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## Polymathy: A New Outlook

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This article aims to contribute to the study of polymathy by introducing novel perspectives on the phenomenon and by advancing a new model that systematizes the different variables involved in its development. The article is divided into four sections. The first section involves a reflection about the nature of polymathy; the term *mathema* is presented as the unit that underpins the development of polymathic knowledge, and the elements that constitute the fundamental qualities of polymathy are identified and discussed. In the second section, the novel conceptualization of polymathy as a life project is introduced; it builds upon previous psychoeconomic approaches to offer a new perspective on the phenomenon. In the third section, a developmental model of polymathy is suggested; it organizes the different constructs involved in the development of polymathy into a framework that can serve as basis for future studies. Finally, implications for research, practice and policy are discussed.

It is the ultimate task of our existence to achieve as much substance as possible for the concept of humanity in our person, both during the span of our life and beyond it, through the traces we leave by means of our vital activity. This can be fulfilled only by the linking of the self to the world to achieve the most general, most animated, and most unrestrained interplay. (Humboldt, 2012, p. 58)

Concepts such as multidisciplinary, multipotentiality, multiskilling and cross-training have been the subject of interest in several mediums. Publications on these issues span over scholarly (e.g., Alves, Marques, Saur, & Marques, 2007; Marks, Sabella, Burke, & Zaccaro, 2002; Zaman & Goschin, 2010), and popular/executive literature (e.g., Horbury & Wright, 2001; Triepke, 2015; Zenger, Folkman, & Edinger, 2011). Nonetheless, those themes often appear in a scattered fashion, without a unified theoretical base. In this work, I examine a concept that can offer a new way to comprehend the underpinnings of such phenomena and synthesize fragmented findings into a single theme: polymathy.

Polymathy traditionally means learning in many fields or expertise in multiple areas. It is formed from the junction of

two Greek radicals, *πολυ* (*polys*; meaning 'much', or 'various') and *μάθημα* (*mathema*; meaning knowledge or skills acquired through experience, study, or by being taught; Harper, n.d.). Polymathy is used in the popular domain as a label for eminent scientists, artists, creators and performers who display a significant amount of knowledge in many fields. However, the concept is still largely unknown and scarcely explored in academia, despite its richness of meaning and the contributions it can offer to current discussions in several academic domains.

For the advancement of the systematic study of polymathy, two issues are particularly relevant. First, the conceptual domain of the phenomenon is not clearly delineated in the literature. Polymathy has been conceived and described in distinct ways, but those conceptualizations still lack articulation with each other and a unifying theoretical framework. For instance, polymathy has been viewed as a label for an intellectual type (e.g. Burke, 2011; 2014); as a label for creative individuals in multiple domains (e.g., Kaufman, Beghetto, Baer, & Ivcevic, 2010; R. Root-Bernstein & M. Root-Bernstein, 2011); as a thinking ability or thinking trait (e.g., Sriraman, 2009); and as a worldview or an ideal to be pursued (e.g., Murphy, 2014). Second, the construct of polymathy still lacks a consolidated operationalization strategy. To the best of the author's knowledge, polymathy has been assessed as an operational construct in less than a handful of works. Root-Bernstein and colleagues utilized collections of surveys, interviews

and biographical data to assess the degree of polymathy and scientific success of individuals, finding compelling evidence for a correlation between broad avocational interests (a proxy for polymathy) and scientific eminence (R. Root-Bernstein, Bernstein & Gamier, 1993, 1995; R. Root-Bernstein et al., 2008). Besides that, Sriraman (2009) utilized a hermeneutic-phenomenological approach to identify polymathic thinking traits while his subjects attempted to unravel a given mathematical paradox; he discovered that polymathic thinking was associated with the successful identification of the problem.

The scant number of systematic studies on polymathy leaves entire avenues of research unexplored. Many questions are still unanswered: what is the nature of polymathy and what are its components? How is polymathy linked to other important constructs in the psychological and educational literature? What kind of nomological relations are expected? How can the construct of polymathy be systematized in a way that it can inform research and give rise to generalizable findings?

With that in mind, this article is an effort to systematize the phenomenon of polymathy, aiming to pave the ground for future research. It takes a detailed look into the concept and seeks to articulate it with other well-developed concepts, weaving knowledge from areas such as education, psychology and economics. The paper is organized into four sections. In the first section, the Ancient Greek term *mathema* is revisited and redefined as the unit that underpins the construction of personal knowledge. This leads to the identification and discussion of the necessary elements to qualify a person's store of knowledge as polymathic. The second section introduces the novel conceptualization of polymathy as a life project. It builds upon previous psychoeconomic approaches to creativity and lifelong learning (e.g., Lubart & Sternberg, 1995; Rubenson & Runco, 1992; Sternberg & Lubart, 1991; Walberg, H. J., & Stariha, 1992) to offer a novel perspective that integrates aspects of personality (e.g., personal values and life goals) with decision-making based on valuations of net gains and costs. The third section advances the developmental model of polymathy. The model organizes the different ideas and constructs presented in this paper into a framework that can serve as a basis for future studies. Finally, implications for research, practice and policy-making are discussed.

## The Fundamental Ideas Behind Polymathy

This section employs an analytical approach with the aim to unravel the nature of polymathy and its fundamental components. The strategy is to break the term polymathy into two parts (the nominative part and the adjective part). First,

the nominative part is examined. The focus is on the word *mathema* and its signification as the basic unit of personal knowledge. Then, attention is turned to the adjective part—that is, what qualities underpin the concept of polymathy? It is proposed that polymathy as a quality concatenates three fundamental elements: breadth, depth, and integration.

### Mathema: The Basic Unit of Knowledge

*Mathema* is a word from Ancient Greek whose root appears in the formation of the word polymathy. Most of the definitions of *mathema* available in the English language come from works of the Classical era, from etymological dictionaries or from biblical studies. A *mathema* can mean “science, knowledge, mathematical knowledge, a lesson, or something that is learnt” (Harper, n. d., para. 1). It can also designate the “mental effort needed to think something through” (Hill, 2011a, para. 2), and “fact-knowledge as someone learns from experience, often with the implication of reflection” (Hill, 2011b, para. 2).

Based on the definitions, usage and descriptions of the term, one can derive that the concept of *mathema* represents a cognitive structure that stems from a deliberate effort to encode, organize and systematize sets of information. Thus, it is possible to define *mathema* as a mental array, fruit of the combination of information in a purposeful and reflective way, which can be stored, manipulated, and retrieved for later usage. In this approach, *mathema* represents the smallest unit of systematic knowledge. It is both the basis for the construction of one's sets of knowledge and the medium whereby personal experiences can be transformed into meaningful learnings.

The definition of *mathema* advanced here purposely resembles the well-developed concept of schema (Bartlett, 1932; Piaget & Cook, 1952). In fact, a *mathema* refers to a subtype of schema; what differentiates them is the utilization (or lack thereof) of deliberate mental effort in their formation. While a *mathema* requires the intentional expenditure of mental energy (for instance, it may be constructed through the exercise of critical examination and reflective thinking), a schema may be formed through a passive, or quasi-automatic process, dispensing the employment of active thought. An illustrative example is the belief that “Brazilians are good at soccer”. Is it a schema or a *mathema*? It will depend on how this belief was formed. If it was constructed without much critical examination, in a passive way, it is just a schema. Alternatively, if such belief stems from a deliberate and somewhat profound investigation, it is a *mathema*, even if it turns out to be ultimately false.

