EVOLUTIOSoc: A Meta-Framework for Complex Social Systems

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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 the thematic grouping of topics based on a seminal evolution history work. Stage two involved testing the framework and fine-tuning it with selected works in evolution, both from the field of biology and the social sciences.

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 wellbeing 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.

The review of views studies concludes that children's, young people's and parents' views about what helps and hinders their walking and cycling involves the strong culture of car use, the fear and dislike of local environments, children as responsible transport users, and parental responsibility for their children. Brunton et al. (2006)

The CEN Workshop Agreement (CWA) first presents an in-depth analysis of the current state-of-the art of ICT Practitioner Skills/Competence frameworks in order to clarify the nature of the next steps towards a European ICT Skills Meta-Framework, and its relationship to the

proposed European Qualifications Framework (EQF). Then, recommendations based on the results of the analysis are presented.@de2006european

A comprehensive overview of ICT frameworks has been produced, and a structured inventory of five particularly significant ICT Practitioner Skills/Competence frameworks is presented, in terms of a number of key attributes. Three specific frameworks, representing the national approaches in three large Member States, are analysed in some detail, and certain findings are evident, based on their mutual similarities and differences. The overall structural paradigm and an example comparable profile for each are examined. European Committee for Standardization (2006)

A structured review of four significant ICT Practitioner Frameworks (the three major national frameworks in the EU and one from North America) was carried out and is presented, and Level Descriptors for the specification of ICT Practitioner competence are developed from the generic EQF descriptors. In addition, based on the comparisons of existing frameworks, broad Guidance is provided for appropriate and effective use and further development of such frameworks. European Committee for Standardization (2006)

An "Ideal Scenario" is presented, aiming to introduce the potential benefits of greater coherence at the European level, and options are shown for possible ways of moving towards that world. It is recognized that there is a need for stronger evidence of benefits in relation to the different uses of such frameworks, and a set of recommendations for progressing increased coherence are made, in relation to both ICT Practitioner competence Frameworks and ICT Qualifications of different types.@de2006european

The in-depth analysis of a range of evidence leads to the following conclusions: - It is recommended to encourage and strengthen the process of convergence of ICT Practitioner skills/competence frameworks within the EU by means of a three step process:European Committee for Standardization (2006)

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

1 Introduction

Title: Evolution in the SOcial Sciences/ Theory of the Firm

0. Introduction / 0.1 Background / 0.2 Purpose of the European ICT Skills Meta-Framework European Committee for Standardization (2006)

A Meta-Framework is one which stands beyond (or above) (other) frameworks, in the sense of describing (other) frameworks. A Meta-Framework is a framework about frameworks. There are a number of existing frameworks for ICT Practitioners within the EU and beyond, and the proposed Meta-Framework would "stand beyond" them in particular because it is not intended, or designed, to stand alongside them. It is not a "new" ICT Practitioner Skills/Competence Framework, but attempts to encompass and disseminate information about existing (and possible future) such frameworks, for the benefit of all.@de2006european

Better understanding about ICT Skills can be useful in a number of ways, but extensive discussions as part of the Workshop process have concluded that the greatest value from this Meta-Framework can be gained from its use as:

• a tool for structured comparison between existing ICT Practitioner Skills/Competence Frameworks; • a guidance resource on which those considering the possibility of developing their own Frameworks can draw; • a conceptual basis for planning future developments that would help assure a greater supply of competent ICT Practitioners to European employers; and • a starting point from which the proposed European Qualifications Framework can be applied to, and evaluated for, ICT Practitioner work, both by employers and by practitioners planning their careers.@de2006european

Just as Information and Communication Technologies themselves are highly complex and continuing to evolve, so the skill-sets needed in relation to deploying and using ICT are both very complex and not yet stable or mature in terms of coherence of their classification. As a result, efforts to clarify and codify the structures of these skills have not yet reached a level of stability that enables adequate agreement at the European level on classification frameworks that could be thought of as a possible future standard for the European Union.@de2006european

The need for such a review was recognised in light of an effectiveness review of interventions promoting a shift away from car travel towards more active modes of transport, the 'modal shift' review (Ogilvie et al., 2004).This found equivocal evidence of effectiveness for population-level interventions that promote walking and cycling as alternatives to car use (…) Synthesising views studies and effectiveness studies together can lead to more specific recommendations for

developing interventions, choosing which to evaluate rigorously, as well as which to implement as policy. Brunton et al. (2006)

Synthesising these findings with the 'modal shift' review's effectiveness findings identified some interventions that are appropriate and effective; and some that may be promising either because they appear effective in some studies, but not others, or because they complement people's views, but have not been rigorously evaluated for their effects. Effective interventions to be adapted for wider use include social marketing, with and without the development of cycle networks.@brunton2006synthesis

Studies of people's views have several implications for intervention. The most important is the need to reduce the convenience of car travel and simultaneously increase the safety of pedestrians and cyclists in residential areas and around schools. According to the research evidence, this would encourage children, young people and parents to walk and cycle, and to use public spaces more, which would strengthen overall community environments.@brunton2006synthesis

1.1 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.

3. **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.

4. **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.

5. **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.

1.2 The Role of Biology (The role of natural evolution as a framework)

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.

1.3 The Need for a Meta-Framework in the Social Sciences

Successfully building well-being in students is not simply a matter of delivering a one-off positive education intervention. Rather, an embedded approach across interconnected systems throughout a whole school is needed (Waters 2011; White and Murray 2015). A meta-framework can give researchers and practitioners a purposeful direction within which to design, apply and evaluate interventions. Such a framework must have broad and generalizable parameters that reflect a comprehensive model of student well-being, while still offering the flexibility needed to choose and/or design interventions that are best suited for different contexts.@waters2019search (…)In addition to its higher-order comprehensive nature, if a meta-framework is going to be useful in advancing positive education it must be evidence-based and actionable. Thankfully, the field has amassed a decent preliminary evidence base on effectiveness to draw upon (see Waters 2017, for a recent review of the field) Waters and Loton (2019) (…)Resultantly, a meta-framework must be useful in supporting the decision making of educators and practitioners applying positive education knowledge and interventions in concrete ways with students. Consistent with leading thinkers in the field who assert that wellbeing is a multidimensional construct, and that students need to have the opportunity to develop a diverse range of skills to build wellbeing (Diener et al. 1999; Forgeard et al. 2011; Keyes and Annas 2009), a meta-framework must be multidimensional.@waters2019search (…)Currently, the majority of frameworks in positive

education are not multidimensional but, rather, focus on only one or two aspects of wellbeing. For example,(…) Waters and Loton (2019)

1.4

The aim of the qualitative evidence synthesis was to examine people's attitudes towards the taking of agents or supplements that may be used in the primary preven- tion of colorectal cancer, i.e. NSAIDs (including aspirin), vitamins, minerals, folic acid or folate, selenium, calcium and dietary supplements generally. The synthesis included studies that focused on exploring the views, beliefs or attitudes of people who took any of these agents for any purpose. A systematic search to identify relevant studies was performed by an information specialist following piloting of appropriate search strategies. The search combined terms describing the agents of interest (NSAIDs, aspirin, vitamins, etc.) with a pub- lished, validated filter for identifying qualitative studies, together with the medical subject heading "qualitative research" [11]. The full search strategy is available in the Appendix (Carroll, Booth, and Cooper 2011)

The process involved leveraging an established model to refine a meta-framework for understanding views on the uptake of potential chemopreventive agents. Reviewers critically assessed data categorization, iteratively refining themes based on alignment with data and incorporating new insights. The revised model integrated insights from the original framework and empirical data, resulting in an enhanced conceptual framework to elucidate perspectives on chemopreventive agent uptake.(Carroll, Booth, and Cooper 2011) ## 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.

