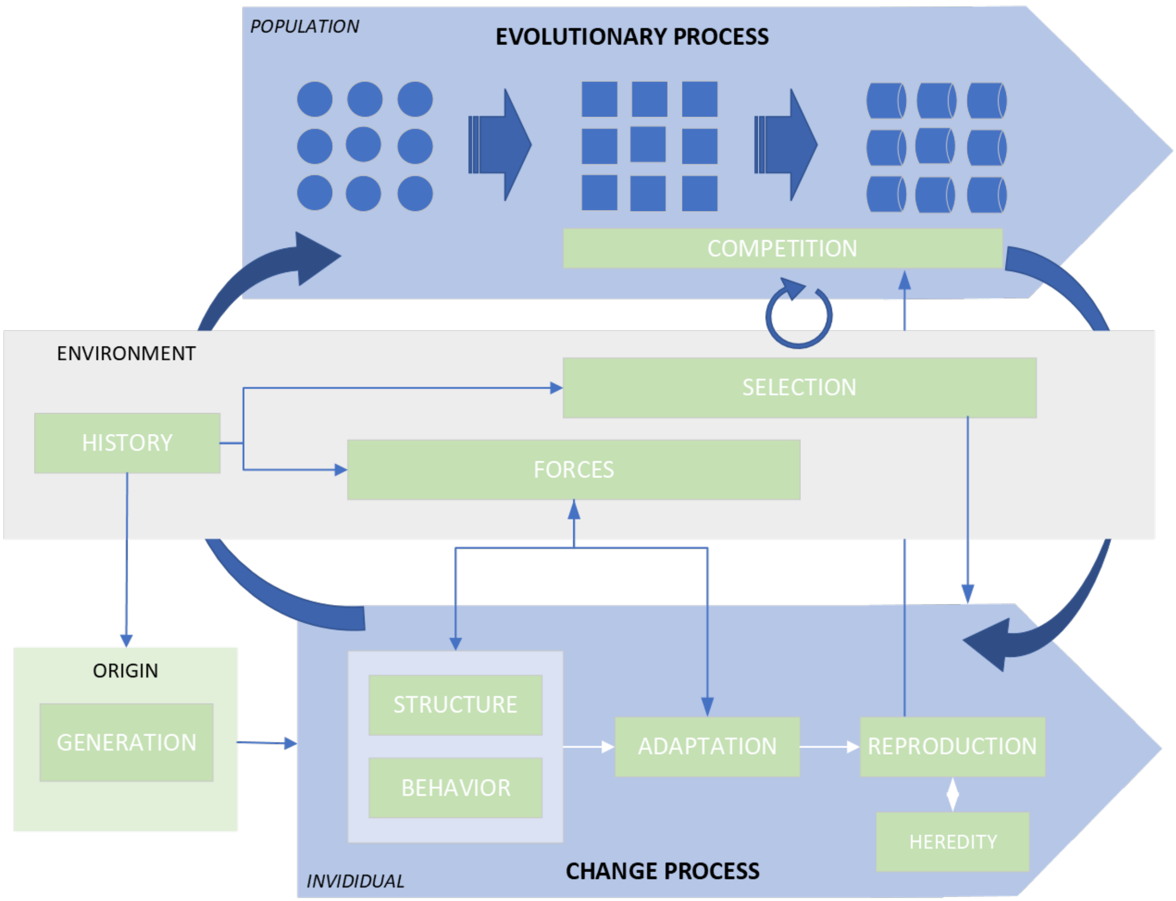


Figure 4.1: Fig1. Framework for evolutionary systems analysis. Source: own elaboration

the frequency of advantageous qualities (which are those that offer a greater ability to survive) will be higher, and those that offer less ability to survive have a lower frequency.

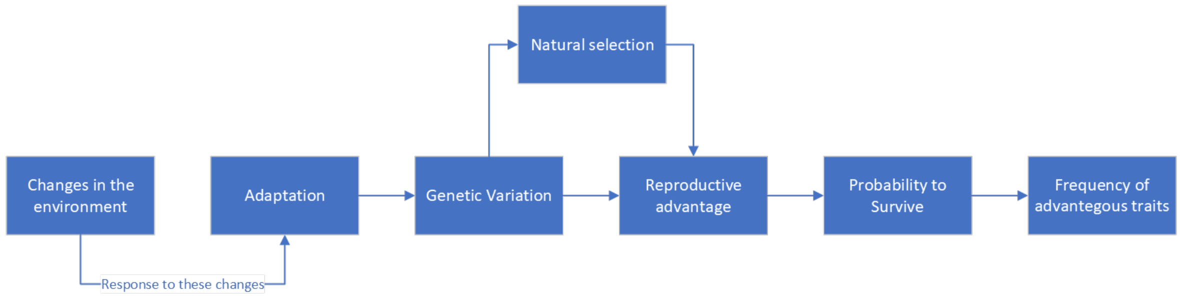


Figure 4.2: Fig2. Simple evolutionary framework

In the process of evolution is worth consider the role of feedback loops between mental an social evolution (as imagined by H.Spencer). For this author a more complex society is a stimulus for more mental development. This is the foundation of evolutionary psychology and of sociobiology.