**The personal store of *mathemata*.** *Mathemata* (the plural of *mathema*) may or may not thrive in a person's mind depending on how well they perform on two aspects. First,

a *mathema* must act as a coherent unit that can serve as a dependable basis for predictions. Second, a *mathema* must successfully fit into an already-established environment. This environment contains other sets of *mathemata* and is organized around specific mental procedures, sets of values and beliefs that may or may not be inviting to different types of *mathemata*. Thus, individual differences on how a person tends to select, accumulate and organize *mathemata* will influence the quality of their aggregate sets of *mathemata*. The summation of all existent *mathemata* in a person's mind, along with their relationships, their relative degree of prevalence and their accompanying thinking procedures is called a person's total store of *mathemata*.

### Breadth, Depth and Integration as the Core Dimensions of Polymathy

With the nominative part of polymathy defined (*mathema*), this section turns the attention to the adjective part of polymathy; i.e., the qualities that make a person's total store of *mathemata* polymathic. It is proposed that the quality of being polymathic—or *polymathicness*—entails three components: breadth, depth and integration.

**Breadth.** Breadth refers to a broad range or great extent of one's total store of *mathemata*. Breadth is the most conspicuous dimension of polymathy; it is intimately tied to all known definitions of the construct and to the etymological roots of the term (*poly* means various). Breadth can be further divided into two sub-qualities: comprehensiveness and diversity. Comprehensiveness entails extension while diversity entails variety. Although they are not independent from each other, it is possible to have extensive knowledge with different degrees of variety. An example of both qualities is the attainment of sophisticated sets of *mathema* in domains that are considered "distant", such as arts, science and sports. The lack of this dimension is associated with the idea of narrowness, specialization, and the restriction of one's expertise to a limited domain.

**Depth.** Depth refers to the vertical accumulation of knowledge and the degree of elaboration or sophistication of one's sets of *mathemata*. Sometimes, breadth is mistakenly thought to be the only necessary component of polymathy; that is, the possession of superficial knowledge in many areas would suffice. To avoid this confusion, some authors (e.g., Burke, 2011; R. Root-Bernstein, 2009) use the concept of dilettancy as a contrast to the idea of polymathy. Dilettancy refers to taking up several activities in a superficial or desultory way while polymathy entails *profound* learning in several fields. Another usage of the term polymathy is to form the construct called *creative polymathy*, which refers to the demonstration of creative abilities in many domains

(see Beghetto & Kaufman, 2009; Kaufman, Beghetto, & Baer, 2010; Kaufman, Beghetto, Baer, & Ivcevic, 2010; R. Root-Bernstein, 2003a, 2015; R. Root-Bernstein & M. Root-Bernstein, 2004, 2011). Like the concept of polymathy itself, creative polymathy implies the dimension of depth. A creative product arises from the combination of stores of *mathemata* that are expected to possess at least some level of sophistication.

**Integration.** Integration involves the capacity of connecting, articulating, concatenating or synthesizing different sets of *mathemata* and different ways of thinking. In this work, integration is proposed, along with breadth and depth, as a fundamental component of polymathy. Although the dimension of integration is not explicit in most definitions of polymathy, it has been associated with the idea of polymathy by several authors. Goodman (2005, p. 103) argued that polymathy relies on three elements: broad learning, striving to produce new knowledge, and the ability to synthesize different personal research endeavors. The author also posed that polymaths in Ancient China were notable for their capacity to cluster along separate "nexuses of knowledge" in order to find new meanings and create new connections (p. 107). Burke (2014, p. 183) characterized polymaths as people who are especially able to create new syntheses and perceive gaps and spaces between disciplines in the present era of fragmented knowledge. Sriraman and colleagues posited that people with polymathic thinking traits possess a Gestalt worldview that can work back and forth between multiple domains; it leads them to solve difficult problems by connecting notions from different areas in novel and useful ways (Sriraman, 2005, 2009; Sriraman & Dahl, 2009). Kaufman, Beghetto, Baer, & Ivcevic (2010, p. 385) wrote that polymaths, by seeing connections and synergies where none existed, can create new work at the intersection of multiple domains. Finally, R. Root-Bernstein and colleagues argue in numerous works that polymathy entails not only the accumulation of broad and profound knowledge but also the formation of useful connections between different bodies of knowledge (e.g., R. Root-Bernstein et al., 2008, p. 56; and R. Root-Bernstein, 2009, pp. 855-864).

This section posited that the elements to qualify an object as polymathic are three: breadth, depth and integration. Thus, if the object to be assessed is the person's knowledge, one can define polymathic knowledge as the possession of a personal store of *mathemata* that is characterized by the qualities of breadth, depth and integration. This definition implies that any kind of systematic knowledge is included (not only academic knowledge, for instance), as long as it displays considerable amount of breadth, depth and integration. In the next section, an approach that aims to integrate a person's pursuit of polymathic knowledge with their sets of values, goals and aspirations in life is explored.

## Polymathy as a Life Project

This section introduces the concept of polymathy as a life project. A life project refers to a lifelong individual enterprise that entails the pursuit of specific goals, and that involves a series of investments and payoffs. An analogy can be made with the financial outlook toward projects. In finance, a project consists of a series of inflows and outflows. These flows need not be about money—they can refer, for instance, to psychic costs and gains (e.g., the exertion of one’s mental energy in the pursuit of a goal, or the feeling of happiness when some important goal is achieved). Projects are considered worthwhile if the present value of the benefits surpasses the costs. Nevertheless, while, in finance, the value of the project’s payoffs and costs can be objectively assessed via market prices, in the realm of life projects, the value of most benefits and costs will be subjective. That is, their valuation will depend on aspects of one’s personality.

### The Polymathic Personality

Some people possess a personality, i.e., a set of motivational, emotional and cognitive patterns, that can be intimately associated with the undertaking of a polymathic life project. More specifically, this paper poses that one’s values and lifelong motives are of key relevance.

A person with a polymathic personality places cardinal value upon and is driven toward two principal goals: (i) the development of a conscience with as much richness of knowledge and experience as possible and (ii) exercise one’s potential agency to enhance and transform the world. The first goal is sought through the acquisition of a store of *mathemata* with an increasingly polymathic quality, while the second goal is sought through the generation of increasingly excellent, surprising and adaptive contributions. Those pursuits possess a natural interconnection. The achievement of a highly informed conscience is intertwined with the awareness of one’s potential of agency in the world (Deimann & Farrow 2013; Peukert, 2002), which in turn is related to the development of one’s knowledge and its utilization in novel and useful ways.

The polymathic qualities outlined above can be manifested through some specific sets of behaviors. One of the most conspicuous characteristic of polymathic people is that they tend to develop multiple avocations (which can occur simultaneously or sequentially) during their life. This can be translated as a preference to engage in several types of structured activities beyond those regarding one’s main activity. Structured activities (e.g., playing music, practicing sports, playing a challenging strategy video game) differ from unstructured ones (e.g., watching television, viewing

pictures on social media) as the former tend to highly stimulate new encodings of *mathemata* and require intense use of attention, whereas the latter tend not to involve the same level of structured thinking (see also Csikszentmihalyi, 1988). While some people will be drained by engaging in structured activities in different domains, polymathic people will be exhilarated by it.

