





# Challenges in **Creativity** & **Psychology** for the **XXI Century**

Edited by Julio C. Penagos-Corzo & María Antonia Padilla Vargas

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Ex hacienda Santa Catarina Mártir s/n, C. P. 72810  
San Andrés Cholula, Puebla, México  
Tel. +52 (222) 229 20 00  
[www.udlap.mx](http://www.udlap.mx) • [editorial.udlap@udlap.mx](mailto:editorial.udlap@udlap.mx)

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# Introducción

► Julio César Penagos Corzo · Universidad de las Américas Puebla

Creativity is a path, a destiny, and an origin. For some it is intangible, but as an object of study it can be measured, analyzed, modified . . . and also promoted. Perhaps it is this latter aspect that makes the most sense in this text. This book brings together the leading scholars in the study of creativity, while at the same time giving entry to young researchers who are at the start of their journey in this field or who are using creativity to generate innovative applications in their respective fields of Psychology. This is what makes this book so diverse and original. It is not confined to one field, nor is it intended for one type of specialist. Creativity is the thread that runs through it; sometimes as a source, sometimes as a path, sometimes as a destination.

Like everything cognitive, creativity has biological, cultural, and psychological components. Biology narrows it down, culture enriches it, and psychology sets it apart. Biology is the framework that regulates the boundaries of association. Culture drives the meanings that allow us to transgress (or not) the said borders. But it is in the psychological aspect where creativity truly differentiates itself. It is in this dimension that its deepest nature is found. The dimensioning of biology and the enrichment or mediation that culture can offer are highly relevant to the creative phenomenon. However, it is in the psychological field where creativity reaches its fullest dimension, and perhaps it is here where it originates: Its cognitive, emotional, and motivational components can be found here, the components that drive, forge, and originate it. These building blocks can be summarized, with some theoretical considerations, in the psychological construct known as the creative attitude: a conglomerate of evaluations, affections, and primarily flexible behaviors that are tenacious and proactive under uncertainty and are ori-

# unction

ented to the generation of socially or individually relevant ideas or actions (Penagos-Corzo, 2014). Thus, it is likely that this creative attitude has been an important aspect in the participation of the authors of *Challenges in Creativity and Psychology for the XXI Century*, and we also hope that it will be present to some extent in our prospective readers.

As an object of psychological study, creativity has led to the identification of characteristic behaviors and thought styles. It has made it possible to develop instruments to measure it, while thousands of words have been written in relation to it. From a psychological point of view, creativity is studied to be understood, predicted, and controlled.

Creativity is an elusive construct. Its standard definition generally involves originality and utility (Runco and Jaeger, 2012). However, when it comes to embracing it in its entirety, few approaches to creativity are parsimonious. By not considering the principle of parsimony, the complexity of the object of study overflows; it becomes elusive and probably ends up not being studied at all. A parsimonious approach may contain the simplicity of Guilford's (1950) proposal or may describe its cognitive, socio-affective, and physical components (Hadani, Fortescue, Rood, & Runco, 2014): (a) imagination and originality, (b) flexibility, (c) decision-making, (d) communication and self-expression, (e) collaboration, (f) motivation, and (g) action and movement.

The principle of parsimony represents a great challenge, as the scientific approaches to creativity are so diverse that they may even appear to speak different languages. In this sense, Hennessey and Amabile (2010), in a review of the relevant literature, point out that the approximations (or interrelationships of forces) to the comprehension of the creative phenomenon can be considered as a series of concentric circles in which the most internal is

the neurological force followed, in ascending order, by affection and cognition, the individual and the personality, the group, the social environment, society, and culture until finally reaching systemic approximations. This categorization is probably more useful than the classification originally proposed by Rhodes (1961): person, process, and product. The concentric circles described by Hennessey and Amabile are a representation of the levels of analysis of the creative phenomenon. They also represent the way in which forces operate or interact. Finding elements that bind variables that can be linked in a solid way is likely to lead to greater parsimony. For this reason, it is worth highlighting the chapters of our guest authors, Marc Runco and Manuela Romo; their approaches are undoubtedly contributions that both synthesize and expand. These are parsimonious visions of creativity, visions that are doubly appreciated: once for their contribution and twice for the fact that they were created for this book.

As virtually any thought process does, the generation of creative ideas requires a certain amount of association. Perhaps what makes this process unique in creativity is that the association is given unconventionally, and perhaps with some degree of over-inclusion (Schmajuk, Aziz, & Bates, 2009). However, it is also important to note that data on over-inclusion in creative thinking may be contradictory (Ottemiller, Elliott, & Giovannetti, 2014). Even so, it is widely accepted that the creative process requires openness and flexibility. In both cases, a type of associative effort is fundamental, which in the absence of a better word I will call “inclusive.”

In fact, if we were figuratively speaking about creativity, we would call it inclusion. Inclusion is more than a metaphor for creativity, it is its greatest encouragement and maximum expression, for inclusion means to listen to what is different, to dialogue with what is different, to encounter what is different, and in some way to merge with what is different. It is its maximum expression because it is the best example of what is human and reflects creativity as the greatest expression of a human capacity: Unlike creating from nothing, it is to create from something, from the union of what is different. In other words, to create is to include.

Inclusion is a word with a social meaning. Inclusion is spoken of when, for example, people with disabilities are incorporated into a school or company, or when spaces for diversity are opened up. Inclusion becomes a sign of a society that respects, integrates, incorporates, and probably goes further than those that do not. Thus, a human dimension is the same as a creative dimension.

For all of the above reasons, this book is inclusive and embraces diverse approaches and challenges of creativity in its first part, which are translated into creative approaches in applied psychology in its second part.

It is important to mention that the book was conceived as a work to be presented in the framework of the 75th anniversary celebration of the University of the Americas Puebla. However, the vicissitudes of a changing world altered our deadlines and even part of the original proposal, although the essential aspect remains: sharing expert visions alongside young, inclusive, and diverse proposals. The final version of this book was made possible due to the participation of our co-editor, Antonia Padilla, and the University of Guadalajara, which allowed our particular challenge to become a reality.

I would like to express my deepest gratitude to the authors who contributed to this book: Robert Sternberg, Howard Gardner, James Kaufman, Mark Runco, Keith Sawyer, Margaret Boden, and Manuela Romo. They are the undisputed leaders in the study of creativity, the promoters and motivators of knowledge. Without knowing it, they were essential for this book to see the light of day. Their generous contributions to this book, as well as their far-sightedness, will always be an incentive to explore new paths and face new challenges.

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## ABOUT THE AUTHOR

### **Julio César Penagos Corzo, Ph.D.**

He is the vice-president for Mexico, Central America and the Caribbean of the Interamerican Society of Psychology. Author of several articles about cognition in humans and animals. [julioc.penagos@udlap.mx](mailto:julioc.penagos@udlap.mx)



Perspectives on Creativity

part  
one







## Two Challenges For Researchers Studying Creativity

**JC:** Considering your work and experience, what are the main challenges for researchers working in the field of creativity in the XXI Century?

**Howard Gardner**  
Harvard University

To answer your question, I envision two challenges for researchers studying creativity, which may also be opportunities. First of all, in what ways do the digital media affect the nature and likelihood of various kinds of creativity? And second, what influences determine whether creativity serves ethical or unethical ends, and how can we encourage a “humane society”?

**chapters**

# Personal Creativity and Authenticity for a Creative 21st Century

► Mark A. Runco · University of Georgia

## PERSONAL CREATIVITY AND AUTHENTICITY FOR A CREATIVE 21ST CENTURY

Even a cursory glance at the creativity research in the past several decades shows clearly the elasticity of supply and demand. The scientific research on creativity increased steadily during this time period, and as it did so the breadth of applications also increased, which in turn led to a wider recognition of the benefits of creativity and an even more pronounced demand. Today things are moving faster than ever before. There is no sign of slowing. As you might expect, the theories and new ideas have outdistanced the empirical tests. Many new ideas in this field have yet to be fully tested. This is one reason to take stock and examine the new theories of and ideas about creativity. This chapter explores several of these new theories and ideas. Special attention is given to the theory of personal creativity, but this requires discussion of various key concepts, including authenticity, the dark side of creativity, problem finding, and literal divergent thinking. There is even brief discussion about the use of computers for creativity testing. Come to find out, the theories, methods, and concepts that are currently being bandied



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about are like insight; they evolve over time. In a word, they are protracted (Gruber, 1988). Some are not really new, or at least have roots in research from decades earlier.

The question of roots is an especially apt one in the field of creativity studies because newness plays such a central role in originality, and originality is vital for creativity. Not surprisingly, the originality requirement itself has a long history. Runco and Jaeger (2012) found indications of originality as prerequisite in theories dating before 1900. Also unsurprising is that the originality requirement itself is evolving. A clear indication of this can be found in the work on creativity and culture. Kharkhurin (2014), for example, had several concerns about the standard definition of creativity (i.e., originality and effectiveness) and suggested that originality does not have universal applicability. He described parts of Eastern culture where originality, and its correlates, such as individuality and independence, are much less valued than in the West. Kharkhurin also pointed to the value of *authenticity* when defining creativity in a fashion that is broadly applicable.

There are two interesting things about this suggestion concerning authenticity. One is that authenticity is connected to several of today's most popular research topics. Consider, for example, the *dark side of creativity*. This term was introduced by McLaren (1993) in an article that appeared in a special issue of the *Creativity Research Journal*. That special issue was edited by Howard Gruber and Doris Wallace. The entire special issue was focused on morality and creativity. A number of articles described creativity in the moral domain, some pointing to exemplars (e.g., Gandhi) and others offering ideas for education that would support the moral creativity of children's thinking (Haste, 1993). I myself explored the role of *intentions* in both creativity and morality (Runco, 1993). I also examined the relevance of conventions, which seemed to be quite important because (a) creative things are often unconventional, while (b) morals typically imply that conventions are abided. McLaren (1993) focused his discussion on the dark side and described how creativity may not depend on values. Original things can be beneficial to society, or detrimental. This distinction has attracted a great deal of attention, especially as of late. A number of investigations have been conducted on different aspects of the dark side. Cropley and Cropley (2010) extended this line of thought and offered the distinction between *malevolent* and *benevolent* creativity.