Research questions This review seeks to answer two questions: What research has been undertaken about the public's views of walking and cycling as modes of transport? How do children's, young people's and parents' views of the barriers to, and facilitators of, walking and cycling match interventions evaluated for their effects on walking and cycling?

(From Methodology) *The review was conducted in three parts. First, we searched for and mapped the existing research literature on the general public's views of walking and cycling. Second, we conducted an in-depth review of a subset of this literature, the scope of which was selected by our Advisory Group, focusing on the views of children, young people and parents.*

Third, we synthesised the findings relating to these 'views studies' together with the research on interventions carried out by Ogilvie et al. (2004). The overall conclusions of the review are thus based both on international evaluations of specific interventions, and from findings of recent 'qualitative' research conducted in the United Kingdom (UK) examining the views and experiences of children, young people and parents.@brunton2006synthesis

1 Scope The scope issues in this workshop are very important, but they relate, rather than just to the types of skills considered, to the clarification and positioning of precisely what the proposed ICT Skills Meta-Framework is (and what it is not)European Committee for Standardization (2006)

The design of frameworks arises first and foremost from the intended purpose, or application. This is fundamental, since – although frameworks designed for one purpose can be, and often are, used for purposes beyond those they were designed for, they may well not be particularly well-suited for the other applications, and so may not perform effectively in that context. In short, frameworks – once created - can "take on a life of their own", and this can often produce unexpected, and sometimes undesirable, effects in other contexts.@de2006european

In short, the main priority of an ICT Practitioner Skills/Competence Framework (and any European Meta-Framework related to such frameworks) is to provide something largely specified by employers, and of real value to them as well as to those employed as - and those seeking work as - ICT Practitioners, as well as stakeholders associated with both sides of the labour market. Its contribution as a platform via which the proposed EQF can be applied in relation to ICT Practitioner work remains secondary in the context of this Workshop European Committee for Standardization (2006)

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 Natural Science as the Cornerstone of Evolutionary Inquiry

The study of evolution in the natural sciences serves as a foundational pillar for understanding evolutionary phenomena across various disciplines due to its fundamental principles and overarching explanatory power. Evolutionary theory, rooted in biology and natural selection, elucidates the mechanisms driving change and adaptation in living organisms over time. These principles extend beyond biology, providing insights into the dynamics of change, adaptation, and innovation in diverse systems, including social, economic, and cultural domains. By examining how species evolve and interact within their environments, evolutionary science offers valuable analogies and frameworks for understanding analogous processes in other disciplines. Consequently, evolutionary concepts serve as a unifying framework, facilitating interdisciplinary research and fostering a deeper understanding of complex phenomena across different fields. Thus, the study of evolution in the natural sciences not only enriches our understanding of biological systems but also provides valuable insights into the dynamics of change and adaptation in broader contexts.

2.2 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)

2.3 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

The author employed a systematic approach that leveraged existing works in the domain of natural sciences to construct a preliminary evolutionary framework. This framework served as a foundation for streamlining the identification, coding, and synthesis of data from studies in the domain of evolutionary economics and the theory of the firm. By leveraging those relevant concepts, theories, and models present in key evolution-centered works in the field of natural science, the author achieved a more efficient means of establishing an a priori framework. This facilitated the testing of existing theories and models in evolutionary economics and the theory of the firm against our preliminary criteria.

Moreover, this methodological choice served as a pragmatic alternative to other forms of qualitative data synthesis. By flagging and communicating divergent findings or themes along the meta-framework construction process, the author ensured transparency and facilitated discussion around the synthesized findings. The resulting synthetic product is an enhanced framework that captures the key theories and concepts under study, and associations between themes and tensions identified in the literature. This comprehensive approach enhances the rigor and reliability of the metholological process (Carroll, Booth, and Cooper 2011).

The approach employed in this study diverges from conventional methods utilized in framework synthesis. Unlike other published versions, where the a priori framework is typically developed through extensive literature review, consultations, and topic expertise, our approach does not require such exhaustive processes beforehand. Instead, the author started from a corpus of pre-existing literature and a seminal work that contained the key concepts and the relationships between them in the adjacent field of natural sciences. This foundation allowed for a faster and more efficient coding and synthesis process compared to traditional meta-framework construction methods. By circumventing the need for extensive preparatory work, our approach offers a more efficient and streamlined method for conducting framework synthesis, enabling authors to focus more directly on the review process itself.

3.1 Objectives

The present study delineates a comprehensive meta-framework designed to fulfill several pivotal objectives. Foremost among these aims is the systematic description and synthesis of primary and secondary data, incorporating an examination of the fundamental interrelationships inherent within. Concurrently, the meta-framework endeavors to map the evolutionary

trajectory of pertinent studies in the domain of business scholarship and the theory of the firm, aligning them methodically within its overarching structure.

The meta-framework aspires to transcend conventional paradigms of data synthesis, aspiring instead to furnish a novel interpretive lens through which to scrutinize the theory of the firm from an evolutionary standpoint. By foregrounding the dynamic interplay between firms and their milieu, this endeavor represents a departure from static conceptualizations, facilitating a nuanced understanding of organizational behavior within an ever-changing economic landscape.

Furthermore, it is incumbent upon the meta-framework to engender a tangible utility for both academic scholars and industry practitioners alike. Hence, the resultant synthesis is envisaged as a flexible tool, amenable to facilitating a deeper comprehension of firm-level decision-making processes and behavioral dynamics. In effect, the meta-framework is envisaged to serve as a practical aid, fostering enhanced insights and efficacious strategies pertinent to scholarly inquiry and managerial practice within the realm of business economics.

3.2 What is a Framework?

Although there is no standard, universal definition of what a framework is from a qualitative research standpoint, the literature in general endorses the position of frameworks as bridges between the construction of theories and the way of conducting empirical observations (Partelow 2023; Mollinga 2008). This relevant position of frameworks within the theory of science is in turn reflected in the growth they have experienced in recent decades, to the point of being present in practically all areas of scientific knowledge. Its applications span wide and varied fields within the natural and social sciences, technological development, and environmental and experimental sciences, and many well-established frameworks are regularly applied by scientific organizations and policymakers around the world.

In some cases, frameworks act as valuable tools that help develop a common language and structure research processes (Binder et al. 2013). In other cases they serve as reference material used by scholars and practitioners to navigate the complex interactions between phenomena of different nature and to analyze and integrate the knowledge that thus emerges (Pulver et al. 2018). Whatever its purpose, if we tried to classify the most used frameworks today, we would realize that there are two main trends: frameworks that aim to capture the complex functioning of a phenomenon or system, and those that seek to simplify the central concepts. This is enough to give us an idea of the importance of frameworks as tools to structure and operationalize scientific knowledge.