Polymathic people also tend to see beyond the vocation-avocational dichotomy. While some non-polymathic people may compartmentalize their activities between vocational and avocational—the former being useful while the latter being peripheral and alienated from one’s professional realm—polymathic people will instead seek to integrate their “bewildering miscellany of activities” (cf. R. Root-Bernstein et al. 1995, p. 131) into successful and effective “networks of enterprise” (see Gruber 1988, 1989). Rather than wasteful, they will see the time and energy spent on diverse activities as something that can yield a series of positive returns. These returns may include personal satisfaction, the opportunity to broaden one’s life experiences, the opportunity to obtain ideas and experience that can inform one’s main vocation, and the opportunity to sharpen domain-general or correlative talents (see also Kaufman et al. 2010; R. Root-Bernstein & M. Root-Bernstein, 2004).

In this light, the pursuit of polymathy can be understood as a unifying factor of one’s personality, whereby the many different facets of a person’s behavior and choices can be organized and understood under the lens of the polymathic personality (compare with Young’s (1923) concept of ‘integrated personality’, Allport’s (1955) concept of ‘propriative striving’, and Maslow’s (1965) concept of ‘self-actualization’).

### Benefits and Costs of the Polymathic Life Project

This section examines the benefits and costs of undertaking a given life project. They are divided into two major categories: psychological and economic. Each category contains specific types of benefits and costs, which are discussed below.

**Psychological benefits.** It is traditional for psychologists to partition human consciousness in the domains of cognition, affection, and conation (or motivation). Likewise, the psychological benefits of a polymathic life project can be organized into three types: cognitive, emotional, and conative. Cognitive benefits refer to knowledge and intellectual gains; a person may prize and benefit from the acquisition of new sets of *mathemata*. Emotional benefits involve affective gains; a person may prize and enjoy positive emotions from polymathic pursuits. Finally, conative benefits refer to motivational gains; a person may have their willingness to expend effort renewed by pursuing meaningful objectives.

**Economic benefits.** Economic benefits include productive and efficiency gains, and benefits that would not be accessible if not through the undertaking of polymathic behaviors. The polymathic pursuit entails a constant process of encodement, re-encodement and sophistication of sets of *mathemata* across different domains, which contrasts with the behavior of other types who do not venture much outside their primary domain (specialists) or who seek breadth but not so much depth of knowledge (dilettantes). By delving into diverse fields and making the brain cope with lots of new information often, polymathic people may have access to unique opportunities to improve their productivity and efficiency, especially regarding general learning, creativity, and resource (e.g., time, information) management.

**Creative benefits.** A special type of yield associated with the polymathic life project are creative benefits. Creativity refers to novel and useful contributions that originate from the combination and concatenation of ideas, cognitive categories, or pieces of knowledge (see for example, Koestler, 1964; Mednick, 1962; Mumford & Gustafson, 1988; Simonton, 2011). If the creative process entails the articulation of multiple and diverse sets of *mathemata* to beget novel and effective results, one can conclude that at least some polymathy is *condicio sine qua non* for creativity; that is, without some degree of breadth, depth and some integrative capacity one cannot generate creative ideas. Thereby, a person who builds a life project centered on the development of these very qualities is expected to be in a privileged position to produce ideas that are original, useful and surprising. The relationship between polymathy and creativity is explored in multiple works by R. Root-Bernstein and colleagues (e.g., M. Root-Bernstein & R. Root-Bernstein, 2003; R. Root-Bernstein, 1997, 2003a, 2003b, 2004, 2009, 2015; R. Root-Bernstein et al., 1993, 1995, 2008, 2013; R. Root-Bernstein & M. Root-Bernstein, 2004, 2013).

**Psychological costs.** Psychological costs are the inverse of psychological benefits. The polymathic life project can bring not only benefits but also psychological distress. For instance, psychological distress may arise because the polymathic person may not build a career path that is considered “traditional”. This can lead to difficulties that go beyond pecuniary issues, affecting one’s process of identity formation, and one’s feelings of belonging and self-worth. In addition, the polymathic life entails goals that can be very demanding, and the achievement striving related to their pursuit may lead to increased levels of stress and anxiety. Although there is no literature specifically addressing this issue, it is possible to find studies linking achievement striving tendencies and over-extensive job scopes with higher levels of stress and psychological distress (see Jepson & Forrest, 2006; Jex, Adams, Elacqua & Bachrach, 2002; Xie & Johns, 1995).

**Economic costs.** Economic costs refer to the resources expended in order to follow a polymathic life project and to the benefits a person foregoes when they commit to a given course of action. In this paper, two types of economic costs are explored: psychic energy costs and opportunity costs.

**Psychic energy costs.** Psychic energy costs refer to the deployment of information-processing capacity to carry out mental operations. Authors such as Kahneman (1973) and Csikszentmihalyi (1988) pose that attention is a scarce resource—i.e., a person’s supply of psychic energy is limited and only some bits of information can be processed at any given time. How a person will deploy their energy is a determining issue for the kind of life project that they will undertake.

**Opportunity costs.** A cost of opportunity refers to a benefit that a person could have earned but gave up because they took an alternative course of action. When a person commits to a certain pursuit, their resources must be employed in that pursuit to the detriment of all other possible options. Likewise, when a person undertakes a polymathic life project, they forego diverse kinds of rewards in favor of this life project. This is a central concept that will be further examined in the next sections.

## Discussion: Finding One’s Most Valuable Life Project

Undertaking a polymathic life project involves devoting a great deal of one’s resources into the acquisition of a store of *mathemata* that qualifies as polymathic and the generation of novel and adaptive contributions stemming from it. A cardinal element in a polymathic life project is the drive to seek knowledge, to “search for the living springs of knowledge”, in a “continuous, indefatigable pursuit of unshakable truth” (Marrou, 1956, p. 58). However, the drive toward knowledge may take different formats. Some people may be delighted by drinking from the same spring of knowledge during their entire career, while for others this prospect will be disheartening. This section investigates why a given type of life project can be preferred over others, considering individual differences regarding endowments, personality, values and life goals. First, the polymathic and the specialist paths are compared, and their benefits and costs are examined accounting for heterogeneous valuations due to personality aspects. Second, a distinction is made between individuals based on their degree of creative ambition; the role of polymathy for achieving different kinds of creative products is then discussed.

**Polymathy versus specialism.** One of the most celebrated strategies to achieve success in an era of massive and fragmented knowledge is to channel one’s time and

energetic resources into a single area; i.e., taking the specialist path. This issue is particularly relevant in a context in which the time and effort to reach the frontier of knowledge is ever increasing (see also “burden of knowledge”; Jones, 2009). Since one has limited resources, why “waste” them in multiple pursuits if, alternatively, one can concentrate them into a narrow area and thus reach the frontier of knowledge sooner?