How is the mechanism of evolution: cyclic vs. continuous?

The role of the organism to focus in new habits and become an active creative agent in charge of its own destiny is an idea of H.Spencer.This takes the evolutionary analyst to think about the role of knowledge and learning to change habits and create new instincts, in the end, to unfold a process of self-improvement (which is Lamarckian).

Study of the role of innovation and learning, and of free enterprise of individuals to cope with a competitive environment (H.Spencer). Linked to the above is also the discussion about the role of the government and the state as instruments that affect the environment.

4.1.1 Competition

The evolutionary analyst must understand competition as that within an ecology based on struggle. These are three fundamental terms to understand the evolutionary analysis framework.

It is important to stop for a moment to understand the implications of the concept of ecology to explain an evolutionary system. To achieve this, a common approach has been to use biogeography as a way of knowing about the spread of relationships and how species compete to occupy territory.

4.1.2 Convergent evolution (parallelism)

This conception of the evolutionary process implies the existence of a parallelism between independent evolutionary trajectories.

The environmental challenges over species A and B, make those species develop the sames structures and behaviors, which may have an impact on morphology, physiology, and life history traits. This continues forward with the same genetic pathways (even the same phenotypic traits), the consequence being on predictability/replicability of evolution, namely, the same solutions given to similar selective pressures.

This opens the debate between uniformitarianism (and graduation) vs catastrophism. The former is Lyell's idea of the same processes of change today than ever. The later is about sudden changes, such as catastrophic events. ### Lamarckian approach The Lamarckian approach to evolution is based on the changes posed by the environment that determine (influence) the needs of organisms. These needs, when varying, affect the degree of use or disuse of certain organs (as is the case of a giraffe) and hence the greater or lesser development of certain parts of the body. This greater or lesser development of the parts of the body in turn affects the size and power of the organism's organs and, ultimately, the organism's ability to be preserved through reproduction.

4.1.3 Buffon's perfect adapted organism

According to this framework of thought, only when alterations in the environment occur, due to alterations in climate or geography, do variations appear. This is the moment when natural selection operates to adapt the species to new conditions.

Environmental stressors cause the perfectly adapted organism to begin a process of degeneration and lose its original adaptability and perfection. This process that takes place over time gives rise to intermediate or transitional forms, which ultimately explain the diversity of life on earth.