From an epistemological point of view, frameworks, whether emerging from the top down or bottom up, cover the imperative need to build a seamless connection between different levels or scales of scientific knowledge, thus linking the higher more general levels of knowledge (a paradigm or a general theory) with the bottom levels (a model or a case study). As

such a framework is intended to *"organize diagnostic, descriptive, and prescriptive inquiry, providing the basic vocabulary of concepts and terms to construct the causal explanations expected by a theory"* (Partelow 2023). Ultimately, frameworks aim to make science easier, guiding researchers in their research design and providing them with a groundwork of key concepts and foundational knowledge that they can then measure, compare, and evaluate. This way, researchers do not need to reinvent the wheel with each new investigation and can instead focus their skills on advancing the framework by applying it to other less-known areas, or integrating it with new knowledge from other disciplines.

Frameworks also help researchers position their work within a specific field of practice or knowledge, providing them with a well-grounded set of interconnected concepts, theories, and paradigms that have been shown to be useful in that field (Cox et al. 2016). Therefore, frameworks are not only valuable for synthesizing knowledge and focusing researchers' attention on key concepts and its interrelationships, but they also help drive the community debate, encourage a more collaborative and interdisciplinary research work, and lay the foundation for subsequent empirical efforts and for effective communication of the advances and discoveries being made.

Despite the growth of framework creation in recent years and its widespread applications in science, governance and policy-making, doubts persist about their development and the way in which they can be applied. Very often frameworks are developed from the experience and knowledge of scholars and practitioners themselves. This often earns them the criticism that they act as "black boxes" and do not make clear why some concepts and their relationships are chosen and others are left out. But this is not the only way a framework can be developed. It is also quite common for prior knowledge and experience to be combined with an empirical synthesis process derived from some research, allowing frameworks to emerge in a more robust way.

Once a framework has been created and its applications in a field seem clear, it is time to operationalize it. This will often pose numerous challenges for both its creators and end users. For example, if the purpose of the framework is to guide empirical analysis of a particular phenomenon, scholars and practitioners will need to develop specific strategies for choosing particular cases and conducting synthesis activities. In other cases the need will arise to connect the conceptual framework or the indicators provided by the framework with real-life data. In such cases, issues may arise when interpreting the data and adjusting the framework to reality.

3.3 Rationale for a Meta-Framework

The adoption of a meta-framework as the principal methodological tool is underpinned by several reasons. First is the inherent suitability of framework synthesis for the analysis of descriptive data, particularly when confronted with the imperative to encapsulate the intricate structural nuances and dynamic interaction patterns characterizing the phenomenon or

system under scrutiny (Smith and Firth 2011). Given the inherent complexity intrinsic to the evolutionary inquiry into firm behavior, encompassing a multitude of internal and external variables and their interplay, a methodological approach offering a comprehensive depiction of both structural configurations and behavioral dynamics becomes imperative for elucidating this multifaceted domain.

Moreover, the step-by-step procedural framework inherent in synthesis methodology endows it with a commendable level of transparency, thus enabling a clear delineation of the systematic processes guiding data analysis, from descriptive elucidation to explanatory inference. This procedural transparency extends further to encompass the researchers' interpretative endeavors, thereby ensuring a traceable trajectory of analytical insights over the course of the study.

Unlike alternative qualitative data analysis approaches such as grounded theory, narrative methods, or phenomenology, framework analysis adopts a pragmatic epistemological stance, thereby rendering it accommodating to a diverse array of data types and research contexts (Goldsmith 2021; Gale et al. 2013). This versatility is particularly salient in the context of the present investigation, where primary data derived from conceptual and empirical studies across natural and social sciences, alongside secondary data elucidating evolutionary paradigms within the realm of firm theory, collectively underpin the construction of the meta-framework. By integrating insights from disparate disciplinary domains, the meta-framework aspires to offer a holistic vantage point, transcending disciplinary boundaries to provide a nuanced understanding of evolutionary dynamics within the context of firm behavior.

3.4 Stages in the Construction of the Meta-Framework

Framework analysis is a robust methodological approach that comprises five stages that facilitate systematic qualitative data analysis. Beginning with data familiarization and culminating in mapping and interpretation, these stages ensure comprehensive exploration and synthesis of research findings. Each stage plays a critical role in elucidating patterns, themes, and associations within the data, ultimately contributing to a nuanced understanding of the research topic. Notably, the framework approach's flexibility enables adaptation to various research contexts, including longitudinal studies, case studies, and projects involving diverse participant groups. By embracing the methodological rigor inherent in framework analysis, researchers can effectively navigate the complexities of qualitative data and advance knowledge in their respective fields.

Stage 1: Familiarization

The initial stage of meta-framework construction, familiarization, aims at providing the researcher with a purposeful understanding of the collected data. Through an immersive engagement with the dataset, researchers embark on purposeful reading and re-reading of the

data, allowing them to identify key ideas, patterns, and variations, as well as recurrent themes that underpin the richness of the data that serve as the foundation for subsequent analytical endeavors. This stage is instrumental in establishing a foundational comprehension of the dataset, encompassing an exploration of major themes pertinent to the research questions and their recurrence throughout the data. Data familiarization extends until the researcher attains a comprehensive grasp of the dataset's breadth of variation (Ritchie and Spencer 2002; Goldsmith 2021).

Specifically during the familiarization stage of our study, the author identified a seminal work from the existing literature that explored the trajectory of the evolutionary concept in the natural sciences through a historical lens (Bowler 2003). This work encapsulated fundamental concepts, theories, and their interrelationships over time, providing a foundational understanding of the evolutionary process within natural scientific thinking. Leveraging insights from Bowler's work, the author conducted a comprehensive review of the dataset, thoroughly examining recurring themes, patterns, and nuances pertinent to the domain of evolution in natural science. This process ultimately led to the formulation of a preliminary framework on the theme of evolutionary natural sciences in the subsequent stage of the methodological process.

Stage 2: Developing a preliminary thematic framework

Framework development is an iterative process that allows for refinement through testing against data subsets, enabling the progression from simple descriptions to conceptual abstractions (Goldsmith 2021; Gale et al. 2013). The development of themes involves systematic pattern recognition, often employing techniques such as the constant comparative method (Gale et al. 2013). In practice, researchers utilize computer-assisted qualitative data analysis software (CAQDAS) to organize data and develop nuanced understandings. The emphasis lies in identifying important themes and conceptual relationships rather than detailing their manifestation in the data, allowing for flexibility in approach based on the researcher's familiarity with the dataset and research objectives (Goldsmith 2021).

Following the immersion in the data provided by Bowler's seminal work during the familiarization stage, the author embarked on the task of developing a preliminary thematic framework focusing on the evolutionary process in the natural sciences. This stage marked the transition from data immersion to abstraction and conceptualization, aiming to identify inherent patterns and concepts within the dataset while aligning with the overarching research goals (Ritchie and Spencer 2002). The preliminary thematic framework functioned as a scaffold, enabling the integration of new data gleaned from the evolutionary economics and theory of the firm literature, thereby facilitating ongoing refinement, expansion, or streamlining of the framework.

While the preliminary evolutionary framework did not perfectly align with the study's topic, it provided a "best-fit" and relevant pre-existing themes against which to map and code data

extracted from selected studies within evolutionary economics and the theory of the firm domain (Carroll, Booth, and Cooper 2011). By leveraging Bowler's comprehensive dataset as a foundation, the author adopted an augmentative and deductive approach, capitalizing on pre-existing knowledge within the field of natural sciences rather than commencing the analysis from a blank slate. This methodological choice enabled a nuanced and more agile analysis of the literature reviewed grounded in robust theoretical foundations.