One way to shed light on this issue is by exploring the idea of individual differences regarding a person’s breadth-depth homeostatic drives. The breadth-depth homeostasis can be thought of as a kind of internal timer or counter that generates a homeostatic drive or pressure toward the element (either breadth or depth) that has been neglected for some time. Some people will be drawn to diverse interests but will feel comfortable with not developing much depth in any of them; they are the dilettante type—their breadth-depth homeostasis leans toward breadth. Some people will be drawn to a particular subject and will feel comfortable with not developing much breadth of knowledge; they are the specialist type—their breadth-depth homeostasis leans toward depth. Finally, some people will be drawn toward diverse interests and will also engage in profound learning in many of them; they are the polymath type—their breadth-depth homeostasis leans toward a balance of both.

From this perspective, a strategy that might seem universally advantageous at the surface (e.g., channeling one’s energy into a narrow area for a long time) may prove the opposite when differentiated costs are computed. For instance, the polymathic person, compared to the specialist type, may pay higher ongoing costs for suppressing their breadth drive. Still, a polymathic person can deal with their seemingly contrarian breadth-depth homeostatic drives in ways that do not involve the suppression of any of the two drives. In fact, learning how to deal with these drives in effective ways is as an essential mark in the development of polymathic people.

First, polymathic people can develop a number of avocations in parallel with their main pursuit. If one considers the effects of the “law of diminishing returns”, it is possible to conclude that a “portfolio” of concurrent activities may not only be an effective strategy to deal with the breadth-depth homeostatic drives but also be an optimal solution in terms of aggregate knowledge acquisition. The reasoning goes as follows: when the person allocates more and more resources toward an objective, at some point, adding even more resources in this task will lead to smaller and smaller returns per the same unit of resource spent. Thus, at that point, allocating the same unit of resources into other activities would be more advantageous. An eminent exemplar who utilized this strategy was Vladimir Nabokov; he intercalated his writing with an intense—and

professional—interest in entomology (Johnson & Coates, 2001). Taking up activities in areas that are considered “distant”, such as science and arts (as did Nabokov), may be especially fruitful. Studies about the habits of individuals with outstanding creative accomplishments also corroborate this idea. For instance, eminent scientists show much greater likelihood of developing avocational interests in uncorrelated areas than their less successful counterparts (see for instance, R. Root-Bernstein et al., 1993, 1995, 2008).

The second strategy to deal with the breadth-depth homeostasis is to follow a trajectory that includes the developments of expertises in a sequential manner. In some cases, this trajectory can be envisioned beforehand; a polymathic individual may undertake an “exclusive” pursuit for some time, and utilize the prospect of developing different expertises in the future as a means to attenuate the breadth drive in the present. In other cases, the decline in the interest on one subject may organically coincide with an increase in the interest on other subjects (see also R. Root-Bernstein and M. Root-Bernstein, 2011, for an examination of diverse life trajectories of creative people).

**Risks.** In financial projects, the concept of *value at risk* estimates how much a set of investments might lose, given certain conditions, in a given period. Where life projects are concerned, the notion of risk that implies a loss of investment has a much more limited usage. In a life project, a person’s most precious investment is their time and psychic energy. Unlike money, these resources cannot be hoarded. Since they will be spent anyway, what a person can do is utilize them in the most favorable way. In this context, notions such as commitment, opportunity costs and flexibility become especially relevant.

A pivotal issue for polymathy development is dealing with the commitment-flexibility duality. Flexibility is associated with broadening one’s range of experiences, one’s worldview and being acquainted with different ideas, disciplines and forms of thinking, which may bring both psychological and practical benefits (Deimann & Farrow, 2013; McCrae, 1987; McCrae & Costa, 1997). However, there is a caveat: the breadth-seeking person may run the risk of becoming a dilettante—given that the number of areas of interest today are countless, one can easily be lost among the bewildering array of possibilities and end up failing to develop depth in at least one domain.

Flexibility may also serve to offset risks traditionally associated with being a narrow specialist. These risks include being stuck in a career that one may cease to enjoy, or having to end a career which represents a great deal of one’s identity (e.g., athletes whose identity are completely tied to their sporting careers tend to suffer more psychological distress when they retire; see Grove, Lavalley, & Gordon, 1997). A polymathic person may offset both kinds of risks by

successfully integrating flexibility and commitment, breadth and depth—be it sequentially or simultaneously—into one’s life project and therefore into one’s identity.

**Experts versus pioneers.** Some people place high value on the attainment of the status of expert in a given area. After all, the benefits are various, ranging from pecuniary to psychological and social. However, attaining expertise is not an easy task. For instance, Herling (2000, p. 13) poses that expertise involves a process of continuous learning characterized by the constant acquisition of knowledge, reorganization of information, and progressive problem solving. In general, expertise entails two elements: (i) domain-related knowledge and experience, and (ii) problem-solving ability that qualifies as effective in a given domain (see Ericsson, Charness, Feltovich, & Hoffman, 2006; Herling, 2000; Hoffman, 1998; Simonton, 2014; Sternberg, 1997). In the terminology of this paper, the concept of expertise is embedded in the idea of ‘depth’, one of the core dimensions of polymathy. Although both the expertise seeker and the polymathic person have in common the pursuit for depth of knowledge, they have fundamental differences, especially in regards to their thinking processes and their personal motives.

The polymathic person is not a seeker of expertise or knowledge *per se*. Amassing expert knowledge is just one facet of polymathy. A non-polymathic expert may build an entire career by using already tested applications of knowledge to solve problems in a given area. This is far from the idea behind a polymathic life project. A polymathic life project involves more than the expert application of extant knowledge; it entails the constant manipulation of sets of *mathemata* from different domains in unique ways to generate original ideas and products. In each step of their development, the polymathic person will seek to form new and functional combinations, by taking advantage of their comprehensive and diverse sets of *mathemata* and their increased capacity for the synthetization and integration of ideas. Most of the time, ideas will be novel and adaptive only to the individual or to a limited area of application (e.g., one’s job function). However, the degree of originality and appropriateness of those ideas and products tends to increase inasmuch as one accumulates more expertises and refines one’s thinking skills. What, then, may happen when the person with a polymathic life project amasses expertise that reaches the frontier of knowledge?

Biographic and historiometric studies show that outstandingly creative people tend to be also unusually polymathic (see R. Root-Bernstein et al., 1993, 1995, 2008). Thus, it can be posed that polymathic behavior may play a prominent role for people who pursue particularly disruptive kinds of goals, such as pioneering a new discipline or challenging the assumptions of an existing field.

A very straightforward explanation would be that the disposition for both the pursuit of polymathy and the types of behaviors that are propaedeutic for highly creative outcomes are associated at the personality or genetic level. Thus, if opportunities are presented, and if intrapersonal and environmental variables are favorably aligned, the polymathic person would be very likely to achieve highly creative outcomes.

A more elaborate explanation (which does not rule out the first one) is that the dimensions of polymathy (breadth, depth and integration) may combine themselves in synergistic ways to generate highly creative outcomes. For instance, polymathy can act as both an expander and a filter for creative thinking. On the expansion side, a broad range of experiences and expertises may extend one’s possibilities of ideational permutations (cf. Mednick, 1962; Simonton, 2011). On the filtering side, a balanced set of *mathemata* may enhance one’s ability to select and retain the ideas that are appropriate to the detriment of ideas that are just original or contrarian for their own sake (cf. Sternberg, 2003; Simonton, 2011).