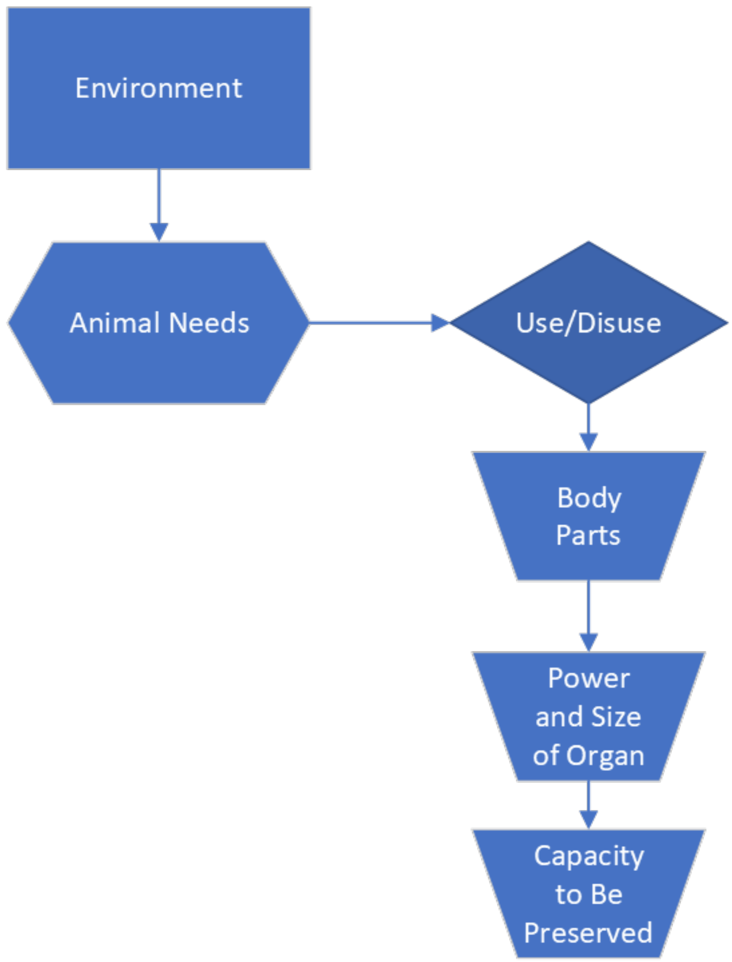
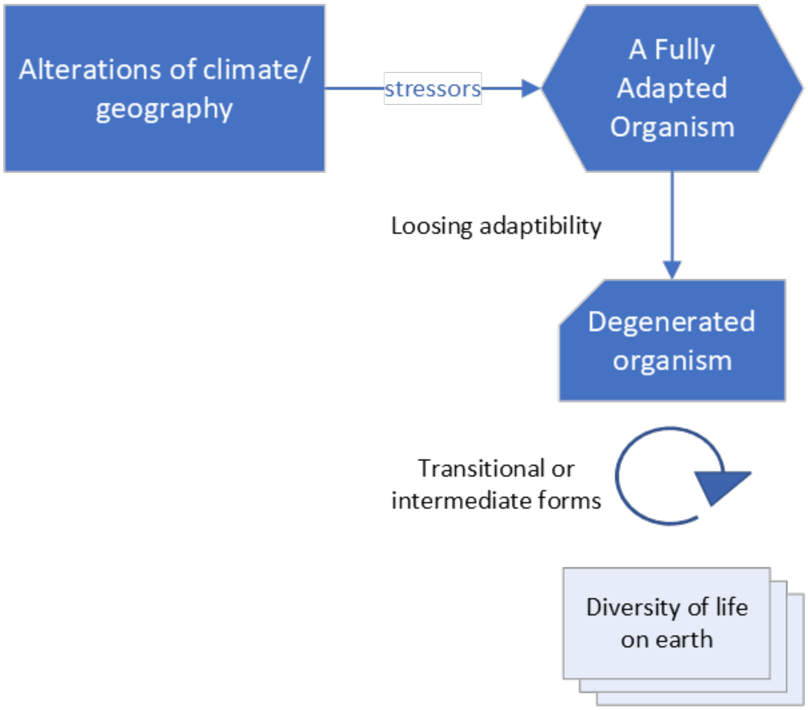


Figure 4.3: Fig2. Lamarckian evolutionary framework



Spencer's framework

Herbert Spencer's analytical framework establishes that new situations in the environment give rise to organisms having to learn how to cope with them. From this learning is derived the development of new instincts, which are more complex human faculties, which allow the organism to be more prepared to face the "survival of the fittest."

4.2 Origin

The problem of the origin is associated with that of the "Problem of Generation" and its accompanying theories of generation. An analysis of the origin involves the need to explore for evidence of the past in search for a better system (what are the sources of evidence?).

The following are some of the theories to consider when addressing the problem of generation of the original structure:

- Spontaneous generation (often only for the simplest forms)
- Preformationism (forms that are predetermined)
- Pre-existence
- A mold that is fixed.

After the evidence of generation has become evident, the next step is to continue understanding the trend towards higher levels of complexity, and thee material forces that have an influence on the trend.

When the evolutionary analyst deals with the problem of generation she must attend to the *developmental process*, and the constraints that it can impose on the rest of the evolutionary process. These constraints might introduce non-random variations, which can mean a way to direct. the course of evolution.

It is especially useful for the evolutionary analyst to consider that the unit (species) has a limited number of developmental pathways available and that the selection process would therefore be limited only to the possibility of tinkering with the details.

4.3 Structure

The main issue when considering Structure is to establish what the analytical unit of the system is (and what its main basic components are). In the case of natural evolutionary theory, this unit has traditionally been the organism, but also the population and later, after modern synthesis, the gene. It is the analyst's job to determine as clearly as possible which is the "unit" on which the evolutionary analysis of the system will focus.

Thinking about population opened the door to a statistical model of explanation, which is opposed to the Newtonian view of law-based causation. This is the eternal debate between determinism and probabilism.

4.4 Environment

What is the role of the environment as a key impact driver?

The environment surrounding the chosen unit of analysis exerts various types of forces that act on the structure to provoke a process of change, with greater or lesser intensity, and in one direction or another.

The forces of change originating in the environment force the unit to change, so it is essential that the analyst analyze the environment in depth as a key impact driver, understanding the role of the environment in the evolutionary process of the system.

