

ANALYSIS OF SOME TRAINING THEORIES APPLIED TO THE GENERATIVITY CONCEPT

Ma. Silvia López Alonso

Universidad de Valencia. Facultad de Psicología
masiloa@alumni.uv.es

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ABSTRACT

We found exciting to study how generativity has evolved since Erikson (1950) outside the Psychology and Sociology disciplines, and had permeated into the fields of Ecology, Grammar and Syntax, and Information and Communication Technology (ICT), without losing part of the essence of the genuine meaning given by Erikson back then, about the generative task and generativity as a construct. I wanted to investigate this further, and my findings turned out to be very interesting

In this paper I perform a basic analysis of some training theories applied to the generativity concept as a task and a construct since Erikson (1950), in the field of Psychology and Sociology, Grammar and Syntax, Ecology, Information and Communication Technology (ICT).

Keywords: generativity; Erikson; Chomsky; ecological; sociotechnical

RESUMEN

Análisis de algunas teorías de la formación aplicadas al concepto de generatividad. Nos pareció apasionante estudiar cómo la generatividad había evolucionado desde Erikson (1950) fuera de las disciplinas de la Psicología y la Sociología, y había calado en los campos de la Ecología, la Gramática y la Sintaxis, y las Tecnologías de la Información y la Comunicación (TIC), sin perder parte de la esencia del sentido genuino que Erikson le dio entonces, sobre la tarea generativa y la generatividad como constructo. Quise investigar más sobre esto, y mis hallazgos resultaron ser muy interesantes

En este trabajo realizo un análisis básico de algunas teorías de la formación aplicadas al concepto de generatividad como tarea y como constructo desde Erikson (1950), en el ámbito de la Psicología y la Sociología, la Gramática y la Sintaxis, la Ecología y las Tecnologías de la Información y la Comunicación (TIC).

Palabras clave: generatividad; Erikson; Chomsky; ecológico; sociotécnico

INTRODUCTION

The work presented is a bibliographic review. We started collecting data in the repositories of the University of Valencia, Web of Science and Google Scholar using the following: keywords “generativity” AND “Erikson”; “generativity” AND “Chomsky”; “generativity” AND “Ecological”; “generativity” AND “Sociotechnical”. The inclusion criteria were: having a greater number of quotes; that the authors should have a high author index; that generativity was understood as a construct; that there was a generative task, and that the definitions were related to the Eriksonian.

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Since Darwin raised the idea of biological evolution (1859) by setting out the principles of natural selection, namely that all species have descended over time from one common ancestor through a process called *natural selection* (Carlson, 2014). And Mendel's laws (1865) known as the set of basic rules on the transmission by *genetic inheritance* of the characteristics of parent organisms to their offspring, ignored for a long time and recovered by Johannsen (1909), who coined the word *gene* from the Greek word meaning *to generate* (Cassle, 1965). At a later stage, the *gene* concept would appear as we know it today, that is, an elementary unit of heredity, consisting of a part of DNA that occupies a specific *locus* on the chromosome, and which is transferred from one generation to the next as a unit of genetic information, (RANM, 2012). *Genes are like the bricks of inheritance*, which are transferred from parents to children thanks to the DNA in them with the necessary information code (Medlineplus, 2022). A new wave of scientific research emerged with the aim of understanding the nature and content of the genetic information that has driven biology for the past hundred years. It basically established the cellular basis of inheritance (chromosomes) and defined the molecular basis of inheritance (DNA). This set the notion that the human genome contains an extraordinary value of information about medicine, human development, physiology and evolution (Lander et al., 2001).

Consequently, there are countless perspectives related to the fact that the *human genome* knowledge goes beyond the field of knowledge of biology and medicine. Psychology (Erikson, 1950; Levinson, 1986), Anthropology, Epidemiology, Sociology (Keyes & Ryff, 1998), Phenomenology (Affifi, 2015), Linguistics and Education (Chomsky, 1965), Computer Science (Frazer et al., 2002), Communication Sciences, New Technologies (Harvey, 2017; Katz & Macklin, 2006; Zittrain, 2006) or Ecology (Hawcroft & Milfont, 2010; Kaiser, Wölfling, & Fuhrer, 1999) internally and externally explore the generative potential for their respective disciplines.