Finally, it is informative to explore the possible effects that the absence of polymathy may have on the disruptive type of creativity. The lack of engagement in polymathic behavior may act as an inhibitor of the pursuit of creativity at the highest levels. For instance, people that do not have the habit of engaging in polymathic behavior may see the pursuit of pioneering ideas as something foreign to them. As remarked by Koestler (1964, p. 44), thinking which remains confined to a single matrix of thought has its obvious limitations. A complementary remark is then suggested: thinking that integrates many matrices of thought can go beyond obvious limitations.

## A Developmental Model of Polymathy

A polymathic personality will propel the person toward the kinds of pursuits labeled here as polymathic. However, the complete picture of a person’s engagement and their persistence in a polymathic life project will depend on a complex interplay of variables. Some of these will be internal to the individual, such as genetic endowments, natural abilities and temperament. Some will be external, such as one’s educational environment, family background and milieu.

In this section, the developmental model of polymathy (DMP) is presented with two main objectives: (i) organize the elements involved in the process of polymathy development into a structure of relationships that is wed to the approach of polymathy as a life project, and (ii) provide an articulation with other well-developed constructs, theories and models,

especially from the fields of giftedness and education (e.g., Gagné, 1995; Renzulli, 2016; Subotnik, Olszewski-Kubilius, & Worrell, 2011; Tannenbaum, 1986).

With the goal to facilitate future research, the DMP was designed to reflect a structural model. The model has five major components: (1) polymathic antecedents, (2) polymathic mediators, (3) polymathic achievements, (4) intrapersonal moderators, and (5) environmental moderators (see Figure 1).

At the center of the model, the first three components (polymathic antecedents, polymathic mediators and polymathic achievements) configure the *polymathic path*. The polymathic path refers to a sequence of three stages in which a person is expected to go through during their developmental process. The first stage, polymathic antecedents, refers to personality characteristics, aptitudes, and behavioral tendencies that are primordial elements in a polymathic life project. The second stage, polymathic mediators, refers to stores of *mathemata* and procedural skills that are acquired and developed along a person's life; they are pivotal for one's progress toward polymathic goals. The third stage, polymathic achievements, refers to attainments and outcomes that represent the pinnacle of the polymathic development; they include valuable personal achievements as well as the generation of valuable contributions to society.

It is important to note that, although the elements of each stage are organized in a sequential order, feedback effects among them are expected (see also "talent as a retroactive cause", Gagné, 2004, p. 134). These effects are not shown in the model's figure for the sake of parsimony.

In addition, the model proposes that the development of the polymathic path is moderated (i.e., receives positive or negative interference) by two types of variables: intrapersonal and environmental moderators. Intrapersonal moderators refer to individual characteristics, other than those directly associated with a polymathic personality, which can affect the development of a polymathic life project (e.g., genetic endowments, natural abilities and temperament). Environmental moderators refer to elements external to the individual that can also affect the development of a polymathic life project (e.g., one's milieu, impactful life events, the surrounding culture, etc.).

In summary, the developmental model of polymathy posits that polymathy as a life project: (i) is driven and propelled by certain personality characteristics and natural abilities; (ii) is mediated by the cultivation of a polymathic store of *mathemata* and polymathic thinking skills; (iii) is moderated by elements internal and external to the individual; and (iv) culminates in outcomes concerning one's self-formation and the generation of valuable contributions to society. These components are examined in detail in the next sections.

## Polymathic Antecedents

In this work, polymathic knowledge has been defined as the possession of a store of *mathemata* that is characterized by the qualities of breadth, depth and integration. Polymathic antecedents refer to the aptitudes and personality traits that antecede (i.e., precede in a chronological or structural order) the attainment of such knowledge. Thus, these aptitudes and traits can be indicators of the likelihood or the potential to achieve polymathic knowledge and the objectives linked with a polymathic life project. In the model, polymathic antecedents are composed of two constructs: polymathic giftedness and trait polymathy. The first refers to abilities or aptitudes and the latter refers to personality characteristics. Their differentiation is due to their contrasting psychometric measurement strategies. In psychometry, assessment methods are traditionally divided into the categories of performance-based measures (e.g., general intelligence; Wechsler, 1955) and self-report instruments (e.g., The 'Big-Five' inventory; Costa & McCrae, 1992). The model aims to facilitate future research by fitting one construct in the first category (polymathic giftedness) and the other (trait polymathy) in the second category.

**Polymathic giftedness.** The approach of polymathy as a life project implies that some people will face diminished costs in the acquisition of systematic knowledge across various domains. This can be interpreted as a differentiated ability to learn things regardless of the domain they "belong." In the literature, the term giftedness is often used to refer to characteristics such as the potential for superior performance, natural talent, and the possession of above-average intellectual abilities (see Gagné, 1985, 2004; Subotnik et al., 2011). However, giftedness that is polymathic cannot stay encapsulated in just a single domain.

An extant construct that can serve as a proxy for polymathic giftedness is multipotentiality. Multipotentiality, albeit used inconsistently in the literature, refers to the possession of various natural talents and demonstration of interests in multiple domains (Rysiew, Shore, & Leeb, 1999). When multipotentiality is operationalized, researchers tend to break it into two dimensions: *multiple abilities* and *multiple vocational interests* (see Achter, Lubinski, & Benbow, 1996; Milgram & Hong, 1999a, 1999b). Multiple abilities are measured via performance-based measures, such as the SAT (Scholastic Assessment Test). In contrast, multiple vocational interests are measured via self-report questionnaires, such as the Strong-Campbell Interest Inventory (Campbell, 1987), Holland's Vocational Preference Inventory (Holland, 1978), and the Study of Values (Allport, Vernon, & Lindzey, 1970). As noted earlier, such mixing of psychometric strategies within a single construct can be confusing. Thereby, this work suggests that only the first dimension of