Stage 3: Literature search and selection

The author employed a systematic review approach to conduct a literature search and selection specific to the domain of evolutionary economics and the theory of the firm. This involved formulating a search strategy tailored to the research questions, which required using relevant terms and filters to identify pertinent studies.

The search strategy incorporated specific keywords such as "EVOLUTIONARY" AND ("FIRM" OR "ENTERPRISE" OR "BUSINESS" OR "ECONOMICS"), along with filters restricting the search to only papers written in English and without any date constraints. Multiple databases, including Scopus, Google Scholar, and Web of Science®, were systematically queried to ensure comprehensive coverage.

For inclusion in the review, studies were required to satisfy three key criteria: first, they needed to focus on exploring evolution from an economics, business, or theory of the firm perspective; second, they had to meet... And third,...

Seventy-five studies meeting the established criteria were identified, forming the foundation of the review. Table 1 outlines the definitions of the three SEARCH pathways and enumerates the sub-categories of studies identified within each pathway. Alongside research papers and books on evolutionary economics, various discussion papers delineating differing conceptual frameworks, employing diverse research methodologies, and exhibiting varying degrees of connection to the theory of the firm were also discovered.

Given the relatively low number of selected studies, a literature pearl-growing technique was additionally employed.The pearl-growing technique is a qualitative research method employed to discover supplementary sources of information or relevant studies by leveraging references, citations, or recommendations found within already identified sources. The process began after the initial literature search using databases to pinpoint relevant materials. The author then carefully reviewed the reference lists or bibliographies of these sources, paying close attention to cited sources and recommended readings. Subsequently, the identified references were utilized to unearth additional studies, articles, or books that may enrich the understanding of the topic. The iterative process involved expanding the search based on newly discovered leads until saturation was reached. The author critically evaluated the relevance of these new sources, considering their alignment with the research question and potential contribution. Finally, findings from these additional sources were integrated into the synthesis of the

literature, enhancing understanding. This technique ensured the identification of diverse perspectives, theories, and findings, enriching the literature review and increasing the likelihood of uncovering significant insights (Petticrew and Roberts 2008; Barnett-Page and Thomas 2009).

Stage 4: Indexing

Once the preliminary thematic framework was established and studies were selected, the author moved on to the indexing stage, a systematic process akin to creating an index for a book. This involved the application of the established framework to the studies data. In essence, the author linked the data from studies with the components of the framework by assigning relevant thematic references to passages within the textual data (Ritchie and Spencer 2002).

During the indexing process, the author made subjective judgments regarding the meaning and significance of each passage, considering both its individual context and its broader relevance to the research. The data was coded and annotated using the Atlas.ti software, rendering the indexing process transparent and facilitating collaboration and validation within the research community. Moreover, this stage offered an opportunity for framework refinement, as the author evaluated the compatibility of the preliminary framework with the data from the selected studies. Necessary adjustments to component definitions and boundaries were made through iterative revision until all data were indexed on the final framework. Ultimately, indexing ensured the alignment between the framework and the data from the studies, thereby facilitating subsequent analysis and interpretation (Goldsmith 2021)

Although there were some helpful overlaps that facilitated the rapid and reliable coding of a significant portion of data from the selected studies, the preliminary framework proved inadequate in terms of depth or complexity to fully account for all the data in the included studies.

(... lo que sigue es el ejemplo de explicación) All of these characteristics were found in the included studies to affect perceived need and decision- making. It was felt that the pre-existing theme of "personal factors" alone was insufficient to illustrate the complexity of factors at play. The role of age, gender and the physical properties of agents were new factors identified by the synthesis affecting the a priori theme of use, which were absent from the original conceptual model. Carroll, Booth, and Cooper (2011)

(see Figure X) Very little study data were coded against the themes of "Spending capacity" (or "Costs")and "Access: obtaining the agent",which may reflect differences in the cultural context of the preliminary conceptual model (a low-income country in South America) compared with the studies included in the review (principally UK, Europe and North America). However, relatively more substantial amounts of data were coded against the remaining themes. Carroll, Booth, and Cooper (2011)

Stage 5: Charting

Having indexed the textual data according to the thematic framework, transition to the charting phase involved consolidating individual insights into a cohesive portrayal of the data, thereby providing a holistic view of the research findings. As charting was built upon earlier decisions made in the indexing step, it allowed for revisiting and enhancing the selection and organization of units of analysis and framework components. In practice, this process involved the creation of one or more matrix-based charts aimed at summarizing the data, where rows and columns delineated units of analysis and framework components. The author established the structure of the chart, populated its cells with summarized data, and determined the appropriate level of abstraction.

By lifting data from its original context and rearranging it according to relevant themes, a deeper insight into **the range of attitudes and experiences** encapsulated within the data was gained that informed the overarching research objectives(Ritchie and Spencer 2002). Various tools, including pen and paper, word processing programs, spreadsheets, and computer-assisted qualitative data analysis software (CAQDAS), were utilized to create charts.

Stage 6: Generation of the final model

In the final stage of the synthesis process, the author integrated insights gleaned from preceding stages with the original research questions and emerging themes. This entailed a comprehensive review, recombination, consolidation, and condensation of charts to harmonize with the study's focal points and predominant patterns. In this endeavor, the author's creativity played an instrumental role in selecting the most suitable approach to effectively convey findings (Gale et al. 2013; Ritchie and Spencer 2002).

4 Results

4.1 Bowler's seminal work

Peter J. Bowler's seminal book, "Evolution: The History of an Idea" (2003) explores the historical evolution of evolutionary thought, offering a comprehensive foundation for understanding the development of economic systems. Bowler's interdisciplinary perspective highlights the dynamic nature of economic processes, portraying them as evolving systems that change over time. Through his analysis, Bowler provides valuable insights that can enhance research in evolutionary economics by illuminating the historical roots of evolutionary ideas and their relevance to economic analysis.

One key aspect of Bowler's work relevant to our research question is its examination of the interplay between cultural, scientific, and anthropological factors in shaping evolutionary theories. Bowler traces the evolution of evolutionary thought from its origins in ancient Greece to its modern understanding, highlighting how societal beliefs and values influenced the development of evolutionary concepts.

This is especially valuable because evolutionary economists recognize the importance of understanding the cultural and ideological contexts in which economic systems emerge and evolve.

This is particularly valuable, since for evolutionary economists, understanding the cultural and ideological contexts in which economic systems emerge and evolve is essential.

Another significant contribution of Bowler's book to our main research objectives is its exploration of the contributions of key figures to evolutionary thought. Bowler examines the ideas and theories of prominent thinkers such as Charles Darwin, Alfred Russel Wallace, and Jean-Baptiste Lamarck, elucidating their influence on the development of evolutionary theory. By understanding the intellectual lineage of evolutionary thought, researchers in evolutionary economics can gain insights into the historical roots of contemporary economic theories and methodologies. Moreover, Bowler's analysis highlights the diversity of perspectives within evolutionary thought, providing researchers with a rich tapestry of ideas to draw upon in their analyses of economic systems.

Bowler's book also delves into the controversies and debates surrounding the concept of evolution, shedding light on the varying interpretations and contestations of evolutionary theory throughout history. This aspect of the book is particularly relevant to researchers in evolutionary economics, as it underscores the complex and multifaceted nature of economic evolution.

By examining historical debates over evolutionary theory, the author gained a deeper appreciation for the contested nature of economic processes and the diverse array of factors that shape them. Bowler's nuanced analysis encouraged the author to critically engage with evolutionary concepts and methodologies, fostering a more robust and interdisciplinary approach to studying economic systems.