The universal succession of the natural evolution periods that structures the life of living organisms, and human life in particular, has its origin both in psychobiology (it is in human nature) and in its social environment. Therefore, each individual's life cycle develops overlapping its biological progress (which has an inherited base), its psychology or personality, and the social environment that surrounds it, incorporating and managing the various common aspects to build a personal and individual structure, a unique pattern of relationships with the world of receiving attachment, training and culture, maturing, producing, creating, rectifying, innovating, living in comfort, caring and protecting the next generation (Levinson, 1986).

GENERATIVITY IN PSYCHOLOGY AND SOCIAL SCIENCES

Just like Freud, Erikson claims that a crisis takes place at each stage of human development. However, unlike Freud, who presents crises as having an unconscious nature, as a result of repression experienced, for Erikson (1950) these have a psychosocial nature because they involve internal and environmental difficulties of the subject throughout his/her existence. Healthy and successful development from childhood to adulthood going through adolescence and puberty, personality, health, cultural, economic, religious circumstances, future expectations, family, friendships, role performance within the family or work (Erikson, 2004). All these are intrinsic and extrinsic circumstances that intermingle with the previous and subsequent stages of the present lived by the subject, namely, *role identity crises* that the subject must successfully resolve in order to maintain his personal well-being and to be satisfied with life (Keyes y Ryff, 1998; López, 2017; Zacarés y Serra, 2011).

For Erikson, *generativity* sits within the evolutionary development of middle adulthood as a challenge against stagnation. If the previous stages (i.e., childhood, adolescence, and youth) are overcome, a clear identity and serious social bonds can be achieved. Consequently, generativity could be defined as the concern to watch over the next generation with tasks related to attachment, care, training, culture or production aimed at direct descendants, or at young people in general. It also includes ecological care of the urban space and of what belongs to everyone. What does *generative task* mean? According to Erikson, overcoming this stage is a guarantee of the individual's well-being and life satisfaction, and not doing so leads to personal fatality (Erikson, 1985; Keyes, Shmotkin, & Ryff, 2002; Meléndez, Tomás, & Navarro, 2008; Zacarés & Serra, 2011).

Based on Erikson's *generativity-stagnation* stage and the crisis that arises from overcoming it, different studies suggest satisfactory coping models.

According to Kotre, generativity is "a desire to invest one's substance in forms of life and work that will outlive the self", the backbone in the adult's life story. Even though some of his statements regarding this concept are ambiguous, they could suggest that for Kotre generativity is a) a *symbolic immortality*, an inferior lifestyle that enables leaving a material legacy (Huta & Zuroff, 2007), and b) the means to live a *superior and spiritual life* that transcends oneself and guarantees immortality (Kotre, 1998).

On the other hand, Bradley and Marcia suggest five states or prototypical styles to solve the problems of Stage 7, *Generativity-Stagnation*, which derive from combining two levels of generative involvement, a) the subject's concern and active participation level for his personal growth and that of others, and b) the level of empathy towards others, namely, tolerance for those who are different, their ideas, values and traditions, and concern for care (Bradley, 1997; Bradley & Marcia, 1998; Martín, 2004). Namely, (1) *Generative State*, (2) *Pseudogenerative-Agent*, (3) *Pseudogenerative-Community*, (4) *Conventional Status* and (5) *Stagnant*. In order to measure the generative states, a *semi-structured interview* measure is built that reaches acceptable statistical levels (Bradley, 1995; Bradley & Marcia, 1998).

After being shelved for decades, generativity regains its relevance as a construct in studies on adult development by Dan McAdams, who defines it as a virtue, and differentiates between the favourable attitude towards generative matters (*generative interest*) and *generative action* (transferring that attitude or interest to action) that involves a specific motivational behaviour (McAdams, Hart & Maruna, 1998; McAdams & Logan, 2004). It provides measurement tools, although they have not yet been validated (Villar, López, & Celdrán, 2013). As such, he emphasises the *narration of the life story* of each individual, clearly related to the autobiographical memory that is obtained by reconstructing the past, present and the justification for the future through *vital narrative stories* where his generative efforts emerge (Harvey, 2017; Martín, 2004).