The connection to authenticity was offered by Tan (2016) in her expose of Confucius and creativity. This of course supports what Kharkhurin (2014) proposed about a cross cultural definition of creativity including authenticity. It also implies that this line of thought has a very long history, dating back at least to Confucius. As Tan (2016, p. 84) described it, "Confucius supported

incremental changes that were built upon the wisdom of the past and posited the need for everyone to engage in moral self-cultivation within a community.... Moral self-cultivation involves a creative process of self-directed learning, authentic moral motivation, and self-actualization where one examines, illuminates, and shapes the meaning of their lived experiences”.

As noted by Tan (2016), and explored below, personal authenticity and creativity does not stop with the individual. It starts with the individual but may become social—and benevolent. Incidentally, that is an excellent way to summarize the thesis of the present chapter.

The other interesting thing about this emphasis on authenticity is that it fits well with some of the earliest scientific studies of creativity. I am referring to the work of Maslow (1970) and Rogers (1972), each of whom was extremely interested in creativity, well before it was a popular topic. Both recognized the importance of creativity for development and health. At the heart of these humanistic theories was the idea of self-actualization. This is the epitome of psychological health. It is characterized by honesty with one’s self and acceptance of one’s own strengths and weaknesses. The self-actualized individual is relatively free of defense mechanisms that keep a person from being self-aware. In short, the self-actualized person is *authentic*. As a matter of fact, both Rogers and Maslow eventually gave up trying to extricate self-actualization and creativity. They both concluded that creativity was inextricable from self-actualization.

There seem to be several good reasons to recognize both the personal and the social benefits of creativity. The former are suggested by theories of authenticity and the latter by discussions of benevolent creativity, including that of Confucius. At the same time there are several reasons to maintain a distinction between personal creativity and social creativity.

### **SOCIAL VS. PERSONAL CREATIVITY**

Florida (2002) is well-known for his findings about the creative class of society and the geographic distributions of it. He also seems to appreciate the more personal benefits of creativity. He wrote:

Modern life is increasingly defined by contingent commitments. We progress from job to job with amazingly little concern or effort. Where people once found themselves bound together by social institutions and formed their identities in groups, a fundamental characteristic today is that we strive to *create our own identities* [emphasis added]. It is this creation and recreation of the self, often in ways that reflect our creativity, that is the key feature of creative ef-

fort. In this new world, it is no longer the organizations we work for, churches, neighborhoods, or even family ties that define us. Instead, we do this ourselves, defining our identity along the dimensions of our creativity. (p. 7)

Creativity can indeed be an entirely personal thing. This was implied above because, after all, authenticity is indicative of honesty with and acceptance of one's self. Personal creativity is also a part of the construction of one's identity. Elsewhere I went into great detail that it may also be a requirement for what Piaget (1976) called the invention of understanding (also see Runco, 1996, 2003).

Creativity is probably the most difficult when there is social pressure to behave or think in a conventional fashion. To be authentic, the person experiencing such pressures must rebel. This is why ego-strength is so important for creativity (Runco, 2003). Ego-strength gives the individual the confidence to resist social pressures and expectations. It may be that slumps in creativity, including the most common, occurring around age 9 or 10 years, could be avoided or minimized if the child has the ego strength to resist peer pressure.

Hence, although social influences no doubt play some general role in the context of creativity (e.g., determining which resources or domains are available), it is possible, and in fact important, to recognize that creativity can be a personal thing. This must be emphasized because so many definitions these days emphasize the social side of creativity (e.g., Glaveanu, 2014; Kasof, 1995; Sawyer, 1992). Glaveanu, for instance, put it this way:

The most important part of creativity . . . [is] the reconstruction of this work, symbolic and material, when perceived and used by others. Without this ability to make existing things new by reworking our understanding of them and relation to them, the Mona Lisa would simply be today an old, well crafted painting (Glavenau, 2014, p. 20).

This view implies that creativity must be social. "Others" must recognize contributions as creative or they are not creative. Sadly, that view disregards most everyday creativity, as well as the creativity of children. It will make it quite difficult to determine how to best fulfill creative potentials, given that by definition potentials are latent and not overtly expressed.

The most detailed social theory may be that of Kasof (1995). He went into great detail about how creative things must be judged and socially recognized, and how creativity therefore involves expectations, social context, and even impression management. Kasof went as far as to recommend the

study of impression management in order to insure that one's work attracts attention (and may be judged to be creative). This strikes me as contrary to the emersion and intrinsic motivations that have been shown to be so instrumental in creative work. Surely a person who is investing in impression management has less time to invest into his or her creative thinking.

The theory of personal creativity, like the definition of creativity that includes authenticity, has a protracted history. This includes discussions of authenticity and self-actualization, several of which were cited above, but a turning point occurred when social definitions of creativity seemed to take hold in the research. In a manner of speaking, the theory of personal creativity is a reaction to the emergence of social theories. Many of these have gone too far and claimed that without social recognition, there is no creativity.

### CREATIVITY NEED NOT BE SOCIAL

*Personal creativity* is a fairly new label, but the idea that creativity depends solely on intrapersonal processes is fairly old. A careful reading of history might even show that this idea was intertwined with genius and its origins. In one historical analysis, Albert (1975) described how genius was once explained in terms of Muses and other outside forces, and it only eventually became a characteristic of the individual. The concept of creativity was not yet operationalized when genius was attributed to the Muses, and in fact it took quite some time for creativity to separate itself from "intelligence," "giftedness," and genius, but the point is that various expressions of human ability and talent have, at various points in history, been explained in terms of outside, contextual, or social determinants.

Some of the early scientific research on creativity held the personal, individual view, as is apparent when reading Patrick (1934, 1935) and the research from IPAR in the 1950s and 1960s (see Helson, 1999). This early research borrowed various personality tests and administered them to unambiguously creative groups (e.g., architects, writers), results being presented as profiles of creative personalities with certain core characteristics (e.g., openness, wide interests, intrinsic motivation, independence). Although judges were sometimes involved in the IPAR research, perhaps ranking the participants or their responses to the various inventories, the findings of this work assumed creativity to depend on certain characteristics of the individual.

Quite possibly the trend towards socially recognized creativity was supported by the growth of the field and the interest in being scientific and objective. The social view assumes that objectivity is a matter of agreement among "appropriate judges." The problem, of course, is that this objectivity does not apply outside of that particular group. Empirical research shows significant discrepancies among different groups of judges (Runco, McCar-

thy, & Svensen, 1994; Runco & Smith, 1992). There are even more dramatic discrepancies when judgments from different eras are compared (Runco, 1993; Runco, Acar, Kaufman, & Halladay, 2016; Runco, Kaufman, Halladay, & Cole, 2010).

The theory of personal creativity acknowledges that social recognition is an important part of innovation, social change, and progress. All it does is insure that the label “creativity” is reserved for the processes involved in bringing something new (and useful) into being. That might be an idea, insight, or solution, and whatever it is *might* be shared and eventually have social impact. If it does, there is a good way to describe it: impact.

Socially recognized creativity is more than creativity. It is creation *and* recognition. The former is what a person brings to the process; the latter is what others bring, or more accurately, how they react. To be parsimonious and have a detailed understanding of the creativity, its distinctiveness from recognition must be respected. The same should be said about fame, impact, or reputation (Runco, Kaufman, Lindzay, & Acar, 2015). These may result from creativity but they are not vital parts of it.

## THE CREATIVE PROCESS

Certainly it would help to be specific and avoid the too general label “creativity.” One way to be specific is to separate creative *potential* from creative *performance*. The former characterizes individual talent. The latter includes various forms of accomplishment and, well, each of those things listed just above (i.e., social recognition, fame, impact, and reputation). Runco (2008) used a hierarchy to show how creative potential is related to personality, context, and cognitive ability, while creative performance is an entirely separate umbrella under which accomplishment, behavioral activity, products, and all sorts of creative performances fall.

Another approach describes stages of the creative process. There are a number of such stage theories, though most bear some resemblance to that proposed by Wallas (1926). This begins with preparation, incubation, illumination, and then verification. Some add a fifth stage, called something like implementation. This stage might help to distinguish what an individual does (e.g., incubate) from what occurs after a creative insight comes to light. That does assume that the insight is implemented and is judged to be creative. It also conflates creativity and innovation. That is because creativity is a prerequisite for innovation, the difference being that innovations are implemented. Thus another stage is probably necessary if this approach is to help distinguish personal from social creativity. Given the discussion above, a good name for this stage would be *social recognition*. Realistically, it might be a part of implementation, but this creates no problems because



even implementation is after the personal processes, including incubation. Several other stage theories of creativity are presented in the edited volume by Runco (1994).

It would be most useful to go beyond labels and to describe the mechanism used by the individual when creating a new and useful idea, insight, or solution. My own attempt at this, presented here as just one example (also see Jay & Perkins, 1997), focuses on (a) constructions of original interpretations of experience, (b) intentions, and (c) discretion. The first of these is interpretive in the sense that information is transformed by the individual into new and useful meaning. Bruner (1972) might have been thinking of this sort of thing when he penned “Beyond the Information Given.” Various lines of research confirm that individuals can go beyond given information and construct new meanings. This includes research on perception, top-down processing, and assimilation. Intentions are included in the creative process because new things can be found by accident, and there isn’t much talent in that, other than recognizing something new when you see it. Discretion is included because creativity is more than just originality. Creative things are also effective (Runco & Jaeger, 2012). It is discretion that separates truly creative work from the originality that is just bizarre, irrelevant, or psychotic.

Personal creativity may not lead to an artifact or product that is available for social judgment. It may result in original and effective insights, solutions, or ideas instead. This does not mean that personal creativity cannot be studied objectively. Ideas, insights, and solutions can each be studied empirically and objectively. Gruber (1985, 1988) was, for instance, cited above for his work on insight (and for his finding them to be protracted). Other views of insight have been presented by Alba and Weisberg (1983) and Epstein (1990). Creative solutions, on the other hand, are usually investigated by studying problems, though here we must be careful, given the important distinction between problem solving and problem *finding*. This may even qualify as another of the key ideas in the science of creativity! Without a doubt, creativity may occur before the person even starts to solve a problem. Creativity may be seen before solutions make themselves known, even before a problem has been defined. Some have gone as far as to say that there is more creativity in finding and defining a good problem than there is in solving problems (Getzels, 1975). To be thorough, the different labels used for problem finding should at least be mentioned. Preparation was already mentioned, but others have looked to problem identification, problem discovery, problem construction, problem generation, or problem definition.