The connection between the environment and the origin is a key issue as well, since the direction of the change, if it exists, and the intensity or depth of the change that may take place in the structure of the unit may sometimes depend on it.

This opens the debate between directionalism vs catastrophism in change. The latter is a random process of a destructive-creative type, in which change occurs in discontinuous steps and not through a gradual modification. The above opens the debate over purposeful changes (goal directed with no fixed line of advance- H. Spencer). The “struggle for existence” (Malthus) and the “survival of the fittest” (spencer).

One result of this view is whether evolution is linear (represented by a ladder) vs a tree (the idea of branching).

4.4.1 History

The system as the outcome of historical forces (Montesquieu).

The evolutionary analyst should elucidate whether the same forces of the past are those that govern the forces of today.

...And the vision of progress with phases of equilibrium as the whole moved from homogeneity to heterogeneity (E.Tylor)

(From Change) A good question to be reviewed by the evolutionary analyst: Is change a staged process, a process depending on historical forces?

4.4.2 Forces

It is important when analyzing the environment to specify the type of force applied to the structure, and its sources in said environment.

The forces that operate to produce evolutionary changes can be:

1. Mutation
2. Natural selection
3. Genetic drift

Following another typology of change forces (which should be clarified):

1. Hybridization
2. Recombination
3. Superposition

4.4.3 Selection

Is (natural) selection an episodic or a continuous process?

Are there periods of stable life where (natural) selection does not operate? or, Is (natural selection) always operating even in a stable environment?

A related approach is the one which considers selectionism vs. saltationism, and the extension with the role of mass extinctions. This would open the debate about evolution not always being progressive, and the acceptance that species could degenerate in less challenging lifestyle.

Is the (social) behavior programmed into us by natural selection? This would take us to the question of the development of social instincts.

The idea of struggle and death might have a positive purpose to keep species well adapted to a challenging environment (this is an utilitarian perspective). They might have a creative role (along with sex reproduction). Utilitarism in behavior and change/adaptation can be seen in J.S. Mill and W.Poley.

How evolution can produce advance in several directions (and not only towards humanity)?

The notion of selection used in this paper is that of having a balance between different characters within a population and not about the development of a murderous or aggressive instinct.

4.5 Behavior

Behavior is the way in which the structure articulates a response to the pressure exerted by environmental forces. Behavior establishes the boundaries within which the structure is capable of absorbing the forces of the environment and giving an adaptive response to the new situation or challenge posed by the environment.

The result of the behavior, which takes place within the boundaries established by the structure of the unit, can give rise to three types of adaptive responses by the system:

- New system qualities (traits)
- Loss of system qualities (traits)
- Modification of system qualities (traits)

What types of evolutionary behaviors can we find?:

1. Cyclical
2. Linear
3. Random

Another way to

4.6 Change

Both the structure and the behavior are permanently immersed in a process of change, since the unit is always sensitive to the forces exerted on it originating in the environment. The overall evolutionary process of the unit will depend on the way in which these forces affect the unit.

The characterization of the change process must be carried out considering the following key dimensions, all of them closely related:

1. The direction or trend of the change process. This question has historically been part of the discussion on evolutionary theory, with different approaches given by different authors.
2. The change driver, whether it is a single one or a set of drivers that configure the change process. This opens the debate between configurable versus non-configurable change or, in other words, whether change is manipulable (Lamarckian) or non-manipulable (Darwinian).
3. The mechanics of the process, whether gradual and slow, or sudden/abrupt and in jumps, or any intermediate alternative in the continuum formed by these two extremes.
4. The time scale on which the change process takes place. This can develop over a vast amount of time or a small amount of time, or somewhere in between.
5. Open-ended process based on trial-and-error vs. directed (fixed) process

Some important considerations to keep in mind are that the process of change always implies progress, but it can also involve regression. Therefore, the evolutionary analyst faces both forward and backward movements.This goes hand in hand with the idea of continuous progress, as opposed to progress in jumps or saltation.

A good question to be reviewed by the evolutionary analyst: Is change a staged process, a process depending on historical forces?

What is the role of the state of technology to explain the change process, and that of diffusion of knowledge?

Be aware that the process of accumulation of change can lead to the formation of new organs (new structure), according to E.Darwin.

4.6.1 Mutations

Mutations play a role in the process of change, specifically they provide a source of random variation, but they do not generate new species. Mutations generate variation and natural selection then shapes the distribution of traits within a population over time.

It must be taken into account that not all genes that undergo a mutation produce drastic changes in the organism (individual); in reality, most mutations are neutral and do not produce noticeable changes. The evolutionary analyst will have to take into account that the environment plays a role in determining which mutated characters are those that spread in the population (this is nothing more than the phenomenon of selection).