Professor Javier Martín Holgado should be mentioned as he, in an increasingly individualistic society, reminds adults, institutions and governments of their responsibility to assume the generative task to guarantee the welfare of future generations (Fresnedo & Sáez, 2022; Zacarés, Ruiz & Amer, 2002; Martín, 2005; Martín, 2006; Martín, 2009). Generativity is the gorgeous capacity that all human beings generally have to convey something of ours to the coming generations, they are bonds that unite children, young people, adults and older people (VIU, 2017).

GENERATIVITY IN ECOLOGY

Environmental problems, such as climate change, natural resources depletion and their consequences, are a widespread concern nowadays (Ostrom, 2007).

"Humanity has emerged as a major force in the operation of the biosphere, with a significant imprint on the Earth System, challenging social-ecological resilience. This new situation calls for a fundamental shift in perspectives, world views, and institutions. Human development and progress must be reconnected to the capacity of the biosphere and essential ecosystem services to be sustained. Governance challenges include a highly interconnected and faster world, cascading social-ecological interactions and planetary boundaries that create vulnerabilities but also opportunities for social-ecological change and transformation" (Folke et al., 2011).

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Researchers in the psychology field work to find the psychological factors that could foster the individuals' participation and commitment to environmental causes. "Our environment needs to be preserved for future generations" (Flanagan et al., 2019; Ostrom, 2009). Going back to generativity as a relevant approach during middle age that commits the adult individual to strive and work to leave a useful legacy to his next generation in society and its environment that ensures a promising future (Erikson, 1959) and, following the generativity model suggested by McAdams and St. Aubin (1992), the generative concern can also focus on environmental issues. That is, a sense of esteem and responsibility for the local environment and the community that generates commitment and collective work actions, dynamics and effective civic skills of identification and care for the environment that benefits natural systems and non-human living beings. (Flanagan et al., 2019).

Caring for the biosphere, perceiving it as the assembly formed by living beings on Earth, the interrelationships between them and with the environment, so that it is the foundation of future generations, also offers a context that increases generativity. This concept is positively related to confrontation and social interactions and emphasises a hopeful confidence in the future (Ostrom, 2007). It is consistent with research works showing the importance of generativity in the relationship between commitment and environment, by expressing its relevance as a key organising shell within the environmental domain (Matsuba et al., 2012; Milfont & Sibley, 2011). Alisat et al. (2014), including McAdams, evaluate ecological generativity as an environmental commitment within the narrative of life stories. That is, it allows knowing the factors that drive the individual towards feeling of personal and close connection with nature in the context of the narrative identity. The results highlighted the compromised environmental identity (the importance that the natural world has in some people to making sense of themselves) and generativity as key mediating factors in the relationship between young and middle-aged participants. Generativity predicted conservation attitudes and the ecological behaviour (Milfont & Sibley, 2011).

GENERATIVE GRAMMAR: CHOMSKY

Until the publication of Noam Chomsky's book *Syntactic Structures* in 1957, which was the origin of what the *Generative Grammar* would be, rather than fostering the fluid course of language, the traditional grammar was conceived as an element that compressed, limited and prevented its vital development (Pater, 2019). In his book, the author suggests mechanisms by which speakers of a language can produce and understand sentences, versus an invalid grammar of immediate constituents. To come up with a living language that grows and develops with the free use of a society or people (Chomsky, 2002; Chomsky, Noam, Gallego, & Ott, 2019), coined by Chomsky as Universal Grammar (Chomsky, 2005; Chomsky, 1981; Corballis, 2019), he's and other linguists' theories caused a relevant change in the understanding of the genuine meaning of language. In this approach, language is defined as a mental construction of representations and calculations located in the human brain prior to sound and meaning (Ullman, 2000).

The aim of this section is to provide an overview of current aspects of the study on human language capabilities as an object of the natural world that is key in the generative grammar (GG) field. GG studies the linguistic ability as an integral element of human cognition. It is based on Descartes' *view of the self*: "Only humans appear to possess a mental grammar that allows the composition of infinitely meaningful expressions from a finite stock of discrete units" (Descartes in, Chomsky, Gallego y Ott, 2019). This is formulated in contrast to the linguistic theory, which mainly has to do with the ideal speaker-listener, in a completely analogous speech community, knowing its language without insignificant grammatical contexts such as distractions, memory limitations, attention or interest shifts, and errors (fortuitous or own) when applying their linguistic knowledge in the actual behaviour (Chomsky, 1965).