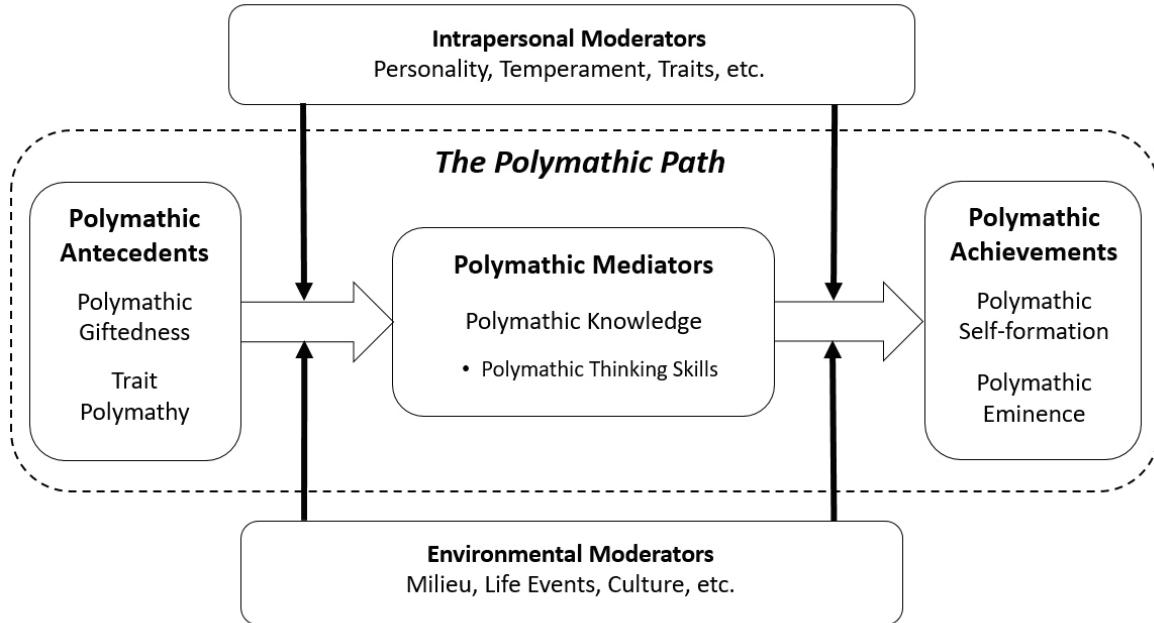


Figure 1. The Polymathic Path

multipotentiality (multiple abilities) should be utilized as a proxy for polymathic giftedness. The second dimension of multipotentiality (multiple vocational interests) should be considered part of trait polymathy.

**Trait polymathy.** In earlier sections, the concept of polymathic personality was introduced. The construct of trait polymathy aims to capture the elements that constitute a polymathic personality in an operationalizable way. In the literature, the concept of trait traditionally refers to endogenous basic tendencies, associated with one's responses to stimuli, and one's self-perceptions, preferences and values (e.g., Allport, 1937; McCrae, 2001). Thus, the novel construct of trait polymathy refers to a constellation of individual characteristics regarding one's tendency toward the pursuit of polymathic knowledge and polymathy-related goals.

The full development of this construct falls outside the scope of this article. However, it is suggested that a suitable strategy for its operationalization would be the application of self-reports, possibly conjugated with other-reports, which is consonant with how other personality measures are assessed (e.g., the 'Big Five' inventory; Costa & McCrae, 1992).

### Polymathic Mediators

The DMP predicts that polymathy as a life project starts with a series of individual characteristics related to one's aptitudes, values and behavioral tendencies, and peaks at the attainment of goals related to the individual's self-formation and their contributions to society. This process, however, is

mediated by a series of intermediary learnings, competencies and skill-sets, which represent stores of psychological, economic and social value that a person develops along the polymathic path.

**Polymathic knowledge.** Polymathic knowledge, as defined earlier, refers to the possession of a personal store of *mathemata* that is characterized by the qualities of breadth, depth and integration. As conceptualized in this work, polymathic knowledge encompasses not only traditional 'crystallized' knowledge (i.e., knowledge acquired through education and acculturation; cf. Cattell, 1971) but also procedural thinking skills. A polymathic stock of crystallized knowledge can be interpreted (and assessed) as the possession of expertise (depth) in many domains (breadth), while polymathic thinking skills refer to procedural abilities regarding the generation, organization and concatenation of sets of *mathemata*. In particular, these skills encompass the establishment of efficient networks of thought and of robust inquiry methods.

The process of inquiry and its proper conducting are critical during the progression toward polymathic goals. As a guide for what constitutes a good process of inquiry, one can refer to the tenets of philosophical pragmatism. They include: (i) perceiving strategic aspects about the object in debate; (ii) comparing and analyzing the properties of the object in debate in relation to other objects; (iii) drawing inferences and predictions from the properties of the object; and (iv) examining the logical consistency of one's beliefs about the object in debate (see Dewey, 1938; Peirce 1878,

1974; Webb, 2007). These tenets are very close to what is popularly understood today as critical or reflective thinking. In addition, it should be noted that a good process of inquiry is entangled with other important thinking skills for the development of a polymathic life project. Examples include time management (i.e., the ability to organize and plan how to divide one's time between specific activities) and balanced processing (i.e., the ability to apply critical thinking and analyze different perspectives and potential consequences in-depth before making a decision).

**Micro-polymathy.** The definition of polymathic knowledge presented earlier implies a quality of a person's *whole* store of knowledge. However, it is possible to assess one's degree of polymathy *within* a given domain. For instance, people who are able to perform at a high level in several different sports are called sporting polymaths (see for example, Cox, Russell, & Vamplew, 2002). This kind of polymathy is also common in other domains: there are artists who can act, sing, dance and play musical instruments, scientists who have expertise in different scientific methods, and so on. For a matter of differentiation, I suggest to use the term *micro-polymathy* when referring to polymathy within a single domain.

Micro-polymathy can be an important operational construct, especially where creativity is concerned (the operationalization can be done in various ways: via historiometry, performance-based measures, ratings from peers or supervisor, or consensual assessments). It has been suggested that the habit of undergoing field or perspective changes—even within the same domain—can enhance one's creativity (see also Root-Bernstein & M. Root-Bernstein, 2011)

## Polymathic Achievements

The polymathic life project culminates in attainments that are highly valued by the polymathic person, which are called polymathic achievements. In the DMP, two types of interconnected polymathic achievements are proposed: polymathic self-formation and polymathic eminence.

**Polymathic self-formation.** Maslow posed that the formation of the self is a goal that “cannot be reduced to anything more ultimate” (Maslow, 1965, p. 110). He used the concept of self-actualization to describe the drive toward self-fulfillment to the highest degree; that is, the achievement of the most of a person's capabilities and the becoming of a more fully functioning person. Likewise, Allport took special interest in a person's process of ‘becoming’ and in the relevance of pursuing one's most meaningful and propriative motives in that process (Allport, 1955). Both Allport and Maslow highlighted the role of a unifying philosophy of life, organized around some principles, values and purposes in the

constitution of a mature or self-actualizing person (Allport, 1955, 1961; Maslow, 1965). Nonetheless, in the context of a polymathic life project, what common themes regarding one's self-formation could be expected? This work proposes that a detailed look into the German concept of *Bildung* can shed light on this topic.

In the German tradition, *Bildung* refers to both the process (*Prozess*) of formation and the condition (*Zustand*) achieved by the wholly formed individual (the *gebildete*). This formation involves developing a consciousness constituted by one's reflective awareness of the self, of their relationship to others, and of their relationship to the world (Deimann & Farrow 2013; Fellenz, 2015; Peukert, 2002). In other words, the result of *Bildung* is a person that has gone beyond unreflective or simply utilitarian use of knowledge and competencies. The *gebildete* must develop a high degree of consciousness and awareness about their actions, their relationship to the socio-historical and cultural context, and their potential agency for changing and transforming the world.

The processes (and the goals) of *Bildung* and polymathy development share an intimate connection. The reflective awareness and critical thinking necessary for a *gebildete* status can only be attained if grounded on a plurality of profound and well-integrated stores of *mathemata*. A person who is limited to a single kind of reality can be neither a polymath nor a *gebildete*. The same applies for a person with only superficial knowledge in various domains (the dilettante), or a person who mastered some skills but is unable to articulate or work back and forth between them (see also ‘schizoidism’, Araki, 2015, pp. 79–80). Finally, *Bildung* entails going “beyond the present state of affairs” (Peukert, 2002, p. 421); that is, being able to not only comprehend the world but also—and especially—mold it in a self-determining fashion. Thus, the polymathic self-formation is connected with actions that entail creation, transformation and the generation of new and adaptive outcomes, which, in turn, concern the idea of creativity and eminence.