Maybe the concept of mutation is for more drastic transformations leading to new species, accepting that adaptation and selection might be irrelevant.

Can the evolutionary analyst evaluate the idea that there might be internal forces generating characters unrelated to the organism's needs? A related consideration may take us to consider that evolutionary changes occur in a predetermined manner driven by internal factors (this is called "directed evolution"). This is what has historically been called orthogenesis (F.Eimer).

The above opens involves fixity of direction, and if variation is also considered as not random, therefore there is no need for adaptation. According to this vision the environment would not have any role in evolution. Evolution might come to happen beyond what is functionally needed and not because environmental factors.

Does **"overdevelopment theory"** apply (A.Hyatt)?

4.7 Reproduction

Currently there is a generalized consensus in accepting the reproductive success of the unit as the main driver of selection, that is, the ability to transmit the genetic load of the unit to the offspring (this perspective has been criticised by Stephen Jay Gould). This modern vision of evolution has not always been like this, so less than 100 years ago success was considered to be found in the ability to adapt to the environment.

Selection based on reproductive success has opened the doors to new avenues of interest and study, which now focus more on sexual selection, in the case of natural systems, or on the reproduction mechanisms of any other system. An interesting factor that every evolutionary analyst may want to analyze is the role of geographic barriers to explain the way in which species multiply.

Let us also think that the selection process that takes place in the environment is continuous and is not interrupted even when the environment is stable. In other words, competition between some units and others for scarce resources never stops, even if the environment appears stable. The analogy of the Red Queen hypothesis, introduced by Van Halen Van Valen (2014) to denote that in the evolutionary race between organisms species must constantly adapt and evolve just to maintain their relative fitness within an ever-changing environment, it is good to explain that units must remain constantly improving or, otherwise, they will be outstripped by their rivals.

4.7.1 Reproductive strategies

What are the reproductive strategies in a population? There are a few: parthenogensis, hermaphroditism, R-selected, K-selected, Sewel parity, itero parity, mono/poly gams, hybridization, transmutation, pangenesis, orthogenesis.

Germ (hard heredity) vs somato plasm (soft heredity).

4.7.2 Developmental constraints

The concept of developmental constraints affects in shaping the course of evolution. This is because the embryonic development process imposes a series of limitations on the types of changes that can occur in organisms over time. Patterns and constraints of embryonic development can provide insights into the mechanisms underlying evolutionary change and diversification.

4.7.3 Evo-devo approach

This approach, abandoned by current biologists, states that "ontogeny recapitulates phylogeny". To understand it we must apply an "evo-devo" approach, meaning that embryological processes are part of evolutionary systems. This approach presents the idea of "blending" as the most convincing explanation of reproduction.

The "evo-devo" approach is based on Von Baer's laws of embryology, which establish the following:

1. The basic structures of the body are established before specialized features appear
2. Embryos progress from general to specific characteristics as they develop

Homology vs analogy. These concepts establish that similar structures in different organisms are derived from a common ancestor.

In the case of homology a common ancestor "A" gives rise to a divergent pattern of species "B" and "C" that are specialized and have a different formation.

The pattern in the case of analogy is convergent, since two species "A" and "B" present the same organ with the same function.

4.7.4 Speciation and Specialization

The problem of speciation, that is, the division of a parent into several descendants. This is related to niche specialization and adaptation. Speciation is a fundamental mechanism of biological diversification.

Speciation leads to opportunities for specialization. Specialization within populations can contribute to reproductive isolation and promote speciation. It can also drive specialized traits that lead to divergence of populations over time.

In specialization a constant force, natural selection, determines the level of specialization, posing a pressure to specialize on species (in line with Adam Smith thought). The level of specialization influences the level of adaptation, which drives a divergent process of speciation.

Types of specialization: genetic, behavioral or ecological.

Role of geographical isolation of speciation There are two considerations in regards of the role of geographical isolation for speciation. One considers that specialization emerges without the need of geographical barriers, this is called sympatric speciation and is a radiply evolving type of speciation. Whereas allopatric speciation is much less rapid and more accepted today, and considers geographical barriers at the initial stage of species separation.

4.8 Heredity

Heredity is an accumulated effect (think of Lamarckian IAC).

Species have a gene pool that contain a large pool of genetic variability, in which many of these genes are simply useless or harmful. This gene pool is the raw material for selection.

An important task of the evolutionary analyst will be to determine if there are modifier genes (W.Castle) that influence the genes responsible for phenotypic characters.

Some Lamarckian stances might be worth an analysis. For example, the evolutionary analyst might consider that not all inherited acquired characteristics (IAC) are inherited by or as a response to changes in the environment.