A large amount of research on the creative process looks to ideas instead of insights and instead of solutions. This usually relies on models and tests of *divergent thinking*. Here again there is a long history, with various starts and

stops. Even Alfred Binet, in the first test of mental ability (precursor to the IQ test), had a task that would allow ideation. It was Guilford (1950, 1968), however, that offered a variety of measures of divergent thinking (including Uses, Consequences, and Plot Titles tests) and published extensive data on the separation of divergent and convergent thinking. The Zeitgeist of this work was quite receptive to an alternative to the IQ test, but eventually questions arose about Guilford's statistical assumptions and the predictive validity of divergent thinking tests. The limitations of divergent thinking test scores are now very widely recognized and they are today frequently used in research and education. Runco et al. (2012) offered a modicum of evidence for the predictive validity of divergent thinking test scores in a 50-year longitudinal project. The moderate validity was really to be expected, given that divergent thinking is not synonymous with creativity. Tests of divergent thinking are really just estimates of the potential for creative thinking.

One new line of research on divergent thinking has attempted to redefine the process as literally divergent. Acar and Runco (2012, 2013) began this work by criticizing previous research thinking that seemed to ignore the divergence in the divergent thinking. They described how non-divergent (e.g., linear) thinking could be used by an individual, who might even earn high scores for originality, flexibility, and fluency, even with no divergence of thought. Acar and Runco proposed and tested several new methods for assessing the actual or "literal divergence" among ideas. One of their methods started with 13 polar dimensions of thought (e.g., conventional vs. unconventional). These were used to code ideas such that a person could pursue one line of reasoning, but eventually diverge and pursue an orthogonal or oblique (i.e., divergent) line of reasoning. Indeed, polarities such as conventional vs. unconventional were used because the creative process may sometimes involve seeming paradoxes, such as ideas that are inherently contradictory (e.g., both playful *and* mature, or serious *and* humorous). Rothenberg (1997) offered experimental evidence showing creative insights to depend on the integration of opposites, while MacKinnon (1965) and Csikszentmihalyi (1996) found certain creative persons to be so comfortable with seemingly incompatible behaviors that they referred to the *paradoxical personality*.

Acar and Runco (2014) used computer coding of responses to divergent thinking tests, which is yet another relatively new idea in this field. Semantic and associative networks (e.g., WordNet, Word Associations Network, and Idea Fisher) were used to determine the semantic distance covered by various idea pairs. Their analyses confirmed that both close and remote associates can be reliably measured with this kind of computer scoring system. Additionally, there was a correlation between both close and remote associates and a measure of creative attitudes. Beketayev and Runco (in press)

extended this line of work by using 12 associative networks. They found that certain computer-generated scores might be used to replace traditional indices of divergent thinking. One computer generated score was based on the number of conceptual categories used by an individual, for example, and as expected it was highly correlated with the traditional ideational flexibility score. A number of other computer-scoring systems are available, as well.

The main point of this is that there are new methods, and a bit of new theory, being applied to creative ideation and the creative process. None of this assumes that divergent thinking is involved in all creative work. Divergent thinking tests are merely tools that allow one measure of the potential for creative problem solving. This does not imply that divergent thinking is anywhere near synonymous with creativity. The research on divergent thinking is, however, a nice reminder that it can be useful to study creative potential (e.g., the capacity for original and flexible ideation) and that this is very different from socially recognized creative accomplishment. As mentioned above, it is reasonable to think that the former is required for the latter and that research on creative potential is useful for discovering how to best fulfill these potentials.

## CONCLUSIONS

This chapter broaches the key idea of personal creativity from several angles. It examines its roots in the research on self-actualization and bridges self-actualization with creativity by reviewing early humanistic thinking about creativity and by acknowledging the role of authenticity. The recognition of authenticity in turn supports the cross-cultural applicability of personal creativity. Limitations and assumptions of the alternative view, which points to social creativity, are mentioned (also see Runco, 1995, 1996, 2003). These underscore the need to look to personal creativity, especially when the interest is in fulfilling potentials or understanding what is universal about creative behavior. The theory of personal creativity is parsimonious in that it places social recognition and judgment as late stages which, although significant for many areas of performance and for innovation, are not vital to the actual process of creation. This chapter finally turns to insights, ideas, and solutions, but just as examples of indicators of creative potential.

The implications for efforts to fulfill creative potentials are quite practical and might be considered in educational efforts, or even policy efforts, given the all-too-common macro-problems facing society (Ambrose, in press; Runco, in press). This also brings us back to a point made early in the introduction to this chapter. It concerned supply and demand, the elasticity of which is often cited in the economic literature. Also economic is that, more and more, creative talent is being recognized as a valuable commodity, an asset, a form

of human capital. As this volume attests, that view is now prevalent—and, of course, it too has a protracted history. Guilford (1950) argued that creativity was among our more important natural resources in his 1949 Presidential Address to the American Psychological Association.

For clarity, the key ideas presented in this chapter can be listed as follows:

- Authenticity is a part of a definition of creativity;
- problem finding plays a significant role in creativity;
- literal divergent thinking may be different from what is often measured by so-called tests of divergent thinking;
- computers may be useful for creativity research;
- and social recognition is extricable from the creative process.

Standing back, the interesting thing is that each is seemingly new, though each has a history. The discussion of each cited idea goes back several decades, at least. The recognition of the various roots of ideas that are currently being used in the creativity research does not at all undermine the originality of the new research efforts. After all, the ideas are being combined and reinterpreted in original ways. Recall here the idea presented earlier that interpretation is a part of the creative process. Additionally, all scientific endeavors are collaborative and cumulative. The science of creativity is no exception. It has a history and roots, but also great promise, as is implied by all of the key ideas presented in this fine volume.

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## ABOUT THE AUTHOR

### **Mark A. Runco, Ph.D.**

He has published approximately 200 articles, chapters, and books on creativity. Editor of *Creativity Research Journal*, and member of editorial boards of leading creativity journals. He has received several important awards and honors. [runco@uga.edu](mailto:runco@uga.edu).



2

chapters



# Recent Considerations on Creativity Assessment Methods

► Tatiana de Cássia Nakano · Pontifical Catholic University of Campinas, Brazil

## CREATIVITY ASSESSMENT: QUESTIONS, DIFFICULTIES, AND CHALLENGES

Responding satisfactorily to the problems involving the consolidation of reliable ways to assess creativity is a need that has been increasingly required from researchers in order to reduce concerns about the validity of measure, particularly given the subjectivity and the broadness of the concept (Beghetto, Plucker, & MaKinster, 2001; Cropley, 2000). A consensus about the most appropriate way to assess this construct has not been reached yet.

It is still common to find in the literature authors who are skeptical about the possibility of assessing this construct, relying on arguments such as the idea that the measures could be useful as indicators of overall performance, but, if considered individually, they hardly contribute to the understanding of the phenomenon (Perkins, 1999). Other authors also point out that, when trying to answer questions about the possibility of measuring such a complex construct, creativity often ends up being mistakenly taken as a general domain,



The scientific research on creativity increased steadily during this time period, and as it did so the breadth of applications also increased, which in turn led to a wider recognition of the benefits of creativity and an even more pronounced demand.

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subject to evaluation by a single instrument and by the tasks involved in it (Kim, 2011). This idea itself would create the belief that if the individual is not creative in one area, he will probably not be in others, ignoring the existence of a wide variety of specific areas (confirmed by low correlations between different measurements of creativity, which are often restricted to a single type of item or task). The different types—verbal or figurative, for example—are also highlighted, which can catch different facets of creativity. In this sense, Treffinger (2009) related a problem with the expectation about a single instrument that will measure a person's aptitude or potential for creativity, adjusted for any setting or age. He affirms that, in this case, the problem is not the tests, but the expectations.

A similar concern is presented by Silvia (2011) when stating that most of the instruments are usually composed by many kinds of tasks, whose grades are combined by using the sum or simple average. It disregards, thus, the different creative processes involved in each type of task and so affirming their equivalence and ignoring the possibility that each one would capture different facets of creativity as well as knowledge, strategies, and differentiated skills.

Due to these controversies and the effort of researchers to understand the limits of the measures of a broad construct, recent discussions on the methods used for their assessment has been occurring, especially considering the administration and scoring methods used in creativity measures, taking into account that little has changed since the 1960s and that the advances in psychometrics and psychological assessment over the past decades are being ignored (Silvia, Winterstein, Willse, et al., 2008).

In an attempt to solve part of the problems and questions present in the area, several solutions for assessment of creativity have been proposed and will be presented here. Criticism will also be discussed in order to enable a better judgment by the reader. Such models propose both the use of new forms of assessment and recent methods of data analysis, such as multilevel modeling (Silvia, 2007), partial credit models (Nakano & Primi, 2014) and models of latent variables (Silvia, 2015).

### **PREDICTIVE VALIDITY OF CREATIVITY ASSESSMENT TOOLS**

The first point highlighted in the most current research concerns the questioning about the predictive power of the tests that are been used in the assessment of creativity. According to researchers involved in this discussion, so far there have not been consistent studies so far that ensuring that the test results could predict creative achievements in adult life in personal areas, but not in creative public achievements (Runco, Millar, Acar & Cramond, 2011). For example, Kim (2006) and Lemons (2011) draw attention to the in-

fluence of motivation, life events, and opportunities that affects adult creative achievement.

In this sense, one of the problems specifically related to these instruments refers to the misinterpretation of objectives, according to Kim (2006). This is due to the fact that the battery of tests developed by Torrance (1966) is usually identified as a measure of creativity, although they were not designed to measure it initially; in fact, they were designed as tools for its enhancement. However, their practical use has shown a different application of the results that are, most of the time, taken as a criterion to classify the level of individual creativity. Other researchers point to the fact that a methodological factor that may have a negative impact on the predictive validity of test scores is the criteria in longitudinal studies (Plucker & Runco, 1998).

The same concern is pointed out by Zeng, Proctor, and Salvendy (2011) when questioning the predictive ability of tests regarding the evaluation of creative potential in real life. The authors presented a few arguments which weakened the evidence of validity and reliability of these instruments: (a) emphasis on aspects such as novelty and originality, which have been highlighted in detriment of the investigation of adequacy, value, and practical application of ideas; (b) belief that the instruments may provide creative potential in various fields, in contrast to the idea of creativity as a specific area; (c) low correlation between creative skills measured by tests and creative achievements in real life (around .20 and .30); (d) using tasks that do not involve real-life problems, whose predictive ability is much smaller than those who use real-life ones (mean of .30 versus .49, respectively); and (e) problems related to the discriminant validity of the measures, notably the high correlations between the characteristics evaluated in these instruments (fluency, flexibility, and originality), which will be addressed later. A sixth point highlighted by Glaveanu (2010) is noteworthy: most of the studies on creativity have been developed based on artificial tasks and contexts, which has little or no relation to the cultural context or to real-life issues.