**Polymathic eminence.** The term eminence is often employed in the literature without a definition. Given the importance of this term, this section starts by delving into its meanings. Etymologically, eminence means “a projection, a protuberance” or “a distinctive feature, a conspicuous part” (Harper, n.d., para. 1). In the literature, sometimes the distinctiveness aspect of eminence is emphasized. For instance, Cassandro and Simonton (2003) described eminent individuals as those “who have established distinct and enduring reputations in a particular field” (p. 169). In other circumstances, the focus is on the projection or propulsion aspect of eminence. For example, Subotnik et al. (2011) defined eminent individuals as those “who made a significant contribution to improving or enhancing the

human condition” (p. 13). When a polymathic life project is concerned, the achievement of a distinguished reputation is just a matter of social recognition; the kind of eminence intended is the creation of a life opus that enhances the human condition via the generation of valuable contributions. Eminence is, in fact, a desirable but not necessary outcome of the polymathic life project. During the polymathic path, each individual will compose their unique opus, containing their unique achievements. However, only some individuals will generate opuses that will receive the label of ‘eminent’ by society.

Eminence may arise from two types of contributions. The first type, called here *creative eminence*, regards novel and adaptive contributions to the state of knowledge currently possessed by humankind. As an illustration, if the whole stock of knowledge accumulated by society would form a geometric figure, the achievement of creative eminence would signify the generation of a protrusion in this figure. The second type, called here *excellence eminence*, regards contributions in transcendent ways to making societal life better and more beautiful via excellent performances or products, which do not require the creation of new knowledge. These two types of eminent contributions are related to Subotnik et al.’s (2011) distinction between eminent performers and producers. Performers are mainly concerned with beauty and excellence; they include singers, instrumentalists, dancers, actors, and athletes. Producers, on the other hand, must go beyond excellence to create products that are original and adaptive; the producer type includes composers, choreographers, writers, and scholars/scientists/academics. Each type will have a different kind of relationship with creativity and polymathy.

In the performing fields, it is natural to place towering value on expertise. That is, on the mastering of the paradigms and best practices of the field (Subotnik et al., 2011). For performers, groundbreaking changes are rarely useful because the methods and procedural skills that lead to elite level performance tend to be very well consolidated. Also, in many fields, aspiring elite performers must start their training at a very young age. It means that even before they can develop a mature personality, they will be compelled to allocate most of their time and psychic energy on the single investment of becoming an expert in a field. When this kind of pursuit is confronted with polymathic personality, a number of results may occur: (i) the person may successfully integrate some breadth into their training—e.g., by intercalating avocational activities with their professional training; (ii) the person may become a sequential polymath—e.g., by suspending the breadth drive during some period and retrieving the bond to it at a later point in life; (iii) the person may re-signify their breadth impulse—e.g., instead of seeking breadth in general, they will seek it within a domain and become a

micro-polymath; or (iv) the person may disengage from the field—e.g., the training to perform outstandingly in a given field may become so psychologically costly that they will opt to quit that pursuit.

As seen, there are some ways in which a polymathic person can achieve early expert performance without giving up their polymathy. For this, intrapersonal factors, environmental variables and chance will be determining factors (see also Gagné, 2004; Tannenbaum, 1986). When expertise is seen as an end in itself, it is easy to argue that polymathy can be an oppositional force, even detrimental to its achievement: a polymathic person would become an expert *despite* their polymathy. However, when the achievement of expertise is seen as an element of a person’s whole opus, both expertise and polymathy are taken into a different perspective. In this perspective, becoming an expert in a domain is just a milestone on a path that entails larger goals, encompassing the individual’s self-formation and their potential of agency in the world.

For eminent producers, creativity is the key element and requisite. The mere reproduction of what others have done, even at a highest level of skill, is not sufficient. Regarding their developmental trajectories, producers tend to have more time than performers before they “must” choose their careers. That means more opportunities to develop a wide range of interests before they commit themselves to achieving expertise in a given domain. Producers will also differ on their creative ambitions. Some types of producers might, in fact, be called *faux* producers. They include individuals who would be comfortable with being just experts—they will generate creative productions incidentally or as a matter of professional requirements (e.g., for earning a PhD). At the other end of the spectrum are the producers whose ambition is to influence the “agenda of the times” (Sriraman, 2009, p. 31). They are characterized by a continuous striving to innovate, and the refusal to “live by a presented life theme” or “strive for goals that everyone else accepts” (Csikszentmihalyi, 1985, p. 114). For the latter type of creative ambition (and the goals that it entails), the pursuit of polymathy may not only be beneficial but also essential (see also R. Root-Bernstein, 2003a, 2003b, 2004, 2009, 2015; R. Root-Bernstein et al., 1993, 1995, 2008, 2013).

Those propositions can be further examined by combining Subotnik et al.’s (2011) distinction between performers and producers with Sternberg’s (2006) typology of creative contributions. Sternberg outlined three types of creative contributions: (i) those that accept current paradigms, (ii) those that reject current paradigms, and (iii) those that attempt to integrate multiple current paradigms. As seen, performers tend to be experts who do not greatly deviate from current paradigms; even the most distinguished performers tend to fall into this category. Conversely, the most eminent

producers tend to be pioneers, redirectors or groundbreakers who significantly altered the standards of their fields (cf. Kaufman & Beghetto, 2009; Mumford & Gustafson, 1988; R. Bernstein et al., 2008). Given the associative nature of creativity (Koestler 1964; Mednick, 1962; Simonton, 2003, 2011) and given that polymathy entails not only the raw materials but also the procedural skills that enhance this capacity, one can conclude that the more a person needs creativity the more useful it is to being polymathic. This proposition has been corroborated by the findings of R. Root Bernstein and colleagues (1993, 1995, 2008) and Sriraman (2009). The former using mainly biographical data and the latter using a hermeneutic-phenomenological approach. It is posed that the advancement of a psychometric construct for polymathy (such as trait polymathy proposed in this paper) would open new avenues of research, thereby collaborating to increase the level of scientific knowledge on the topic.

### Intrapersonal and Environmental Moderators

As discussed, one's development path is expected to be influenced by a series of factors. The DMP divides these influences into two categories: intrapersonal moderators and environmental moderators. Each category encompasses a constellation of variables that can affect, either positively or negatively, the development of the polymathic life project. Although this paper will list some of these elements, an exhaustive list of moderators and their loads will depend on empirical testing, which is beyond the scope of this article.

**Intrapersonal moderators.** Intrapersonal moderators refer to the intrapersonal variables that exert influence on the attainment of polymathic knowledge, thinking skills and achievements, but which do not fall into the category of polymathic antecedents. Possible candidates are the four elements that compose the construct of positive psychological capital: self-efficacy, hope, optimism, and resilience (Luthans, Luthans, & Luthans, 2004). Since they are found to have a positive influence on one's psychic state as a whole and help people achieve their goals (see Avey, Luthans, & Jensen, 2009; Sweetman, Luthans, Avey, & Luthans, 2011 for more details), it is reasonable to expect that these factors will also influence the development of polymathy.