In conclusion, Peter J. Bowler's "Evolution: The History of an Idea" was a valuable resource for the author to construct the preliminary evolutionary framework. By drawing upon Bowler's insights, the author was able to understand the conceptual foundations of evolution in natural science, the interrelations between those concepts and the patterns that have arisen along the history of this idea, thereby advancing interdisciplinary thought at the intersection of economics and evolutionary biology.

Overall, while Peter J. Bowler's "Evolution: The History of an Idea" primarily focuses on the historical development of evolutionary thought, it also offers valuable insights into modern aspects of evolution, including its interdisciplinary nature, its application to understanding human behavior and psychology, its incorporation of cultural evolution, and its relevance to fields such as evolutionary economics. By examining the evolution of ideas about evolution, Bowler's work provides a foundation for understanding the complexities of evolutionary processes in the modern world.

4.2 Preliminary framework

Bowler's historical perspective of evolution in natural science provides a robust foundation for delineating themes and aggregate dimensions against which to code the data extracted from the literature on evolutionary economics and theory of the firm literature are coded (see Figure X). Each theme encapsulates essential aspects of evolutionary theory, shedding light on the intricate mechanisms governing species evolution and behavior. The apriori themes that reflect the conceptual framework on evolution derived from the analysis of Bowler's narrative are the following:

4.2.1 Unit of analysis

The unit of analysis serves as the fundamental entity upon which observations and analyses are centered. The "individual organism" stands as a cornerstone in evolutionary studies, representing a single, discrete entity within a given population. In the context of biology, an individual organism refers to a single living being, such as a plant, animal, or microorganism, capable of independent existence and reproduction. Notwithstanding, distinguishing between the individual organism and the population as units of analysis is crucial in evolutionary studies. While the individual organism represents a single instance of life, the population comprises a group of organisms of the same species occupying a defined geographical area and sharing genetic

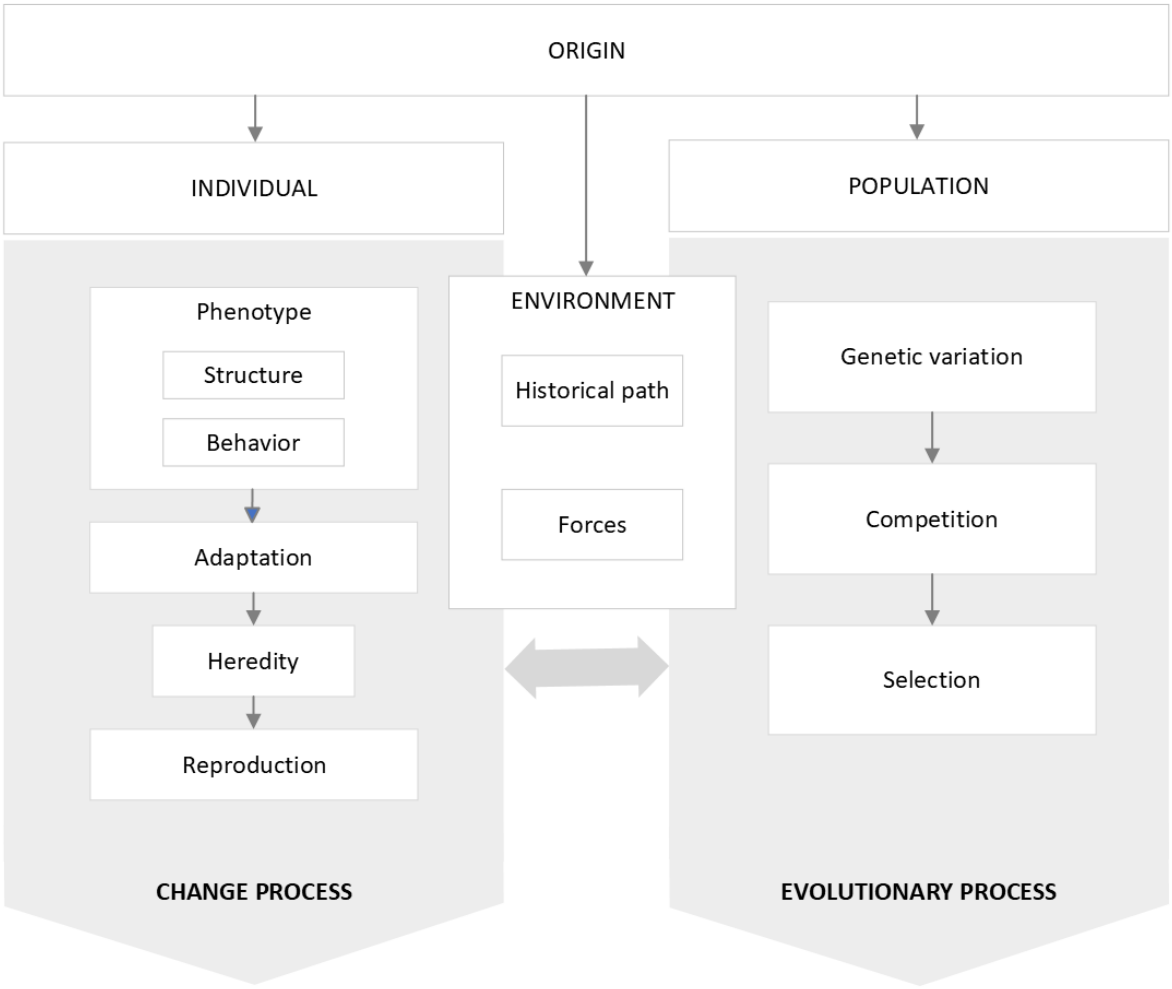

Figure 4.1: Fig1. Framework for evolutionary systems analysis. Source: own elaboration

similarities. The individual organism serves as the building block of the population, with its traits, behaviors, and adaptations contributing to the collective dynamics of the population. For example, 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.

The unit of analysis impacts the scope and focus of any evolutionary approach. Analyzing individual organisms allows researchers to examine specific traits, behaviors, and adaptations within a single entity, providing insights into microevolutionary processes such as natural selection and genetic drift. Conversely, studying populations enables researchers to investigate macroevolutionary patterns and trends, such as speciation and diversification, by considering the collective dynamics and genetic variability within and between populations.Therefore, while the individual organism offers granularity in understanding the mechanisms of evolutionary change at a local level, the population provides a broader perspective on the dynamics of species evolution and adaptation over time. Both units of analysis are integral to comprehensively elucidating the complexities of evolution within natural systems, highlighting the interplay between individual-level characteristics and population-level dynamics in shaping the evolutionary trajectory of species.

4.2.2 Origin

The emergence of individuals within a population profoundly influences the evolutionary process by introducing novel genetic variation, subject to selection, mutation, and other evolutionary forces. Consequently, the inquiry into the origin of species holds paramount importance in evolutionary analysis of natural systems. It addresses fundamental inquiries regarding the emergence, diversification, and perpetuation of life forms on Earth. Understanding the mechanisms governing the origination and divergence of new species from common ancestors is crucial for comprehending the intricate dynamics driving biodiversity, species distribution, and abundance across diverse ecosystems. Such insights illuminate the adaptive strategies, evolutionary pressures, and ecological interactions shaping species dynamics within and among ecosystems.