### **STRUCTURE AND INDEPENDENCE OF EVALUATED TRAITS**

A second point that has been emphasized when questioning the measuring of creativity refers to the factorial structure of the parameters typically applied in the evaluation of creativity and the independence among them. Regarding this issue, many studies using factorial analysis can be found in scientific literature, applying a single instrument or a battery of tests (e.g., Belcher, Rubovits, & Di Meo, 1981; Clapham, 1998, 2004; Heausler & Thompson, 1988; Kim, 2006; Kim, Cramond, & Bandalos, 2006; Plass, Michael, & Michael, 1974).

Analysis of factorial solutions mentioned in those studies suggests a diversity of results (Primi, Nakano, Morais, Almeida, & David, 2013): (a) factors

that group test activities; (b) factors that combine creative parameters; (c) studies that considered creative parameters as a whole, disregarding their occurrence in different activities; and (d) studies that found a general factor of creativity. According to the authors, part of the results can be credited to methodological differences, especially those related to the choice of variables analyzed and the existence of co-linearity among them, a fact that makes it difficult to compare results.

In this sense, many researchers have been pointing for a long time to problems resulting from the high correlation between some of the creative characteristics, especially among fluency, flexibility, and originality (Chase, 1985; Clapham, 1998; Heausler & Thomson, 1988; Runco & Mraz, 1992), presenting results showing correlation values ranging from .52 to .92. This would be explained by the fact that fluency would eventually include other characteristics (due to the fact that this parameter is mandatory so that others can be scored), which would require attention and control. If we consider fluency as equal to the number of different responses (defined as flexibility) plus the number of repeated responses, the indicators cannot be considered independent (Primi et al., 2013). How they are being considered does not make them indicators statistically and conceptually independent of a same latent variable (Primi, 2014). Also, the more ideas produced, the better their chances of being original, confirming the strong dependence between indicators of fluency and originality.

In this sense, we have already found studies in which the investigation of the factorial structure was performed by controlling the combination between fluency and flexibility (Primi et al., 2013), whose results indicated different structures when controlling or not this collinearity. From the analysis of two figural tasks and two verbal tasks of Torrance's tests, applied on 193 Portuguese students, the authors found a factorial solution composed of four factors which basically divide the activities. However, when collinearity between fluency and flexibility was controlled, a new structure of the four factors was found, separating similar processes (characteristics) and content type (verbal or figural) but not the activities anymore. Plucker, Qian, and Wang (2011) also proposed another method for scoring originality based on the percentage scoring method (dividing originality scores by fluency scores). These results point to a new focus of research to be developed.

### **NEW METHODS OF ASSESSMENT OF CREATIVITY: SUBJECTIVE EVALUATION**

A third point refers to the necessity of developing new models of evaluation, more optimized, valid, and accurate (Silvia, Winterstein, Willse, et al., 2008). For the authors, given the advances in psychometrics and psychological eval-

uation in the last forty years, using the traditional ways without questioning or reviewing them is unjustifiable. Thus, it is possible to see rising in the international literature new proposals for the assessment of this construct, which will be presented below.

### UNIQUENESS SCORE

Proposed by Wallach and Kogan (1965), it redicts the score of the answers of individuals on two criteria: fluency (number of responses) and uniqueness (number of unique responses). The answers that were not given by any other participant would score one point, while the ones already mentioned by others would score zero. Given its simplicity, the method of uniqueness has become popular due to both its ease of quoting and its objectivity (Silvia, 2015).

Criticism of the model is based on three main points (Silvia, Winterstein, & Wilse, 2008). The first relates to the dependence of the sample, since given a small sample, the probability of a unique answer is much higher than in a larger sample. The prevalence of single responses would decline following the increase of sample size, which varies among studies. The second point is marked by the misunderstanding between fluency and uniqueness, as people who generate more ideas are probably more likely to have unique answers. The third point, in turn, is supported by the fact that this method evaluates the amount of ideas, not their quality, since a unique answer is not necessarily synonymous with high quality and can be irrelevant or inappropriate to the task. Measurement errors increase by not distinguishing unique answers from inadequate ones.

### Average Score and Top 2

Starting from the combination of existing ideas, some new subjective assessment methods of creativity have been tested, which have received less attention compared to objective methods because the former require more research resources (given the need to estimate not only the variance due to traces but also to judges) and also because researchers still mix up the term “objective” with “valid” (Silvia, 2011).

Unlike traditional methods that involve the score of several characteristics associated with creativity (mentioned previously), the two new methods would consist of: (a) an Average Score, in which all the answers given by the subject are estimated by calculating a simple average of the scores and (b) the *Top 2*, the score of the two best answers indicated by the subject himself. In both methods, a scale of 1 to 5 is used (1 = not creative, 5 = very creative), determined by the analysis of criteria such as rarity, distance between associations, and intelligence (considering humor, irony, and insight combination). Questions about the accuracy or reliability of the methods assessed mainly

by estimating the number of successes and precision / discrepancy between a person and the other evaluators has been raised (Silvia, 2008).

With the focus on checking the validity of the new methods proposed, two studies were conducted. In the first one (Silvia, Winterstein, Willse, et al., 2008), both models were compared to the traditional model of Wallach and Kogan (1965), called *Uniqueness Scoring*, in which answers are scored as 0 or 1, taking as a criterion their singularity (a point to unique responses in the sample). Results showed that the simplified correction model *Top 2* stood out from the others, showing appropriate results of validity and reliability. On the other hand, the results of the second study (Silvia, 2011) showed that the method of Average Score has a higher precision, indicating that both methods probably capture different sides of divergent thinking and reinforce the relevance of studies which explore new methods of scoring and statistical models in the assessment of this construct.

However, these models were received with a considerable amount of criticism by the scientific community and were subjected to questioning regarding the methodology used (Kim, 2008; Lee, 2008; Mumford, Vessey, & Barrett, 2008), as well as the interpretations of the concept of creativity involved (Runco, 2008) and inappropriate use of the technique of consensual assessment (Baer, 2008). It should be noted, though, that favorable opinions were also found (Kogan, 2008). Regarding the argument that the subjects are not able to judge their best ideas, Ng and Feldman (2012) suggest that other studies showed that the individual themselves is in the best position to evaluate their own creativity because they are the most conscious person of the value of their contributions.

In response to the critics, Silvia, Winterstein, and Willse (2008) reaffirm the importance of this kind of study, since there are only a few researches performing comparisons of scoring methods, which is the main merit of this research. They also point out that validity is not a simple task that can be proven from a single study, although it has provided strong evidence of reliability, emphasizing that future investigations may reveal the strengths and weaknesses of this approach. Thus, according to the authors, the proposed methods could solve some evaluation issues that previous methods failed to, justifying its relevance when considering that, historically, psychology of creativity has accumulated enough knowledge of how people generate creative ideas, but there is still a lot to be explored regarding how they judge their own ideas (Silvia, 2008).

### **CONSENSUAL ASSESSMENT TECHNIQUE**

Another method frequently discussed nowadays is the Consensual Assessment Technique (CAT), which consists of an independent judgment of prod-

ucts by experts, on a scale that ranges between the lowest and the highest levels of creativity.

The pioneer in the use of this technique was Amabile (1982), who was based on the finding that a product or response is creative when suitable and independent observers (familiar with the domain in which the product was created) agree that it is creative. Results from a series of studies she conducted using a wide variety of tasks pointed to coefficients of precision from about .70 to .90, encouraging further studies based on this technique.

It is based on the individual perception of each judge about what is creativity without further guidance or training provided. Such an approach has been brought to use again more recently given two main advantages: (a) unlike other creative measures, the CAT is not based on a specific theory of creativity, so its validity does not depend on this factor (Kaufman, Baer, Agars, & Loomis, 2010) and (b) it allows the evaluation of a wide range of creative products, being sensitive to cultural and historical variations in the judgment of creativity (Chen et al., 2002) and does not utilize standardized scores, which is considered to be an advantage because this method compares the scores between participants, not to a normative sample (Kaufman, Plucker, & Russell, 2012).

In this method, judges evaluate the response of each subject within a scale, usually of two to three points. These assessments are usually added up and then used to produce an average score, which can be used within a model of latent variables to estimate the specific variance due to judges or even scaled within Facet Rasch Models, which consider the score according to the difficulty of the task and the judges (Primi, 2014).

Given the evident need in the literature for utilizing expert judges in this type of evaluation—even though it is not clear how essential the use of the expert evaluators would be nor the kind of knowledge necessary to consider a judge an expert—some researchers started working on inquires to answer the following question: could non-expert evaluators reach a consensus and provide adequate judgments of creativity? The advantage of this type of study, in case of results that pointed to similar judgments between experts and non-experts, would be the possibility of replacing experts in order to facilitate future investigation of creativity. In the case of there being differences between them, it would help to understand in what kind of judges would be more appropriate.

With this purpose, Kaufman, Lee, Baer, and Lee (2007) developed research in order to compare the accuracy of the evaluation between two different groups of judges, the first consisting of experts and the second of non-experts (college students). Results showed relevant differences between the evaluation by groups on the assessment of poems, given the low correla-

tion between groups ( $r = .21$ ), although significant (Kaufman, Baer, Cole, & Sexton, 2008), indicating it is not possible to replace one type of evaluation with the other. It was also possible to find high accuracies within groups (above .57 for experts and .80 for non-expert judges) so that even beginner judges have a common and consistent metric among them. Nonetheless, it was not the same metric used by the experts. These results seem to indicate that the replacement of expert judges is not a simple task, with the risk that such a procedure may cause different results.

Some technical limitations are also presented in the literature, mentioned by Kaufman et al. (2008). They highlight the difficulty of finding enough experts in the field of investigation when a large number of products need to be evaluated, in addition to the high cost of it. Other limitations are the lack of studies inquiring the efficacy of training novice judges so that they can carry out judgments like the experts and the obstacles caused by the assumption that there is only one facet in the evaluation of creativity—the variance between judges—, disregarding the influence of other factors when determining the precision of the measurement (Kaufman et al., 2007).

Other criticisms to the model, evidenced by Piffer (2012), are based on the moderate reliability of test-retest (which is not very high compared to most psychometric instruments), a high degree of domain specificity (low correlations between creative performances in different domains), and the evaluation of a limited number of products. Thus, he argues that CAT can evaluate the creative potential in specific domains and not as a general trait.