Noam Chomsky's works stood out due to his linguistics and cognitive science theories. Generative Grammar (GG) is a discipline developed by the author, as a set of theoretical frameworks to study the syntax of languages that provides the rules and principles that underlie the grammatical sentences of a language. It describes the human brain's cognitive-linguistic abilities, it explains the language acquisition and development, and the speaker's involuntary and implicit knowledge. GG positioned syntax in the middle of the linguistic research. *Modern*

generative grammar is currently considered a natural science, part of the cognitive sciences (Chomsky, Noam et al., 2019).

Chomsky suggests that the generativity of the human thought is the most important feature when studying human language, since it enables creating unlimited and different sentences from a limited set of guidelines and environmental information. Specifically, human beings have a finite knowledge mechanism known as the *internal grammar of language* that enables them to build and interpret an infinite number of sentences. Based on this, Chomsky states that a significant part of this grammar is innate, suggesting that human beings have a genetic mechanism, and thanks to this, they can learn a language. That is, the information available in a child's environment favours the conditions for teaching him the broad hierarchy of sentences that he builds (Chomsky, 1981; Ullman, 2000).

A relevant generative grammar will take accountability for mental processes that go far beyond the child's actual and potential level of consciousness (Chomsky, 1965). Chomsky's theory contains: (1) the generative property of human knowledge, (2) the qualitative discrepancies between the human and animal ability, (3) the integrity of the language organisation, (4) the brain as the material space that houses cognitive functions, and (5) the immanent faculty of cognitive functions (Chomsky, 1981; Ortega, 2005).

Some linguists do not agree with part or all of the Chomskian thought (Ford, 2004; Hornstein, 1999; Jackendoff, 2017; Takahashi, 1975). They question whether his theories are a model rather than a reality, and regarding GG, they argue that the ability to speak, to build sentences, can never be learned by the mere contact with the environment because there must be a prior learning process (Marantz, 2005; Pater, 2019; Suddendorf, Addis & Corballis, 2009). On the other hand, thanks to Chomsky's generative and transformational linguistics, (a) a new, more definitive approach is deployed in order to achieve the true linguistic science, (b) its structural analysis, merely static so far, enabled describing its linguistic components, and (c) generative research is a dynamic and creative novel situation with a forward-looking approach. His contributions to education should also be highlighted, as they are based on competencies that form the basis of many educational models, and to the computing theory (Chomsky, 2002; Cook, 1985; Jack et al., 2012; Pastra & Aloimonos, 2012; Peters & Ritchie, 1973).

GENERATIVITY AND INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

The importance of information and communication technology (ICT), the main driver of society and the economy, considers what skills are necessary to create and use complex computer systems (Katz & Macklin, 2006). The basic properties of digital technology are reprogrammability and data homogenisation. Together, they offer a range of open and flexible opportunities used to create innovations characterised by convergence and generativity (Yoo et al., 2012). Harvey (2017) states that design has innovation within it, it poses new ways of seeing the world around us, of being and living in community or individually, its aim is to improve the living environment of men and women at home, in their workplace, leisure or urban spaces. Many times, it implies a radical change of individual or collective customs. In this sense, *communaucal design*, integrated into ICT, is a future-building activity that explores the main demand of online social systems (roles, functionality and sociotechnology), as a communicational and collaborative project of virtual communities or socio-technical systems, where social factors and technical mechanisms interact to streamline joint innovation.

In communaucal, the human being's intervention is basic when managing knowledge, skills, abilities, and design, because of his language, reasoning, life experiences, memories and representations, projects, that is, his entire *generative task*. (Meléndez, Satorres & Delhom, 2020; Zacarés & Serra, 2011) offers endless creation and innovation possibilities for sociotechnology, for the individual psychophysical state and in relationships with human creative work teams (Ghislieri & Gatti, 2012; Harvey, 2017; Makover, 2005). The human being's generative capacity is the origin and source of the keys to design, inspiration, and creativity, it fosters the evolution of meanings (Harvey, 2017). In this scenario, generativity as a construct is increasingly used to understand innovation in systemic contexts and to represent the creation of digital context systems in which social and technical elements interact to favour combinatorial or ecosystem innovation. Seven components are identified in the *generativity con-*

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struct. 1. Generative architecture; 2. Generative government; 3. Generative community; 4. Generative fit; 5. Combinatorial innovation; 6. Generative results; 7. Generative feedback. Of these, generative fit and ordering play a leading role for the construct (Thomas & Tee, 2021).