4.2.3 Population evolution

The evolutionary process unfolds at the population level, encompassing the collective dynamics and interactions among individual organisms within a specific group. Unlike focusing solely on individual organisms, examining evolution at the population level provides insights into broader patterns of genetic variation, adaptation, and speciation within and between populations. At the heart of population-level analysis lies the concept of gene flow, wherein genetic material is exchanged between individuals within a population and sometimes between populations. Gene flow facilitates the spread of advantageous traits and genetic diversity, enabling populations to adapt to changing environmental conditions over time. Conversely, isolation

mechanisms, such as geographic barriers or reproductive barriers, can restrict gene flow between populations, leading to genetic differentiation and potentially the emergence of new species through speciation. Natural selection acts upon this variation, favoring traits that enhance survival and reproductive success in a given environment. Other forces like genetic drift and mutation further contribute to population dynamics. Understanding these processes allows exploration of broader evolutionary patterns, such as speciation and adaptation, by considering the collective dynamics of populations.

4.2.4 Operational environment

The environment plays a critical role in shaping evolutionary processes, providing the context within which populations and individuals interact and evolve. In natural systems, the environment encompasses both biotic and abiotic factors, influencing species distribution, behavior, and evolution. Biotic factors include living organisms and their interactions, such as competition for resources, predation, and symbiotic relationships. Abiotic factors comprise non-living elements like climate, geography, and physical resources. Together, these factors create dynamic ecosystems where species must adapt to survive and reproduce. Furthermore, environmental conditions determine the fitness of organisms, driving natural selection and shaping evolutionary trajectories. Species evolve traits and behaviors suited to their environmental niche, optimizing survival and reproductive success. Understanding the operational environment is crucial for comprehending the dynamics of natural systems and the mechanisms driving evolutionary change. By analyzing how organisms interact with and respond to their environment, insights into the processes shaping biodiversity, ecosystem function, and species evolution can be gained.

The operational environment is also heavily influenced by historical factors. Past events, such as environmental disturbances and climatic shifts, leave lasting impacts on ecosystems, affecting species composition, habitat availability, and biodiversity patterns. Ecosystems with long histories may exhibit greater biodiversity and genetic resilience, while disturbances can create legacies that constrain adaptation. Integrating historical analysis into evolutionary analysis can provide valuable insights into path-dependent processes, informing conservation strategies for promoting ecosystem resilience and adaptation to changing environmental conditions.

4.2.5 Individual change

At the core of evolutionary dynamics lies the change process occurring at the level of individual units. In natural systems, this manifests as the continual adaptation and modification of organisms in response to environmental pressures and internal dynamics. These changes may include phenotypic modifications, behavioral adjustments, or genetic mutations, all of which contribute to the overall diversity and resilience of the population. Natural selection acts as a guiding force, favoring traits that confer a reproductive advantage or enhance survival in a given environment. Genetic mutations introduce novel genetic variation into populations,

providing raw material for evolutionary change. Understanding the change process at the unit level is essential for elucidating the mechanisms driving species evolution and adaptation. By examining the interactions between individual units and their environment, insights into the evolutionary dynamics shaping biodiversity, ecosystem resilience, and species persistence over time are gained.

4.2.6 Structural and Behavioral Traits

The structural and behavioral traits of individual organisms are fundamental components of evolutionary dynamics within natural systems. Structural traits encompass physical characteristics such as morphology, anatomy, and physiology, which determine an organism's form and function. These traits play a crucial role in the adaptation of organisms to their environment and their interactions with other species. Behavioral traits, on the other hand, encompass the actions and responses exhibited by organisms in their environment. These traits include feeding behaviors, mating rituals, communication signals, and social interactions, among others. Behavioral adaptations enable organisms to acquire resources, avoid predators, compete for mates, and establish social hierarchies, all of which contribute to their survival and reproductive success. The interplay between structural and behavioral traits shapes the ecological niche occupied by organisms and determines their fitness within a given environment. Organisms with traits that confer advantages in resource acquisition, predator avoidance, and reproductive success are more likely to survive and pass on their genes to future generations. Over time, this leads to the evolution of traits that are well-adapted to the prevailing environmental conditions. By examining the morphological, physiological, and behavioral adaptations of organisms, valuable insights can be gained into the ecological strategies employed by species, the dynamics of ecological communities, and the co-evolutionary processes that shape biodiversity over time.

4.2.7 Competition

Competition constitutes a fundamental force driving evolutionary dynamics within natural systems. Competition occurs when individuals or species vie for limited resources such as food, water, or territory. This competitive pressure selects for traits that confer a competitive advantage, driving evolutionary change over time. Within populations, competition may take various forms, including direct competition for resources, interference competition through aggressive interactions, or exploitative competition where one species outcompetes another for resources. These competitive interactions can lead to niche differentiation, where species partition resources to reduce competition and coexist within the same habitat. Moreover, competition can drive evolutionary innovation and adaptation as species evolve traits and behaviors to outcompete rivals. This race dynamic can lead to the diversification of species and the development of complex ecological interactions over evolutionary time scales. Understanding the dynamics of competition is essential for elucidating the mechanisms driving species

interactions, community dynamics, and evolutionary trajectories within natural ecosystems. By studying competitive interactions and their outcomes, insights into the processes shaping biodiversity, ecological resilience, and ecosystem stability are gained.

The connection between competition and selection lies in the fact that competition sets the stage for natural selection to act. When individuals compete for resources, those with traits that confer a competitive advantage are more likely to survive and reproduce, passing on their advantageous traits to their offspring. Over time, this process leads to the accumulation of adaptive traits within populations, as individuals with less advantageous traits are outcompeted and their genes are less likely to be passed on. In summary, competition provides the selective pressures that drive natural selection, while natural selection favors traits that enhance competitive ability, thus influencing the outcome of future competition. Therefore, while competition precedes selection in terms of the environmental pressures exerted on individuals, the process of selection ultimately feeds back into competition by shaping the traits and behaviors of individuals within populations.

4.2.8 Adaptation

Adaptation is a fundamental mechanism driving evolutionary change at the individual level within natural systems. Organisms continuously adjust their traits, behaviors, and physiological processes in response to selective pressures exerted by the environment. At its core, adaptation enables organisms to enhance their fitness and survival in specific ecological niches. Through the process of natural selection, individuals with traits that confer a reproductive advantage or improve survival under prevailing environmental conditions are more likely to pass on their genes to future generations. Over time, this leads to the accumulation of adaptive traits within populations, increasing their overall fitness and resilience to environmental challenges. Adaptation occurs through various mechanisms, including phenotypic plasticity, genetic mutations, and behavioral adjustments. Phenotypic plasticity allows traits to adjust to environmental cues, while mutations introduce genetic variation. Behavioral adaptations optimize resource use, predator avoidance, and reproduction. Understanding adaptation at the individual level is crucial for uncovering the mechanisms driving evolutionary change and species diversification within natural systems, shedding light on species' adaptive strategies, the emergence of novel traits, and the dynamics of ecological interactions over time.