It should be noted, however, that a few studies aiming to answer these questions have already been conducted. Regarding the first limitation, Primi, Miguel, Couto, and Muniz (2007) evaluated the accuracy of judges with different levels of expertise (post-graduate students, university students, and professors).

Results indicated a correlation value judge-total of .74 on an instrument to assess creativity through metaphors (from the criteria of equivalence and remoteness). Similarly, by using the Many-Facet Rasch model, Primi (2014) aims to answer the two first critics by pointing out as an advantage in using this method the possibility of building a common metric among the judges, so that it would not be necessary that all judges evaluate all the answers. This optimizes the work and expands the knowledge of different parameters (level of creativity, difficulty of the item, and severity of the assessment) and of determinant factors for the accuracy of results.

Amabile (1982) also points to the fact that this method proves to be impractical in the short term, to its restriction to the historical moment and the dominant conceptions of creativity, as well as to the difficulty of applying it to the judgment of revolutionary products, given the complicity of the



judges to reach an agreement on the level of evident creativity given the lack of familiarity with the new domain. Thus, more studies are recommended in order to obtain more conclusive answers.

### SNAPSHOT

Another recent method seen in the literature is called Snapshot, studied by Silvia, Martin, and Nusbaum (2009). It is considered a quick and simple method to assess creativity and, for these reasons, it aims to replace the others given the advantages of saving the time and staff required. Evaluators judge a set of responses and provide a single overall rating for the entire set. There is no internal coding or score. For tasks such as pencil and paper, the evaluation of the responses is written on the answer sheet, avoiding the need for transcription or typing into a correction/score sheet in order to facilitate the work of the judge. Results showed that, on the evaluation of two tasks by three judges with a scale of 1 to 5 (not creative to very creative, respectively), precision indicated a value of .83.

A second study of validity comparing this method to the *Top 2* using only the two best answers to evaluate the subject's creativity level applying the Structural equation modeling indicated that the Big Five explained a higher percentage of variance of the *Top 2* method (48.3%) compared to the Snapshot (15.5%), indicating as well greater predictive effects obtained by the *Top 2* method. Given the results, the authors concluded a positive evidence of reliability and validity of the method.

### CONCLUSIONS

A review of the literature points to several historical issues that are being faced by researchers interested in creativity assessment. Although an increasingly desired trait, difficulties in identification are still present, given the wide variety of methods that have been used by researchers from various fields in an attempt to understand how such a construct is accessed, manipulated, combined, and transformed into a vision in which this characteristic stands out as one of the 21st Century Skills (Kaufman, 2010; Piirto, 2011; Trreffinger, Schoonover, & Selby, 2013).

In an attempt to solve these problems, various methods have been proposed by researchers. Although showing promising results, these studies are still in early stages so there is a need for continuity and in-depth studies. That is the only way to reduce the researchers' mistrust. Advances in assessment and statistical methodology allowed creativity to be examined psychometrically, tracing directions for research and practice in this area (Plucker & Runco, 1998). Investigations directed to the use of these new methods and more complex and current procedures of statistical analysis should be encouraged so that the area can achieve maturity.

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## ABOUT THE AUTHOR

### **Tatiana de Cássia Nakano, Ph.D.**

She has experience in Psychology, focusing on psychological assessment of children in the following subjects: creativity, intelligence, drawings, gifted, socioemotional abilities, and positive psychology.

[tatiananakano@hotmail.com](mailto:tatiananakano@hotmail.com)

3

chapters

# Correlates between Two Measures to Assess Creativity in Argentine Children: CREA and TTCT\*

► Gabriela Krumm, Vanessa Arán Filippetti, Viviana Lemos

- Grupo Vinculado en Entre Ríos al Centro Interdisciplinario de Investigaciones en Psicología Matemática y Experimental Dr. Horacio J. A. Rimoldi (CIIPME). Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina.

- Universidad Adventista del Plata, Entre Ríos, Argentina.

Correspondence: Centro de Investigación en Psicología y Ciencias Afines, (CIPCA) de la Universidad Adventista del Plata, Cervantes 70, 3103, Libertador San Martín, Entre Ríos, República Argentina.

## ABSTRACT

This study aimed to compare two performance tests that assess creativity in school-aged children. A total of 272 children—of both genders aged 8-13 years, and from different schools of the province of Entre Ríos—completed the TTCT Figural (Form A) and the Creative Intelligence test CREA. For data analysis, partial correlations controlling for age and hierarchical regression analysis were used. The results showed significant positive correlations between the CREA and the skills Fluency, Originality, Elaboration, and Resistance to

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Creativity assessment poses a significant challenge for researchers in this area, as it aims to observe and measure ideas, products or people that are novel, innovative, original, or atypical (Silvia, Wigert, Reiter-Palmon, & Kaufman, 2012).

Premature Closure of the TTCT; a significant positive correlation between the CREA and the final score of TTCT and the Innovative and the Adaptive factors was also found. Hierarchical regression showed that only Fluency, Elaboration, and both TTCT factors predict Creative Intelligence. These data suggest that the concurrent validity between both tasks is partial; hence, the CREA could be considered an interesting tool for screening, but it should be complemented with the evaluation of other aspects of creativity, not covered by its single score.

**Keywords:** creativity, creative intelligence, TTCT, CREA, children

Creativity assessment poses a significant challenge for researchers in this area, as it aims to observe and measure ideas, products or people that are novel, innovative, original, or atypical (Silvia, Wigert, Reiter-Palmon, & Kaufman, 2012). It has focused on the study and analysis of creative cognition, creative traits, and achievements, divergent thinking tasks being so far the most widely used to value creativity (Kaufman, Kaufman, & Lichtenberger, 2011; Kaufman, Plucker, & Baer, 2008) in children and adolescents.

One of the initial views of creativity, which emerged with Guilford's (1950, 1967) intellect model and that currently remains, relates to a set of four abilities: Fluency, Flexibility, Originality, and Elaboration (Kaufman et al., 2011). Tasks based on this paradigm include the Torrance Creative Thinking Test (TTCT) (Torrance 1966, 1974, 1990). The TTCT is based in part on Guilford's concept of divergent production (Kaufman et al., 2011, Kaufman, Plucker, & Rusell, 2012) and represents the most widely used instrument for creativity assessment (Cropley, 2000; Davis 1997; Kaufman et al., 2008). It consists of two subtests, a Verbal and a Figural one, and each test has two parallel Forms, A and B; it might be administered either in a group or individually (Torrance, 1990; Torrance, Ball, & Safter, 1992).

Due to the TTCT widespread notoriety, much research has examined its factorial structure (Primi, Nakano, Morais, Almeida, & David, 2013) finding, in general, that the skills evaluated by the TTCT do not correspond to Torrance's theoretical proposal (Almeida, Prieto, Ferreira, Oliveira, & Ferrándiz, 2008; Aranguren, 2014; Heausler & Thompson, 1988; Hocevar, 1979; Kim, 2006; Kim, Cramond, & Bandalos, 2006; Krumm, Aranguren, Arán Filippetti, & Lemos, 2014; Krumm & Lemos, 2010; Krumm, Lemos, & Arán Filippetti, 2014). Specifically, in regards to the Figural TTCT, some research has suggested that it would measure a general factor (Clapham, 1998; Hocevar, 1979), being demonstrated by the high correlation among some of the skills measured by the test (Aranguren, 2014; Clapham, 1998; Heausler & Thompson, 1988; Kim, 2006). However, a large number of studies have identified more than one factor by means of Exploratory (EFA) and Confirmatory Factor Analy-



sis (CFA) (Almeida et al., 2008; Aranveden & Morais, 2012; Clapham, 2004; Heausler & Thompson, 1988; Kim, 2006; Kim et al., 2006; Krumm, Lemos, et al., 2014). Particularly, CFA studies conducted with the Figural Test (Form A) with American (Kim, 2006b; Kim et al., 2006) and Argentine (Krumm, Arán Filippetti, & Balabanian, 2016) children, and those carried out with Form B with Argentine children and adults (Aranguren, 2014; Krumm, Lemos, et al., 2014) have shown that the creativity construct is composed of two factors: an Innovative style and an Adaptive one, which would include the skills proposed by Torrance et al. (1992).

In Argentina, the TTCT has been studied in relation to other variables such as intelligence (Krumm, Arán Filippetti, & Bustos, 2014), parental styles (Krumm, Vargas Rubilar, & Gullón, 2013), personality (Krumm, Lemos, & Arán Filippetti, 2015; Krumm, Lemos, & Rizzo, 2013), age (Krumm, Arán Filippetti, & Aranguren, 2015; Krumm, Arán Filippetti, Lemos, Aranguren, & Vargas Rubilar, 2013), gender (Krumm, Arán Filippetti, et al., 2015; Krumm, Lemos, et al., 2014), performance in artistic activities (Bertellotti, 2016; Krumm & Lemos, 2012), academic performance (Krumm, 2004), peers' and parents' perceptions of creativity (Krumm, Vargas Rubilar, Lemos, & Oros, 2015), prior knowledge (Aranguren, 2015) and executive functioning (Bustos, Arán Filippetti, & Krumm, 2013).

Following the TTCT theoretical line, the CREA (Creative Intelligence) has recently emerged, aiming at the assessment of creative intelligence according to the indicator of creation of questions in the theoretical context of searching and problem solving (Elisondo & Donolo, 2011). The CREA would evaluate the individual's general disposition for the openness and versatility of their cognitive schemas through a stimulus that triggers asking questions (Corbalán Berná et al., 2003). The ability to pose questions is a method to measure creativity, which derives from the works related to divergent thinking, flexibility, and fluency of Guilford and Torrance (Corbalán Berná & Limiñana Gras, 2010). The main difference is that each question posed in CREA needs to be based on a new cognitive schema. In fact, this instrument is interested in the generation of these schemas but not in the question itself as a creative product (Corbalán Berná et al., 2003; Elisondo & Donolo, 2011). Therefore, it is not the assessment of the question quality which is of concern, but the quantity; in this sense, for Corbalán Berná et al. (2003), there are no inappropriate questions. The CREA offers a unique and indirect measure of creativity in that it compels to activate those mechanisms that participate in the creative act but do not strictly imply a creative production (López Martínez & Navarro Lozano, 2008). The test has been typified for Spanish and Argentine samples of both genders from 6 years onwards (Corbalán Berná et al., 2003; Elisondo & Donolo, 2011).