Zittrain (2006) provides the most well-known description of generativity in the administration and business sectors. It comes from the verb *generate* which means to create or produce. It involves the ability to create new abilities and knowledge that constitute the basis of creativity, investigation, and innovation. It is the ability to adapt and integrate into a series of operations or jobs, accessibility, and ease of command. Lane (2011) incorporated the concept of *generative relationships* as the activity space where innovations arise and for Ahuja, Lampert, & Novell (2013) the value of innovations generated from existing ones is called *generative appropriability*. Katz & Macklin, (2006) explain that generativity in any of its forms, capability and learning overlap to express the interactive processes followed by users to learn and interact with ICT devices.

In this scenario, Foerderer et al. (2014) state that a technology's *generative capacity* enables generating a spontaneous change driven by large, varied and uncoordinated audiences, it is the impulse of a platform and the key to its value (Yoo et al., 2012; Zittrain, 2006). Its goal is the innovation caused by heterogeneous groups (Eck, Uebernickel, & Brenner, 2015). So much so, that it is very delicate to maintain the balance between the generative stimulus and the generative, architectural, and relational control (Foerderer et al., 2014).

CONCLUSIONS

Human beings, unlike other living beings, can think, reflect, speak, communicate, listen, interact, have friends, love, plan for the future, leave a legacy that survives them, educate and train the coming generation. They can improve their surroundings to achieve their own welfare and that of those around them. This makes them superior in his kind and enables them to study and research, design, create, innovate, recycle, anything that allows them to adapt and respond to their needs and leave a legacy that guides and contributes to the well-being of the young generations.

We summarize the different disciplines of generativity, their theories and main references in figures 1 and 2.

DISCIPLINES	REFERENCES	THEORY
Psychology. Sociology. Phenomenology	(Bradley & Marcia, 1998; Erikson, 1985; Kotre, 1999; McAdams, Hart & Maruna, 1998; Moral, Miguel, & Pardo, 2008; Obando, 2021; Zacarés & Serra, 2011)	-Legacy next generation -Not only biological parents -Generative professions -Quality of Life: Well-being
Environmental Sciences; Biology; Ecology	(Folke et al., 2011; McAdams, Dan P. & de St Aubin, 1992; Ostrom, 2007)	-Psychological factors that could encourage individual participation and commitment to environmental causes
Grammar and Syntax	(Chomsky, Gallego, & Ott, 2019; Cook, 1985; Ortega, 2005; Ullman, 2000)	-Aspects of the study of the faculty of human language as an object of the natural world that is key in the field of generative grammar (GG)
Information and Communication Technology (ICT). Sociotechnology	(Ahuja, Lampert, & Novell, 2013; Harvey, 2017; Katz & Macklin, 2006; Zittrain, 2006)	-Development of systems for computer platforms

Figure 1. By the autor

DISCIPLINE	THEORY	GENERATIVE ASPECTS
Psychology (Erik Erikson)	Generativity. Social Psychology	-Recreation energy. -Social innovation. Upward -Generation Encouragement and Guidance
Linguistics (Noam Chomsky)	Generative grammar	-Discrete series of rules that generate infinite syntactic configurations
Organization sciences (Donald Schön)	Generative metaphor	-Figurative description (or production of animated images). From social events or learning situations that form attitudes and behaviors towards them (reflective practices)
Social Psychology (Kenneth Gergen)	Generative capacity	-Ability to question the status quo and to transform social reality and social action
Architecture (Christopher Alexander)	Generative patterns	-Simple process (algorithm) that allows the creation of a well-constructed artifact that can be adjusted to its specific context
Computing (John Fraser)	Generative design	-Generation of a series of multiple and diverse scenarios in design
Design of social systems (Bela Banathy)	Generative research in design	-Generation of the multiple aspects of design thinking and appropriation of those aspects by users
Sociocybernetics (Kenneth Baush)	Generative ethics	-Generative and evolutionary communities that define the norms, values and axiological rules of social action
Studies	Research	-Studies. Research. A recurrent hermeneutical process that generates theoretical quantum leaps

Figure 2. (Harvey, 2017)

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