4.2.9 Selection

Selection mechanisms act upon the diversity of individual units, favoring traits conducive to competitive advantage and survival. As such selection processes play a pivotal role in driving evolutionary change. Natural selection acts as a mechanism for favoring traits that enhance an organism's fitness and reproductive success in a given environment. Through natural selection,

individuals with advantageous traits are more likely to survive and reproduce, passing on their genetic material to subsequent generations. Over time, this differential reproductive success leads to the accumulation of beneficial traits within populations, driving evolutionary adaptation to changing environmental conditions. It should be noted that while natural selection stands as a cornerstone of evolutionary theory, selection operates through various mechanisms, including directional selection, stabilizing selection, and disruptive selection. Directional selection shifts traits towards one extreme, stabilizing selection maintains the status quo within a population, and disruptive selection leads to divergence. Understanding selection processes is crucial for elucidating the mechanisms driving evolutionary change and biodiversity within natural systems. By studying the interactions between organisms and their environment, insights into the adaptive strategies employed by species, the emergence of novel traits, and the evolution of complex ecological interactions are gained.

Natural selection primarily operates at the individual level within populations. It acts on the variation in heritable traits among individuals, favoring those with traits that enhance their survival and reproductive success in a given environment. Over time, differential reproductive success leads to the accumulation of advantageous traits in populations, driving evolutionary change. While natural selection occurs at the individual level, its effects can be observed at the population level through changes in allele frequencies and the distribution of traits within populations.

4.2.10 Reproduction

Reproduction is a fundamental process driving evolutionary dynamics at the individual level. Organisms perpetuate their genetic lineage through the production of offspring, passing on their hereditary traits to future generations. Reproduction ensures the continuity of life and the preservation of genetic diversity within populations. Through sexual and asexual reproduction, organisms produce offspring with genetic variations that contribute to the overall genetic pool of the population. The reproductive process is influenced by various factors, including mate choice, mating behaviors, reproductive timing, and reproductive success. These factors shape patterns of mate selection, mating strategies, and reproductive outcomes within populations, influencing the genetic composition and evolutionary trajectory of species. Examining the reproductive process at the individual level is key for elucidating the mechanisms underlying evolutionary change and population dynamics within natural systems. Such analysis provides valuable insights into the adaptive strategies employed by species, the preservation of genetic diversity, and the evolutionary forces influencing populations over time.

4.2.11 Heredity

Heredity is intricately linked to reproduction as it governs the transmission of genetic information from parent to offspring. This connection is vital because heredity, through the

transmission of DNA, ensures the continuity of genetic traits across generations, providing the raw material for evolutionary change. Furthermore, genetic variation resulting from mutations and recombination during reproduction introduces diversity within populations, fueling the process of natural selection and facilitating adaptation to changing environmental conditions. Thus, understanding the relationship between heredity and reproduction is crucial for unraveling the mechanisms that underpin individual change processes and their broader implications for evolutionary dynamics within natural systems.

4.3 Quantity and quality of included studies

Seventy-five studies of evolution were identified as meeting the criteria above and form the basis of this review. Table 1 provides definitions of the six SEARCH pathways and lists the sub-categories of studies that were identified in each pathway for the current review. As well as research papers and books on evolutionary economics, we found discussion papers about differing priorities, conceptual frameworks, community equipoise, power, democratic practice and advocacy. These papers drew on a wide range of theories, and described episodes of involvement in many different research areas. (…)The health topics covered in the literature included different health conditions (asthma, breastfeeding (…) The papers came from different disciplines (agriculture, genetics, environmental studies) and reported different research methodologies (systematic reviews, technology assessment, participatory research). Oliver et al. (2008)*

4.4 Usefulness of the preliminary conceptual framework

The preliminary framework synthesized from Bowler's historical perspective provides a comprehensive lens for understanding the evolutionary dynamics inherent in economic systems and firm behavior. These themes serve as foundational pillars for subsequent analyses, facilitating deeper insights into the mechanisms driving economic evolution and organizational dynamics. By elucidating the interplay between evolutionary principles and economic phenomena, this framework lays the groundwork for advancing our understanding of the evolutionary economics and the theory of the firm.

4.5 Final evolutionary framework

5 Discussion

The framework we have described categorizes the engagement of participants in research agenda setting in terms of the types of people involved, the degree of public involvement, and the initiators of the engagement. It combines and extends concepts proposed by Arnstein9 and Mullen et al.12 The framework is consistent with an eight-dimensional framework described by Byrt and Dooher. Oliver et al. (2008)

Our review findings provide some answers to Boote et al.Õs questions7: how can public involvement be conceptualized; how and why does public involvement influence health research; and what factors are associated with success?. Oliver et al. (2008)

In many ways our analysis drew similar conclusions to research addressing public participation in health services. We found that lay (…) Oliver et al. (2008)

Particular success has been achieved by a research agenda setting exercise that addressed the key dimensions of the framework by com- bining the benefits of representative consultation with iterative collaboration and explicit decision making.64 Acomprehensive evaluation of process and outcome concluded that the (…) Oliver et al. (2008)

Our framework has been since used in a systematic review of involvement in a broader range of activities: developing health-care policy and research, clinical practice guidelines and patient information.65 Use of the framework in this review ensured that different methods of involvement were described in comparable terms, and it enabled the review to highlight areas where no evidence was available at all. The review showed clearly that no trials to date have evalu- ated different degrees of involvement, different forums of communication, lay involvement in decision making, or the provision of training or personal or financial support for lay involvement. Oliver et al. (2008)

The SEARCH framework has been developed as a tool to support future research and practice in positive education and to help overcome (…) Waters and Loton (2019)

SEARCH is a data-driven, multidimensional and actionable framework, comprising six evidence-based pathways to foster wellbeing. The higher-order nature of these path- ways provides a comprehensive and integrated focus whilst still (…) Waters and Loton (2019)

To further establish the utility of SEARCH for school students the current review paper examined whether the existing evidence from published positive education interventions mapped on to the six pathways. Eighty-five peer-reviewed intervention studies were identified that had tested the

effects of each of the SEARCH pathways on students. The interventions were tested in school students ranging from ages (…)Waters and Loton (2019)

The intervention studies showed a consistent pattern of evidence that each of the six pathways can be effectively targeted to improve wellbeing and academic outcomes, although tests of efficacy were not universally significant. Positive(…) Waters and Loton (2019)

6.1 Substantive findings / 6.2 Strengths and limitations of the review / 6.3 Methods of primary studies / 6.5 The context of previous 'views' research / 6.6 Policy context Brunton et al. (2006)

5.1 Using SEARCH as a Meta-Framework to Guide Future Research

We offer SEARCH as a useful framework to help researchers scaffold and build the science of positive education. For example, when researchers are designing and/or evaluating (…) A positive consequence of this is that it may create greater connections amongst researchers and foster stronger cross-pollination across topics when pulled together by an overarching framework like SEARCH. Waters and Loton (2019)

One potential avenue ofresearch using SEARCH may be in developmental psychology where the framework can be used to create an age-stage appropriate scope and sequencing of well-being curriculums. In addition, research may also show that certain pathways are needed to be developed earlier than other pathways in certain ages (…) Such developmental questions on how to best build wellbeing over time can be scaffolded by using the SEARCH meta- framework.@waters2019search*

5.2 Gaps in Positive Education Research

The current review of existing positive education literature has identified a number of gaps that can be addressed through future research. First, (…) Waters and Loton (2019)

Another gap identified in this review paper is the disparity of research conducted between the six pathways in positive education interventions (…) Waters and Loton (2019)

Finally, this review points towards the need for more RCT designs to be used when testing the effectiveness of positive education interventions (…)Waters and Loton (2019)

One untapped area for future research is the effect of context and where and how the interventions are delivered. In the current review, the bulk of the interventions were (…)Waters and Loton (2019)