The reliability of the test has been studied with CREA A and B; since it was .87, it was suggested that they measure the same construct as parallel forms (Corbalán Berná et al., 2003). The test demonstrated concurrent validity with the Guilford Creativity Battery, correlating with the facets of Fluency, Flexibility, Originality, and Divergent Production; the most noticeable validity was proven with fluency and flexibility. There was also a higher correlation ( $r = .81$ ) between the Guilford Battery and the CREA C (Martínez Zaragoza, 2003; Corbalán Berná et al., 2003). In addition, the multiple linear regression models between the Guilford Creativity Battery and CREA showed that the facets of Fluency, Flexibility, Originality, and Divergent Thinking were predictors of CREA, accounting for 62% of CREA A, 41% of CREA B, and 65% of CREA C (Corbalán Berná et al., 2003). A more recent study on the psychometric properties of CREA with a sample of 94 adult students from an English-speaking population showed convergent validity with both TTCT Tests, Figural and Verbal; in sum, the authors results support the use of CREA as a measure of Divergent Thinking (Clapham & King, 2010). Studies reported in Argentina on CREA are scarce, being only studied in relation to intelligence (Elisondo & Donolo, 2010, 2011), gender, and age (Elisondo & Donolo, 2011).

## THE PRESENT STUDY

Considering that there are few studies that analyze the relationship between TTCT and CREA, and that no studies on this issue have been yet carried out with Argentine children, the aim of the present study was to examine how the measures of the TTCT Figural (Form A) and CREA C are related, considering as basis those studies by Corbalán Berná et al. (2003) and López Martínez and Navarro Lozano (2008).

## METHOD

### Participants

Data were obtained through a descriptive, correlational study using a non-probabilistic, intentional sample of 272 schoolchildren between 8 and 13 years of age ( $M = 10.1$ ;  $DS = 1.23$ ), of both genders (58.8% girls; 41.2% boys), belonging to primary and high schools in the province of Entre Ríos, Argentina.

This research project was approved by the Ethics Committee of the Centro Interdisciplinario de Investigaciones en Psicología Matemática y Experimental “Dr. Horacio J. A. Rimoldi” (CIIPME), unit of the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina. In order to work with the participants, permission was requested from the principals of the schools involved, who obtained information about the characteristics of the research. Next, the parents or legal guardians were sent a sealed manila envelope with the informed consent that explained the objectives of

the study and the types of tasks that would be performed during class hours, emphasizing that participation was voluntary and anonymous. Finally, after receiving the signed consent forms, the evaluation was carried out.

### Instruments

TTCT Figural, Form A. The TTCT Figural (Form A), which is intended for all educational levels, is composed of three activities, each of which takes place in 10 minutes. Each task poses a different set of instructions regarding the completion of drawings or figures, and as a whole the activities evaluate Fluency (the ability to generate drawings and ideas), Originality (the ability to produce unusual responses), Elaboration (the ability to improve and develop an idea), Abstractness of Titles (the ability to produce a suitable title for the drawings), and Resistance to Premature Closure (the ability to close figures, producing original ideas) (Torrance et al., 1992). In terms of correction, Fluency is scored in activities 2 and 3, when the answer is relevant to the stimulus. Answers that do not score in Fluency are not considered in the other skills. Originality, which is assessed in all three activities, is based on the statistical infrequency and the response oddity. In this case, the correction manual by Torrance et al. (1992) sets possible non-original responses for each activity; when a drawing is not included in the list of non-original responses, a point is assigned. Moreover, additional points can be given when more than one stimulus is combined or integrated to make a drawing. In order to evaluate the skill elaboration in the three activities, each detail, idea, and fragment of information that is added to the drawing must be counted, considering the basic response the individual could provide. Once the amount of details (e.g., design, color, deliberate shading, line style, etc.) is estimated, the score is assigned from 1 to 6. Abstractness of Titles is scored in activities 1 and 2 on a scale of 0 to 3 according to the degree of abstraction. Thus, for example, an obvious or generic title receives 0 points, and those titles that are abstract but appropriate to the drawing produced get 3 points.

Finally, Resistance to Premature Closure is evaluated only in activity 2; each given response is corrected on a scale of 0 to 2, according to the way participants have closed their drawing.

In addition, the figural test, in both Forms A and B, measures thirteen criteria called Creative Strength (CS) or strengths of creativity (Torrance et al., 1992): Emotional Expressiveness, Storytelling Articulateness, Movement or Action, Expressiveness of Titles, Synthesis of Incomplete Figures, Synthesis of Circles, Unusual Visualization, Internal Visualization, Extending or Breaking Boundaries, Humor, Richness of Imagery, Colorfulness of Imagery, and Fantasy. The CS score is added to the average of the dimensions or indicators,

which enables the calculation of a final score, called the Creativity Index (Torrance et al., 1992; Torrance, 1998).

**CREA. Creative Intelligence.** This test consists of three stimulus sheets (A, B, and C, depending on the age of participants) from which participants should formulate as many questions as possible within a set time (4 minutes) after the instructions specified in the CREA manual are provided. The test is for individual or collective application and can be used from the age of six. The present research used CREA C for children and adults, and followed the manual recommendations. The application with 8- and 9-year-old children was done individually, and collectively with the older ones.

### STATISTICAL PROCEDURES

To analyze the relationship between the TTCT and CREA, partial correlation and hierarchical regression were used to control age, considering that several studies mention age as a conditioning factor for creativity in children and adolescents (David, Morais, Primi, & Miguel, 2004; Krumm, Arán Filippetti, et al., 2015). Data processing and statistical analysis was performed using IBM SPSS Statistics version 22.0.

### RESULTS

The results showed significant positive correlations between the CREA and the indicators Fluency, Originality, Elaboration, Resistance to Premature Closure in the Innovative and Adaptive factors, and with the TTCT Creativity Index (TTCT CI). Creative Strength also correlated positively with the CREA, but in a low manner (see Table 1).

Hierarchical multiple regression analysis was used to acknowledge the unique percentage of variance explained by each skill or indicator of TTCT factors on Creative Intelligence (CREA C) while controlling for the age effect. The first hierarchical regression model included the following blocks: (a) age and (b) TTCT skills that were associated with Creative Intelligence (i.e., Fluency, Originality, Elaboration, Resistance to Premature Closure, and Creative Strengths). The total model explained 49% of the variance of Creative Intelligence. Specifically, age accounted for 34% of the variance, while TTCT Fluency and Originality skills accounted for 15% of the variance above and beyond the variance explained by age (see Table 2). The second model included the following blocks: (a) age and (b) TTCT factors. The model explained 47% of the variance of Creative Intelligence (CREA C). Age accounted for 34%, while TTCT Innovative and Adaptive factors accounted for 13% of the variance above and beyond the variance explained by age (see Table 3).

**Table 1**  
*Descriptive and Statistical Correlations between the Measures Assessed.*

Age (control)	M (DE)	1	2	3	4	5	6	7	8	9	10
1. CREA C	8.09 (4.33)	-	.40***	.33***	.07	.31***	.26***	.16**	.40***	.28**	.39***
2. F	22.66 (7.66)	-	-	.70***	.04	.21**	.30***	.22***	.94***	.25***	.67***
3. O	15 (6.19)	-	-	-	.02	.14*	.29***	.23***	.90***	.20**	.65***
4. AT	6.78 (4.33)	-	-	-	-	.20**	.24***	.35***	.03	.76***	.45***
5. E	5.92 (2.65)	-	-	-	-	-	.24***	.25***	.19**	.58***	.41***
6. RPC	8.94 (3.96)	-	-	-	-	-	-	.25***	.32***	.73***	.53***
7. CS	5.33 (2.76)	-	-	-	-	-	-	-	.24***	.41***	.79***
8. Innovative	18.86 (6.42)	-	-	-	-	-	-	-	-	.25***	.71***
9. Adaptive	7.21 (2.60)	-	-	-	-	-	-	-	-	-	.66***
10. TTCT CI	17.21 (5.22)	-	-	-	-	-	-	-	-	-	-

Note: N = 271. F = Fluency; O = Originality; AT = Abstractness of Titles; E = Elaboration; RPC = Resistance to Premature Closure; CS = Creative Strengths; TTCT CI = TTCT Creative Index. Numbers in the upper row correspond to the variables equally numbered in the first column. Age effect was controlled through partial correlation.  
\*\*\*  $p < 0.001$ . \*\*  $p < 0.01$ . \*  $p < 0.05$

**Table 2.**  
*Summary of the hierarchical regression analysis of predictive variables of creative intelligence*

Dependent	Predictor	R2	ΔR2	p
Creative Intelligence (CREA C)	Set 1			
	Age	.341	.341	.584
	Set 2			
	Age	.494	.153	.434
	Fluency			.229
	Originality			.067
	Elaboration			.187
	Resistance to Premature Closure			.084
	Creative Strengths			.004

**Table 3.***Summary of the hierarchical regression analysis of predictive variables of creative intelligence*

Dependent	Predictor	R <sup>2</sup>	ΔR <sup>2</sup>		p
Creative Intelligence (CREA C)	Set 1				
	Age	.341	.341	.584	.000
	Set 2				
	Age	.470	.129	.459	.000
	Innovative			.298	.000
	Adaptive			.164	.001

### CONCLUSION

The present study aimed at comparing the scores obtained in two performance tasks that assess creativity in school-aged children. The results showed higher correlations between the CREA C and the TTCT skills belonging to the Innovative factor (i.e., Fluency and Originality). Correlations, though lower, were also found with some indicators of the Adaptive factor (i.e., Elaboration and Resistance to Premature Closure). Finally, significant correlations were found between the Creative Strengths, the final TTCT score, and the CREA C. Consistently, López Martínez and Navarro Lozano (2008) found significant correlations between the CREA and the skills of Fluency, Flexibility, and Originality in a study carried out with 96 Spanish children attending first and third grade, but using the previous version of the TTCT (Form A). However, against the present study, the aforementioned authors did not find a significant correlation between the CREA and the skill of Elaboration. This could be due to the fact that they used an earlier version of the TTCT Figural, which studied a measure of Flexibility, together with Fluency, Originality, and Elaboration. In addition, and unlike in this study, the test was used in younger children and without controlling for age.