The above might take of to the question if all evolution is mere trial-and-error, and how much is a deliberate choice of new habits in response to changes in the environment? Current thinking considers that not all needs to be inherited, so (to what extent) Can the environment influence heredity? (W.Bateson). But be advised that genetics is hostile to this idea.

Mendelian rule of "one single unit" in the germ plasm being responsible for determining the character and transmitting it to offspring. This would lead us to have to elucidate which genes (alleles) are dominant and which are recessive. This would lead us to have to elucidate which genes (alleles) are dominant and which are recessive, and thus explain that there are discontinuous characters (Bateson).

4.9 About the Evolutionary Analysis Model

The analysis model for evolutionary analysis must balance theory with observation (Herschel). In reality, theories derive their power from their ability to establish connections with other areas of study.

(In Structure) Thinking about population opened the door to a statistical model of explanation, which is opposed to the Newtonian view of law-based causation. This is the eternal debate between determinism (causation) and probabilism (statistical).

Other discussions apart from determinism vs probabilism established by evolutionary analysis are these:

- Predictive vs descriptive
- Reductionist vs holistic
- Macroscopic vs microscopic

The method of evolutionary analysis is that of a patient observer (Darwin), who poses some hypothetical situations and then uses the deductive method to try to verify them.

5 Discussion

5.1 On Evolution

When addressing the study of an evolutionary system, it is of paramount importance to first elucidate what **the unit** of the system will be, on which the entire conceptual and methodological apparatus of evolution will be applied. This is a discussion that has changed over time, having moved from the individual organism to what is currently considered a more correct approach, the gene. What the above means is that instead of prioritizing “adaptive fitness” in the analysis, today it seems more appropriate to focus on the reproductive success of the individual. This new perspective has given rise to the movement of ultra-Darwinism.

The analysis of evolutionary **stratigraphy**, that is, the analysis of the evolutionary process cut into layers, can provide valuable evidence and insight about the evolution followed by each stratum, as well as the relationships that exist between strata. Additionally, it may also be valuable to study the global stratigraphy of the system, that is, the system of layers resulting from aggregating lower-level strata into higher-level strata, since this can suggest new stratal relationships that previously remained hidden from view of the evolutionary system.

The geological **law of superposition**, which states that in any sequence of undisturbed sedimentary rocks, each layer of rock is younger than the one below it and older than the one above it, can be used analogously in the analysis of an evolutionary system, thus establishing that each lower layer manifests a behavior on which the behavior of the upper layer is based.

5.1.1 Hierarchy

The idea of hierarchy involves something on top down to somethinge else.

Once the evolutionary system has been sliced into strata and the evidence that each one individually provides, as well as that of the global stratigraphic system, has been analyzed, the evolutionary analyst will be able to infer the **hierarchical structure** of evolutionary elements that characterize the system under observation.

5.1.2 Classification

A classification or taxonomy is a procedure used to better understand the diversity (and variation) of organisms.

When studying the evolution of a population, building a **classification or taxonomy** of units (species) becomes relevant. This requires discipline and deep analysis into the building blocks and the relationships (or degrees of relationships) that stand between individuals. By formulating a classification/taxonomy, new avenues can be opened that allow the evolutionary analyst to trace (and understand) the past of the units and make it easier to foresee the next steps that the unit will go through.

With a classification or taxonomy the analyst can study the diversity of the units (species) based e.g. in their morphology, as well as the ecological relationships that exist between them.

In the history of evolution, three major frameworks for classifying species are usually proposed:

1. Chain of being (Bonnet) -> it is a hierarchical chain of relationships
2. The rope of being (Rubinet)
3. Lineo taxonomy based on visible resemblances (with no hierarchy)

5.1.3 Miscelaneous

The idea of the extent to which the **history of "life"** has been progressive but in an irregular way.

The idea of **"emergent evolution"** (Lloyd Morgan) which highlights the new high-level properties that appear as evolution reaches a certain level of complexity.

5.2 On the Origin

The idea of the Origin is consubstantially associated with the idea of an **end**, since everything that begins must necessarily have an end.

The problem of origin is closed related to the **problem of generation**, thus the evolutionary analyst must elucidate whether the origin of the unit is spontaneous, preformationist, etc.

An alternative perspective to the problem of origin can be raised from **biogenesis** (life arising from non-living matter) and the **"primordial soup"** (Opsin), that is, the combination of elements that gives rise to the synthesis of compounds " organic" after adding energy to the system (from lightning, UVA radiation, volcanic activity, etc.)

5.3 On the Environment

5.3.1 On the Forces

We do not know the forces (and their sources) that operate driving the process of change in the individuals of a population.