**Extrapersonal moderators.** Extrapersonal moderators are environmental factors that exert influence on the attainment of polymathic mediators and polymathic achievements. For instance, the access to opportunities, the influence of one's milieu, the socioeconomic context, and the actions of important individuals in a person's life have been highlighted as pivotal influences in other models in the literature (e.g., Gagné, 1995; Renzulli, 2016; Sternberg, 2003; Subotnik et al., 2011). Therefore, it is reasonable to

expect that these factors will also affect the developmental process of polymathy.

## Discussions and Implications to Policy and Research

Polymathy is a multifaceted phenomenon whose systematic study may open new avenues of research. Through the approach proposed in this work, topics that are normally disconnected have been brought together for a holistic understanding that involves the study of developmental aspects, individual differences, the economics of choice, risk, opportunities and investment valuation, as well as the interplay of a person's "agenda" with their socio-cultural context. In the next sections, some important topics for the progress of polymathy studies are covered and implications to policy and practice are discussed.

### Future Studies

Given that polymathy is still in the early steps of becoming a systematized scientific construct, there is a panoply of possibilities for future studies. Some of them are explored below.

**Psychometric polymathy.** So far, polymathy has been mainly assessed either via the biographical analyses or via a hermeneutic-phenomenological approach. These methods, however, have several limitations regarding the production of generalizable data. For the advancement of scientific knowledge on polymathy studies, it is pivotal to formulate a psychometric measure of polymathy. This work proposed two possible psychometric constructs: polymathic giftedness, which is ability-based; and trait polymathy, which is personality-based. While one can find some valid proxies for the former construct in the literature (e.g., multipotentiality), the latter still lacks a scientific formalization. Inspired by other types of personality assessment (e.g., the 'Big Five' inventory, Costa & McCrae, 1992; and the trait emotional intelligence questionnaire, Petrides & Furnham, 2001), the author proposes the development of a trait polymathy questionnaire in future studies. Such an instrument can be easily applied to a large range of individuals, without the need of retrospective data, and can lead to generalizable findings.

**Polymathy and the everyday Life.** The undertaking of a life project that qualifies as polymathic is intimately linked to how a person ultimately spends their time and psychic energy. For instance, polymathic people tend to devote a larger amount of time and energy into avocational activities, when compared to specialists. One way to assess these differences is via the "Experience Sampling Method" (Csikszentmihalyi & Larson, 1987). This method is a way to

provide a quantitative measure of psychic energy expenditure in real time as well as qualitative data regarding one's affective, conative and cognitive states during each activity. The study of how polymathy is manifested in the everyday life may lead to new insights about the nature of polymathic behavior.

**Polymathy and physiology.** Polymathy can (and should) also be assessed at the biological level. In particular, the study of individual differences regarding the breadth-depth homeostasis may be fruitful. Similar to the sleep-wake homeostasis (Borbély, 1982), in which different individuals display different optimum balances between sleep and wakefulness, the breadth-depth homeostasis posits that the balance toward seeking breadth or depth of knowledge may also vary from person to person. That is, different individuals may display different levels of pressure toward variety (breadth) as a function of the time and energy spent in a single pursuit (depth), and vice versa. This might be assessed with carefully designed studies taking advantage of modern biological monitoring methods (e.g., electroencephalography).

**Polymathy in the business environment.** One of the constructs that can be readily associated with polymathy in the business realm is multiskilling. It refers to increasing the range and depth of people's skills and competencies, and enabling them to carry out tasks previously or traditionally carried out by another function (Horbury & Wright, 2001, p. 2). Cordery (1995) proposed that multiskilling processes can occur in three dimensions: horizontal (more breadth), depth (more profoundness), and vertical (the learning of supervisory or administrative support tasks). According to the terminology in this paper, multiskilling can be understood as a special case of micro-polymathy, which occurs within one's professional domain. Thereby, it is expected that aptitudes and personality factors related to polymathy will also play pivotal roles in the success (or lack thereof) of a person's multiskilling process. Nonetheless, there are some important caveats. For instance, a polymathic person may not engage in a multiskilling program sponsored by her company if their values and the rewards are not properly aligned. It might be even the case that a polymathic person will not engage in multiskilling because it may get in the way of a person's self-directed polymathic pursuits.

## Conclusion: Fostering Polymathy

The advancements and the systematization proposed in this article have the intention to clarify a concept that is rich in meaning and whose potential to inform research and policy is currently overlooked. This is especially relevant in the field of education and, more specifically, gifted education (see also Shavinina, 2013). The concept of polymathy can be used to cast new light on major discussions in these fields,

some of these discussions regarding the very ends and the *raison d'être* of gifted education. For instance, Subotnik et al. (2011) defend that the goal of gifted education should be the achievement of eminence. However, how can education practitioners expect to help the development of path-breaking, field-altering geniuses if major issues that drive their personality, their goals, their values, and, therefore, their motivation are poorly understood? Overlooking the phenomenon of polymathy, even in areas where it should be widely acknowledged, may have led to unfortunate (and unseen) consequences, both for individuals and for society.

In the present situation, people with polymathic personality characteristics are pursuing their life projects without much support from science. These people could (and should) count on a systematic body of scientific knowledge that can help them in their personal strivings and in their identity building. Scientific knowledge should be a source of information, which people can utilize to improve their comprehension of different phenomena and ultimately exercise their agency in reflective and informed ways. When a society fails to acknowledge polymathic behavior and does not provide a conducive environment for its flourishing, this society is not only alienating individuals but also foregoing the opportunity of generating more path-breaking creations, and more original and surprising discoveries that could have enhanced life for the benefit of the whole society.

**Recent polymathic educational initiatives.** Despite the long way ahead for polymathy to become a widely adopted construct, it is the author's opinion that the general interest in polymathy is gaining momentum. In recent years, some educational initiatives with a specific focus on polymathy have sprouted in major American universities. The University of Southern California founded the 'Sidney Harman Academy for Polymathic Study', which offers "a series of conversational encounters intended to intensify integrated interdisciplinary awareness" (University of Southern California, 2017). The College of Natural Sciences of the University of Texas at Austin created an honors community designed for "students with a commitment to science who also have compelling interests beyond them". It involves a certificate program that gives undergraduates the opportunity to create, rather than choose, a field of study. Each student's own personalized field emerges from their interests and is defined by pursuing questions that require knowledge from more than one branch of knowledge (University of Texas at Austin, 2017). Finally, the Massachusetts Institute of Technology and the Harvard Graduate School of Education have promoted a seminar called 'The World in Ten Curves', which is centered on the idea of polymathy, its development and its benefits (Fadel & Bosch, 2014). These initiatives have the aim to synthesize and integrate different matrices of thought, surpassing the schizoid compartmentalization that is prevalent in the

traditional educational system (see also 'schizoidism', Araki, 2015, pp. 79-80).

In conclusion, this article is a contribution to systematize polymathy and put it in a more prominent position in the research agenda. It extends a line of research that articulates different areas of knowledge, such as psychology, education and economics, constituting another step toward a more integrative research agenda, seeking to find synergies among matrices of thought. Finally, the novel ideas proposed in this article will hopefully contribute not only to the development of new research but also to the enhancement of educational practices, and to the flourishing of individuals and society.

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