The lack of correlation between the CREA C and the indicator Abstractness of Titles of the TTCT Figural, could be due to the fact that this ability is evaluated by very specific drawing tasks (activities 1 and 2). This indicator consists of the participant's ability of synthesis and organization when providing titles to the drawings; the more abstract the title, the higher the score assigned, for it shows that the person has captured the essence of the information involved. There are obvious titles, descriptive and simple titles at a specific level, more imaginative titles in which the modifier goes beyond a physical description, and abstract titles, which means more than what is seen in the drawing (Torrance et al., 1992). The fact that CREA evaluates com-

mon and simple questions, and not their quality, could explain the absence of correlation with the aforementioned TTCT indicator.

The results of the hierarchical regressions indicate that Fluency and Elaboration were the only predictors of the CREA C scores, with the Innovative factor being the one that best predicts the performance in the CREA C. Besides, it is worth noting the explanatory percentage that age has in the prediction of Creative Intelligence, being still greater than the variance explained by the indicators and factors of the TTCT. These data reflect the importance of considering age when studying the CREA scores. The study by Corbalán Berná et al. (2003) showed that the four Guilford subtests, Fluency, Flexibility, Originality, and Divergent production accounted for 65% of the CREA C. However, the authors do not provide data on the percentage of variance explained by each indicator (i.e., Fluency, Flexibility, Originality, and Divergent production).

In regards to the tasks proposed in each creativity test, some authors (Corbalán Berná et al., 2003; Elisondo & Donolo, 2011; López Martínez & Navarro Lozano, 2008) mention that, in CREA, each question needs to be supported by a new cognitive scheme, being the versatility of these schemes the most important aspect and what differentiates CREA from TTCT. However, both the TTCT and CREA evaluate the same aspect from the point of view of the responses given to the instruction. For instance, the number of drawings (in the TTCT Figural) or questions (in the CREA) relevant to the stimulus is called 'fluency' in the TTCT, but the final score in CREA.

In the case of the TTCT Figural, the drawings have to be relevant to the stimuli provided in order to score Fluency, without considering those abstractions devoid of meaning or duplications; thus, they can be simple and common drawings. Once the Fluency has been scored, the other indicators (i.e., Originality, Elaboration, Abstractness of Titles, Resistance to Closure, and Creative Strength) are evaluated.

Although Corbalán Berná et al. (2003) argue that the procedure of posing question in CREA is something new, this way of evaluating creativity had already been used in the Verbal TTCT by Torrance (1990) (see also Martínez-Otero Pérez, 2005). In this test, activity 1 requires, the answering of questions on a sheet. However, unlike CREA, the questions cannot be answered by looking at the sheet (this is not evaluated in the TTCT Figural), which imposes a greater difficulty; additionally, not only is the number of questions produced assessed, but also their originality and flexibility. This way, the Verbal TTCT evaluates not only the quantity of the questions posed, but also their quality. In addition, in order to assess the quality of the questions, the manual specifies which answers may be original or not. This way of evaluating creativity could be a disadvantage, since the individual cannot always perform

a number of “suitable” questions in the stipulated time. On the other hand, CREA considers that there are no inappropriate questions (Corbalán Berná & Limiñana Gras, 2010), which is an interesting, easy, and simple instrument of rapid implementation to assess creativity, particularly in children. According to Martínez-Otero Pérez (2005), CREA is a useful instrument to study creativity, especially in children and adolescents, given that in young people and adults there is a greater possibility that creativity will be manifested into concrete products, such as written or pictorial productions.

Furthermore, the TTCT Figural is a long-term test that evaluates five indicators (Fluency, Originality, Elaboration, Abstractness of Titles, and Resistance to Premature Closure), Creative Strengths, and a final score. In addition, the various studies alluded to in the introduction have shown that these indicators are grouped into two factors (i.e., Innovative and Adaptive). While the TTCT offers a more complete measure of creativity than CREA, it is a more extensive task and requires considerable time for its score. Although it has received some criticism due to the lack of norms (Corbalán Berná & Limiñana Gras, 2010), the 1990 and 1998 manuals already include the rules for the TTCT Figural and Verbal, both Forms (Torrance, 1990; Torrance, 1998). On this basis, it would be interesting and necessary to establish norms per assessed context, as well as by age. As for the evaluation of Originality, although the manual provides lists of those drawings that should not be considered original, they should be updated according to time and contexts.

In summary, the evidence of concurrent validity between the TTCT and CREA tests is partial, and CREA can be considered an interesting screening instrument with simple evaluation and punctuation processes, which was one of the original intentions of Corbalán Berná et al., (2003). Data obtained from the regressions reveal that the Fluency indicator of the TTCT Figural is the main predictor of Creative Intelligence scores, suggesting that CREA measures the number of questions or problems performed according to the stimulus. In future research, the concurrent validity between CREA and Verbal TTCT could be studied in the Argentine population.

Finally, since the TTCT and CREA are within divergent thinking tests, they both focus on finding solutions to a problem. In this sense, Romo, Alfonso-Benlliure, and Sanchez-Ruiz (2016) argue that tests of divergent thinking do not consider the creative process and ignore the value and quality of the creative product; hence, sometimes an inappropriate idea could be considered as evidence of creativity (Zeng, Proctor, & Salvendy, 2011). In this line, Runco (2008) mentions that this type of tests implies, at first sight, difficulties when assessing whether an original idea is appropriate or effective. This fact does not imply that divergent thinking tests should be discarded, since no measure is perfect, but it would be important, to the extent possible, to



complement the evaluation of creativity of both CREA and TTCT with other tests. Different options could include The Test for Creative Thinking-Drawing Production (TCT-DT) (Urban & Jellen, 1996), which embraces divergent and convergent thinking between the ages of 5 and 95, and the Child Creativity Test (CCT) (Romo et al., 2016), which attempts to value the creative process in children between the ages of 6 and 12.

Finally, it is necessary to consider that a complete assessment of creativity requires the challenge of taking into account other environmental, academic, family, and social constraints (Romo et al., 2016), and these should be compared with the individual's creative behavior in daily life (Corbalán Berná et al., 2003).

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## ABOUT THE AUTHORS

### Gabriela Krumm, Ph.D.

She is the author of several articles in diverse scientific journals related to the evaluation of creativity in children and adolescents and to the study of the resources associated with creativity.

[gabrielakrumm@doc.uap.edu.ar](mailto:gabrielakrumm@doc.uap.edu.ar)

**Vanessa Arán Filippetti, Ph.D.**

She is the author and co-author of several publications in diverse scientific journals. Her most recent publications examine the structure of Executive Functions (EF) in children and adolescents and its relationship with Academic achievement, Creativity and Intelligence.

**Viviana Lemos, Ph.D.**

Her scientific production is linked to these research lines: Study, evaluation and promotion of socio-emotional resources linked to the child-youth personality as prosocial behavior, moral reasoning, empathy, attachment and creativity.



**4**

**chapters**



# Using Paired Constraints to Solve Creativity Problems

► Patricia D. Stokes · Barnard College, Columbia University

## ABSTRACT

All creativity problems share a common goal: do something new. They also share a common conundrum: how do you start to do something new? This chapter suggests that you begin by breaking a creativity problem down into the structure of its solution. The structure has three parts: (1) an initial state with its well-known components, (2) a goal state with its yet unknown components, and, between the two, (3) a search space in which to construct a solution path. The paired constraints in the current model are tools for path construction. They work this way: one of the pairs identifies one thing, one component from the initial state to be precluded; the other selects a substitute. Once started, the process is self-sustaining: one substitution will suggest or require another. Examples from art and education show how a substitution series becomes a solution path.

The constraint pair model presented in this chapter was developed to analyze the problem solving process in the fine and applied arts (Reitman, 1965; Simon, 1973; Stokes, 2006, 2008), and has more recently been applied to business (Stokes, 2013a) and early education (Haught & Stokes, in press; Stokes, 2013c; 2014a). Three examples—two from art, one from education—will show why the process is called



The structure has three parts: (1) an initial state with its well-known components, (2) a goal state with its yet unknown components, and, between the two, (3) a search space in which to construct a solution path.

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solution-by-substitution. I begin with the basics, introducing the structure of both problem and solution, as well as the source of the substitutions, the tool box (Stokes, 2014b).

### THE STRUCTURE OF THE PROBLEM

The structure—technically known as a problem space (Newell & Simon, 1972)—has three parts: an initial state with its well-known components, a goal state with its yet unknown components, and, between the two, a search space in which a solution path that transforms the initial into the goal state is constructed. As shown in Table 1, both initial and goal states are accompanied by criteria, agreed upon standards that specify and identify a style, product, etc.

**Table 1**

<i>The Structure of a Creativity Problem</i>	
<i>Initial State</i>	Existing situation / current criterion
<i>Search Space</i>	Constraint pairs for constructing a solution path (Preclude current components → Promote substitutes)
<i>Goal State</i>	Changed situation / novel criterion

In traditional models, path construction is accomplished by operators, “if..., then” rules that specify the action (then) to be taken in a given situation (if). In the current model, operators are replaced by constraint pairs that limit and direct search for a solution path.

### THE STRUCTURE OF THE SOLUTION

The first step in the solution process is breaking down the known parts of the problem: to start, identifying the initial state and itemizing its core components. All, or just some, of the components will be placed in the preclude column. To illustrate, Table 2 presents a much simplified problem space for the innovation<sup>1</sup> called Impressionism.

The initial state is contemporary representational painting circa 1870. Its components are itemized in the preclude column. Monet’s goal is a new style; its criterion, the way light breaks up on things. The solution process begins with a single substitution. Light breaks up into separate segments, precluding a continuous paint surface and promoting a mosaic of discrete brush strokes. Now the solution-by-substitution process becomes self-sustaining:

**1** I use the terms *creativity* and *innovation* interchangeably in this chapter.

**Tabla 2**

<i>Simplified Problem Space for Impressionism</i>	
<i>Initial State</i>	Representational painting c. 1870 Criterion: paint the things that reflect light
<i>Search Space</i>	<i>Constraint Pairs</i>
	1. Continuous paint surface → Separate brush strokes
	2. Dark-light contrasts → Contrasting hues
	3. Illusion of depth → Attention to surface
<i>Goal State</i>	New representational style Criterion: paint the way light breaks up on things

one substitution suggests or requires another. The segments into which light breaks are hues, not values. This requires the second pair (preclude light-dark contrasts → promote contrasts in hue), which in turn produces the third (preclude depth → promote surface).

Notice that each substitution is strategically, purposively chosen to realize the goal: showing how light breaks up on things. Itemized in the promote column, Monet's substitutions represent both his solution path and, importantly, the new ways of making and noticing that made his second stylistic innovation (painting how light breaks up between things) possible (Stokes, 2011, 2012).