5.3 Using SEARCH as a Meta-Framework to Guide School Practice

Waters and Loton (2019) **Note: meter aquí el archivo de "Implications"**

SEARCH is not only an evidence-based framework to guide research in the field, it is also a framework that can guide practical application in schools, something that White and Kern (2018) highlight as being ofcentral importance.We offer SEARCH as a framework to assist schools when implementing positive education interventions in a co-ordinated manner across different year levels and across all areas of the school (…) Waters and Loton (2019)

SEARCH provides a data-driven, action-research informed framework for teachers to use when designing positive education interventions. Educators are encouraged to think not only about the content ofthe intervention but how that intervention can be used to build one or more of the higher-order pathways ofwellbeing. For example, while (…) Waters and Loton (2019)

Beyond the design ofindividual positive education interventions, SEARCH can be used to design larger wellbeing curriculums. Such curriculums can teach students how to (…) Waters and Loton (2019)

School leaders and administrators can find strategic and consistent ways to infuse SEARCH into elements of the school that impact faculty and staff such as recruitment and selection, performance development, professional learning, employee wellbeing programs and staff/faculty room culture. A key question for school leaders prompted by the SEARCH framework is 'How can I intentionally create a culture that fosters strengths, emotional management, attention and awareness, relationships, coping and habits and goals for all the adult members of the school?Waters and Loton (2019)

5.4 The Use of a Synthesis Method

There are arguments about whether it is feasible or acceptable to conduct syntheses of qualitative evidence at all,41 and whether it is acceptable to synthesise qualitative studies derived from different traditions. The distinctions, tensions and conflicts between these have been vividly described.@dixon2005synthesising

Perhaps even more likely to generate controversy are attempts to synthesise qualitative and quantitative evidence. It is evident from the discussion above that synthesis of diverse forms of evidence will generally involve conversion of qualitative data into quantitative form or vice versa. Dixon-Woods et al. (2005)

Should reviews start with a well-defined question and how many papers are required? The issue of questions is an important one for syntheses. It will be clear that the methods described above will be more suited to some questions than others: for example questions concerning causality may be better suited to qualitative comparative analysis than questions concerned with the production of mid-range theory, which might be better suited to meta-ethnography. The

issue of how questions should be identified and formulated in the first instance is one on which there is much uncertainty.

Estabrooks et al, like many in the systematic review community, argue that review questions should be selected to focus on similar populations or themes.43 However, others point out that in primary qualitative research, definitions of the phenomenon emerge from the data.15 Whether one should start with an a priori definition of the phenomenon for purposes of a secondary synthesis is therefore an important question.@dixon2005synthesising

A related issue is how to limit the number of papers included in the review. One approach is to narrow the focus. An alternative strategy is offered by theoretical sampling, used in primary qualitative research with a view towards the evolving development of the concepts. Sampling continues until theoretical saturation is reached, where no new relevant data seem to emerge regarding a category, either to extend or contradict it.45 It has been suggested that this approach would also be suitable for selecting papers for inclusion in reviews.46–48 However, the application of this form of sampling has been rarely tested empirically, and some express anxiety that this may result in the omission of relevant data, thus limiting the understanding of the phenomenon and the context in which it occurs. Dixon-Woods et al. (2005)

Appraising studies for inclusion The issue of how or whether to appraise qualitative papers for inclusion in a review has received a great deal of attention. The NHS CRD guidance emphasises the need for a structured approach to quality assessment for qualitative studies to be included in reviews, but also recognises the difficulties of achieving consensus on the criteria that might constitute quality standards.5 Some argue that weak papers should be excluded. Others, however, propose that papers should not be excluded for reasons of quality, particularly where this might result in synthesisers discounting important studies for the sake of 'surface mistakes', which are distinguished from fatal mistakes that invalidate the finding.Published examples include reviews that have chosen not to appraise the papers,14 as well as those which have opted to appraise the papers using a formalised approach.22 If the argument prevails that some quality appraisal is necessary, the problem then arises as to how this should be undertaken. Dixon-Woods et al. (2005)

Conclusions There is an urgent need for rigorous methods for synthesising evidence of diverse types generated by diverse methodologies. These methods are required to meet the needs of policy-makers and practitioners, who need to be able to benefit from the range of evidence available. Dixon-Woods et al. (2005)

5.5 Practical Implications

5.5.1 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 evolution-

ary 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.

5.5.2 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?

5.5.3 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.

5.5.4 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).

5.5.5 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.

5.5.6 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.

5.5.7 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.

5.5.8 The contribution of this review to policy

The key message from this systematic review is that interventions will not work unless public views about the value, safety, benefits and costs of walking and cycling are taken into account. This information will thus be of interest to parents and children, government policy-makers at the national and local level, schools, and research funding bodies. Policy-makers need to understand that perceived safety is a key influence on walking and cycling, but that environmental improvements and facilities can encourage a shift away from car culture.@brunton2006synthesis

5.6 Framework Thematic Discussion

5.6.1 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.

5.6.1.1 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.

5.6.1.2 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)

5.6.1.3 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.

5.6.2 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.)

5.6.3 On the Environment

5.6.3.1 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?

5.6.3.2 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.

5.6.4 On the Unit

5.6.4.1 On the Structure

5.6.4.2 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)

5.6.5 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?

5.6.6 On Heredity

What are the limits of heredity (change)?

6 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.

It is certainly an exciting time for the field with the rapid expansion of science and practice. However, this growth has put positive education at risk of lacking a cohesive direction and of failing to build the cumulative evidence needed to advance the field.@waters2019search

In this paper we have argued that a meta-framework can prevent these risks by providing higher-order parameters that help us to guide future research and practise in ways that ensure more consistent, integrated, cohesive and perhaps even synergistic outcomes. The SEARCH framework, developed from a large-scale bibliometric analysis of the field combined with action research has been supported through a systematic review of evidence in the current paper which has shown that schools can build up each of the six pathways through interventions in and out of the classroom.@waters2019search

We offer this framework to our colleagues in the field and hope it is used far and wide to build rigorous research and reliable practices that help positive education to achieve the dual purpose put forward by Seligman et al. (2009) of boosting wellbeing and academic outcomes.@waters2019search

This review of involving the public in research agenda setting builds on the technique of framework analysis which has previously been described only for primary research.6 We found this approach useful for developing a conceptual framework of public involvement in research based on accessing and reviewing a broad literature. Our framework is consistent with analyses in the literature about empowerment for public involvement in public services more broadly. It is potentially applicable to a wide range of reports of public involvement in research and research-based activities. Use of the framework facilitates learning from many different strategies and reports of these, from informal reflections to formal research. Such a breadth can thus

generate an overview of achievements to inform policies and practices in the area of public involvement in research. As with other systematic review methods, application of the framework also usefully identifies gaps in the literature which need to be filled in order to increase our understanding of how to promote public involvement and evaluate the effectiveness of different approaches.@oliver2008multidimensional

6.1 Recommendations

We need more good quality research on interventions for particular social groups. Nonetheless, it is possible to derive a number of recommendations from the work described in this report. They are grouped into recommendations for developing future effective and appropriate interventions, systematic reviews, and views studies.@brunton2006synthesis

Type of recommendations: Recommendations for developing effective and appropriate interventions / Recommendations for future views studies / Recommendations for future systematic reviews. Brunton et al. (2006) The

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