Apart from the forces that operate at the level of individuals, it is necessary to know what the transmission mechanisms are like from the environment to the individual, between individuals, and vice versa, from the individual to the environment.

What is the materiality of the pressure for change exerted by an environmental force?

5.3.2 On Selection

One of the most difficult questions that every evolutionary analyst must face is how the **selection process** imposed by the environment actually work, and to what extent different alternative selection approaches can help explain the evolutionary course of the system.

We refer to the selection process not as the blind application of a closed paradigm that we know a priori will provide an explanatory response to the evolution of any system, but rather the analyst evaluates to what degree alternative selection models can provide insight into our understanding of the evolution of the system. It is about better understanding how rival visions can have a place in our understanding of the evolutionary phenomena of the system, even in an open and simultaneous way.

5.3.3 On the Unit

5.3.4 On the Structure

5.3.5 On the Behavior

To what extent is the system's behavior governed by inherited **instincts**? And to what extent can the selection process alter instincts? Are instincts constraints to the development of behavior and the process of change, or are they not such constraints?

What behavioral traits can be considered **innate** and which are constructed with the interaction with the natural and social environment? What are the environmental stimuli that might help explain the individual instincts?

Perhaps the analyst, in addition to (the above) behavioralist approach, might approach the analysis of the behavior by exploring the internal processes inside the individual that trigger observable responses in the individual.

Can individual behavior be **predicted**? Furthermore, can behavior be controlled by manipulating the environment and creating a stimulus-response association in the individual? The evolutionary analyst might also focus on how the individual learns through the association of stimuli with specific responses.

To what extent can **learning** and **technology** affect instincts to the point of making them heritable?

The problem of **hierarchy** can also affect behavior to the point that the evolutionary analyst can try to elucidate what the behavioral hierarchy is (e.g. intellectual, social, moral, etc.). How are these behavioral faculties created?

It is important for the evolutionary analyst to assess to what extent there is the possibility that we have the ability to **control genes** and, therefore, that we can control how human behavior can be controlled (The Blind Watchmaker- R.Dawkins)

5.4 On Change

We know what an individual is today, but we do not know how an individual became what it is today. This necessarily raises the need to study the **historical past** as a source of knowledge to understand the process of change or evolution followed.

If change does not leave any **proof** (of evolution), why don't we seek indirect progress (i.e. the equivalent of fossils)?

It is necessary to know which components of the individual's structure (or flows) the **forces of the environment** act on, or on which behaviors the forces of the environment have an impact.

Also relevant is the question of how the **development process** of an individual is like, both before conception (embryonic development) and during its life period.

Does the change caused by forces in the environment respond to any **goal or objective**? Is there any direction, goal or trend? And if there is one, what is the justification for it to exist? Is there any type of constraint associated with the development of the individual that conditions or limits the process of change? Can we rule out that the individual's process of change does not have a teleological character (e.g. a guiding principle, a force, etc.) towards a specific end/goal?

In the analysis of **evolutionary dynamics**, it is interesting to know if the system becomes stable and in equilibrium, stable and not in equilibrium. Finding out this situation allows us to better understand the nature of the evolutionary process and try to predict the next steps in the evolution of the system.

What are the **change mechanisms** used by units to respond to environmental forces? Some may be:

1) Hybridization
2) Recombination
3) etc.

To what extent is the **timeline** for the adoption of changes a key factor that determines the individual results of the change? When analyzing change it is key therefore key to elucidate the timeline in which it unfolds.

Speaking about the timescale of the change processes, it is interesting to find out if the system is constrained by certain structural limitations, or that they have their origin in its own development, and that explain why the changes occur. This would allow the evolutionary analyst to estimate the particular evolutionary **"clock"** of the system. The idea of the clock is to explain traits that evolve at a constant rate overtime, due to underlying molecular mechanisms. In other words, that would explain the rate of change at which changes accumulate over time.

It is evident that the clock idea would not offer precise information similar to that currently used in the field of molecular biology or genetics to provide insight into the the tempo and mode of evolutionary change, but it could be a qualitative approximation to the temporal factors that intervene in the rate of evolution of a system.

A possible model that explains the evolutionary process that should be seriously taken into account is known as **punctuated equilibria"**. According to this model, species remain relatively stable and in equilibrium with their environment for long periods of time. During this time they register small changes in their morphology or level of adaptation. However, at certain times, sudden changes occur that trigger evolutionary episodes of changes (punctuation) associated with events that are accompanied by speciation. These periods of rapid change would be interspersed with long periods of stasis.

The evolutionary analyst should open to the notion of **arrow of time**, and the preferred direction or sequence of change. And if the change process is reversible vs irreversible (with higher entropy). In turn, this should lead the analyst to consider the predictability or unpredictability of evolution.

Is the result of evolution the same system of a new one?

5.5 On Heredity

What are the limits of heredity (change)?

6 Implications

6.1 Evolutionary analyst

One of the practical benefits derived from the present proposal of formulating an evolutionary systems analytical framework is to determine the need to have professionals with an evolutionary analyst profile. An evolutionary analyst is understood to be an academic or professional who has a clear and deep understanding of the evolutionary functioning of systems and who is capable of using rigorous analysis and tools to determine the factors that explain their essence and elements of change.

6.2 Prediction ability

If we are able to acquire a deep understanding of the functioning of the evolutionary system, its components, behaviors and flow of changes, we can then better foresee in which direction the evolutionary system is moving and glimpse whether the system has the capacity to survive or, on the contrary, is doomed to disappearance.

It is worth considering the possibility of whether, based on increasingly deeper knowledge of the evolution of a system, it would be possible to act on the future of the system. In other words, if it could be feasible to design your own plan and carry it out based on the knowledge generated about the evolution of the system.

To what extent is the system under observation random in change or does it evidence a logic that can be known and even altered based on our desires or needs?

6.3 Manipulation of the system and its programmability

If they were really able to manipulate the system as we wish, on what elements would it be most feasible to do so? Would it be possible to act on both the structural and behavioral elements, only on one of them? Being able to act on a known evolutionary system would open new and great opportunities to design systems that meet a wide diversity of needs.

The above would necessarily entail having to assess the ethical problems of altering the course of nature and the new problems that would emerge by distorting the natural mechanisms of the functioning of life and society. The opposite position would be to conclude that the system is unalterable and we cannot intelligently design it to satisfy our desires.

Society would go from a stage in which social systems are considered elusive to another in which we would be able to know to what extent their evolution is random, to what extent there is causality and to what extent they are programmable.

6.4 Inform and activate policies

An evolutionary analysis framework can serve to inform who cannot support themselves, namely, who is more likely to survive and continue competitive, and who is threatened by disappearance.

Identifying who dominates over whom, that is, elucidating the relationships and power structures has great significance, but it is also a way to understand how species advance. In fact, the process of replacement or extinction of species is an essential aspect to understand human progress.

The level at which the analyst expects to inform policy, or the level of contribution expected by decision makers from an evolutionary model, is a factor in determining the level of analysis to be used in the "struggle for existence."

Additionally, if education (education policies) could improve individuals, the benefits could perhaps be passed on through inheritance (this is a Lamarckian view).

6.5 Overcoming the barriers that prevent systematic struggle

From the RQs: Another question that the evolutionary analyst can try to resolve is whether the individual **permits the struggle** to take place and, if not, to what extent this weakens the individual and, therefore, that the individual enters into a process of degeneration that leads to a replacement by another individual.

This leads us to the recommendation, in some circumstances mediated by policies, that the struggle does not have constraints that condition it. Thus, as the environment continues to pose challenges that must be faced (resolved) by the individual, progress will continues.

6.6 Eugenics of individuals

The above leads us to the problem of eugenics, and the reflection on to what extent the system must ensure that the selection produces and there are no barriers for it to unfold its effects.

6.7 The connection with complex systems

The analysis of evolutionary systems demonstrates a connection with complex systems, such that species should be seen as complex systems with an enormous amount of variation, stimulated by selection.

7 Conclusion

The evolutionary analysis of systems fundamentally requires generating much more extensive and precise knowledge about individuals and populations, as well as about the periods and places in which they develop. This is self-evident when it comes to obtaining a deeper understanding of the reasons for change and diversity.

We also know today that systems do not evolve smoothly and continuously over long periods of time but do so based on pulses between periods of interruption that cause disruptive changes and the mass extinction of units.

Knowing the sequence of events that have shaped the evolutionary processes opens new analytical dimensions to the study of the evolutionary phenomenon and allows us to confront elements considered unpredictable until now in the course of evolution.

References

Barnett-Page, Elaine, and James Thomas. 2009. "Methods for the Synthesis of Qualitative Research: A Critical Review." *BMC Medical Research Methodology* 9 (1): 1–11.

Cornet, Yannick, and Henrik Gudmundsson. 2015. "Building a Metaframework for Sustainable Transport Indicators: Review of Selected Contributions." *Transportation Research Record* 2531 (1): 103–12.

Dixon-Woods, Mary. 2011. "Using Framework-Based Synthesis for Conducting Reviews of Qualitative Studies." *BMC Medicine* 9 (1): 1–2.

Van Valen, L. 2014. "19. A New Evolutionary Law (1973)." In *Foundations of Macroecology*, 284–314. University of Chicago Press.