Where do substitutions like Monet's come from? The tool box, the one inside your head (the one you can't think outside of).

### THE CONTENTS OF THE TOOL BOX

What's in the tool box? Two things. I call them basics and borrowings (Stokes, 2014b).

#### The Basics

The basics are expertise. They involve semantic memory, what you know, and procedural memory, what you can do with what you know. For example, in Monet's tool box, we would find things painters know (about styles, current and past) and things painters do (techniques to produce variations of those styles). I think of knowledge and skills specific to the expert's domain as inside sources. A basic tool box can be made bigger by mastering new skills. The Wright brothers began as bicycle experts. Their extensive expertise in aeronautics was acquired hands-on during the development and testing of their "Flyers" (McCullough, 2015).

## The Borrowings

Borrowings are outside sources. They also make a tool box bigger. For example, some creators are expert in multiple domains. They are more “resource-full.” Think of Alexander Calder’s mobiles. They were the product both of Calder’s early education as an engineer (outside source) and his later development as a sculptor (inside source). For others, domains in which they are not expert provide catalysts or contents. The impetus for Impressionism was a color wheel published in a Parisian newspaper by a chemist named Chevreul and *noticed when needed* by a painter named Monet (Stokes, 2011, 2012). In a sense, Chevreul collaborated (albeit inadvertently) with Monet, making the painter’s tool box bigger. Collaborations, as we shall see, are a critical kind of borrowing.

Noticing too is critical. What you notice depends both on what you know and what you need (Austin, 2003). This makes the tool box doubly important. In addition to directing particular skills to particular problems, it *directs attention* to particular aspects of the world (Stokes, 2014b).

## THE STRUCTURES OF SEVERAL SOLUTIONS

Paired constraints of four kinds were used to analyze Cubism and to develop an early math curriculum. The four are: *source constraints*, which define domains; *criterion constraints*, which stipulate goals; *task constraints*, which govern materials and their applications; and *subject constraints*, which specify themes or motifs (Stokes & Fisher, 2005).

## Constructing Cubism

Picasso and Braque’s creation is called Cubism.<sup>2</sup> Cubism had two distinct phases: the first specified both a new goal and a new solution path; the second added a sub-goal, reaching it via a new solution path. We begin at the beginning, with Early Cubism.

### Solution by Substitution I: Early Cubism (1906-1911)

The dates indicate two things: 1906 is when Picasso and Braque began to collaborate, together inventing Cubism; 1911 is when Braque stenciled letters onto a painting, initiating what we will call Later Cubism.

**Source constraints.** Cubism had two obvious sources. One was Cezanne, who used simultaneously shifting perspectives and brushstrokes to paint objects that seem more “real”, more solid and durable, than those in Impressionist paintings. For example, in *Still Life with an Open Drawer* (1877-79)

2 General background on Cubism came from Cooper (1971), Rubin (1989), and Stokes (2006).

the point of view is inconsistent. We see a large bowl and a glass obliquely and from slightly above. The base of the shallow platter holding the apples is shown from below; the apples are at eye-level. The broken brushstrokes mark the shifting surfaces of the objects; the faceting adds to their solidity. Cezanne is showing us the structure of what we merely recognize as bowl, glass, or apple. The most salient borrowings from Cezanne are the shifts in perspective and the faceting. A less salient borrowing is the repetitive use of a limited set of objects (Stokes, 2006).

The other source was a different sort of realism: paintings or sculptures that show what you know rather than what you see. I am thinking of a stained glass window I saw in a Norman church: the Red Sea was brilliantly red; the highly stylized, flattened, frightened figures were immersed in its redness. I do not know if Picasso and Braque looked at medieval painting. They most certainly looked at Gauguin, who also flattened and simplified and stylized his figures, and at African masks, likewise simplified and stylized, and at Egyptian bas-reliefs that cast very small shadows in very shallow spaces.

Table 3 shows the problem space for Early Cubism. The initial state indicates the goal criterion for representational painting in 1906: *paint what you see*. The goal state has a new criterion: *paint what you know* (Stokes, 2006). In the table, *paint what you see* is labeled “perceptual realism;” *paint what you know* is labeled “conceptual realism.”

**Task constraints.** The preclude and promote columns in Table 3 indicate how constraints cascade, one leading to another. Fractured objects produce multiple points of view. Together the first two pairs promote a composition based on pattern rather than on perception. Patterning of this sort moves the eye around the surface of the picture plane, precluding the illusion of 3-dimensional space. The complexity of pairs 1 through 4 requires a limited palette. Most paintings from this period are primarily browns, grays, and black.

**Table 3**

Simplified Problem Space for Early Cubism	
Initial State	Current goal criterion: paint what you see (perceptual realism)
Search Space	Constraint Pairs
	Preclude
	Promote
	1. Intact object → Fractured object
	2. Single point of view → Multiple points of view
	3. Perceptual composition → Patterned composition
	4. 3 dimensions/depth → 2 dimensions/picture plane
	5. Local color → Limited palette
	6. Multiple objects → Limited number of objects
Goal State	New goal criterion: paint what you know (conceptual realism)

**Subject constraints.** Constraint pair 6 refers to the restricted inventory of objects in a Cubist still-life: musical instruments, sheet music, pipe, bottle, glass, candle stick, compote. I added a pitcher with a handle for my much-simplified approximation to Early Cubist style, shown in Figure 1. The diagonal and vertical lines are the armature on which the fragments of the pitcher are arranged. The circular shapes toward the top represent the opening at the top of the pitcher, seen from directly and also obliquely above. The circular shapes to the right represent the handle; those below represent the bottom of the pitcher. The vertical lines in the center represent the neck of the pitcher. The black and white patterning moves the eye around the surface of the drawing.

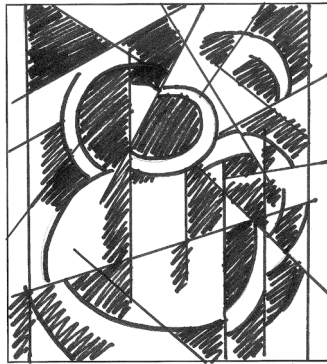


Figure 1. Drawing (by author) in early Cubist style.

### Solution by Substitution II: Later Cubism (1912-1921)

The paired constraints that produced Early Cubism also produced a problem. As the fragments and viewpoints multiplied, realism was being usurped by abstraction. This was not Picasso and Braque's goal. Table 4 suggests how *refining* their goal criterion helped them solve their new stylistic problem.

Under goal state, I added a *sub-goal*, which I labeled *re-emphasizing realism*. Instead of composing with fragments, Braque and Picasso now composed with large shaped areas and brighter, more varied colors. On those shapes were superimposed ordinary, recognizably "real" materials, many (e.g., wood combing, marbelling, *papiers colles*) from Braque's earlier career as a house painter/decorator. Pasting papers, along with mixing sand into their paint, made the surfaces of Later Cubist paintings tactile and tangible, emphasizing their realism.

**Table 4**

Problem space for late Cubism																
Initial State	Early Cubist complexity: approach abstract, non-figurative															
Search Space	Constraint Pairs															
	<table border="0"> <tr> <td>Preclude</td> <td></td> <td>Promote</td> </tr> <tr> <td>1. Compose with fragments</td> <td>→</td> <td>Compose with larger, shaped areas</td> </tr> <tr> <td>2. Muted, monochromatic color</td> <td>→</td> <td>Brighter, wider range of colors</td> </tr> <tr> <td>3. Art materials</td> <td>→</td> <td>Ordinary materials (papers, stenciled letters, sand)</td> </tr> <tr> <td>4. Smooth surface</td> <td>→</td> <td>Tactile surface</td> </tr> </table>	Preclude		Promote	1. Compose with fragments	→	Compose with larger, shaped areas	2. Muted, monochromatic color	→	Brighter, wider range of colors	3. Art materials	→	Ordinary materials (papers, stenciled letters, sand)	4. Smooth surface	→	Tactile surface
Preclude		Promote														
1. Compose with fragments	→	Compose with larger, shaped areas														
2. Muted, monochromatic color	→	Brighter, wider range of colors														
3. Art materials	→	Ordinary materials (papers, stenciled letters, sand)														
4. Smooth surface	→	Tactile surface														
Goal State	Same goal criterion: conceptual realism (paint what you know)															
Sub-goal	Re-emphasize realism															

In Figure 2, I emulated Braque by pasting pieces of patterned wallpaper on which parts of my (far less fragmented) pitcher were superimposed.

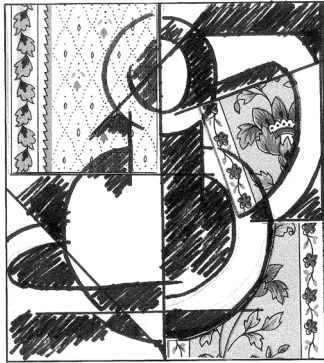


Figure 2. Drawing (by author) in later Cubist style.

### Making the Cubist Toolbox Bigger

Collaborations make tool boxes bigger. The more obvious ones are direct: Picasso and Braque painting side-by-side, jointly constructing the solution paths that define earlier and later Cubism. Interestingly, the two left their earliest approximations to the new style unsigned. This did not, however, leave their individual contributions un-noticeable. Picasso was recognizably a draftsman; Braque, a colorist.

Less obvious are the indirect, the borrowings I consider a kind of collaboration. Much like Monet noticing Chevreul's color wheel, Picasso and Braque

noticed what they needed in Cezanne (faceting, shifting perspective), and in Gauguin (simplifying, flattening). Just as Chevreul can be seen as Monet's collaborator in developing Impressionism, so too can Cezanne and Gauguin be considered collaborators with Picasso and Braque in developing Cubism.

Finally, and critical to Later Cubism, were Braque's borrowings from his own earlier career as a house painter and decorator. In a sense, Braque collaborated with himself. *Papiers colles*, stenciling, and simulating marble or wood grain were all tools in his decorator's tool box. At hand, they too were noticed when needed to re-emphasize the realism lost in Early Cubism.

### Constructing a Math Curriculum

The innovation here is an early math curriculum (*Only The NUMBERS Count*©) designed to solve the place-value problem (Stokes, 2013b, 2013c, 2014a). Place-value means that the place of a multi-digit number determines its value. The values of the places in a two-digit number are tens and ones. The problem is this: American children mistake, for example, the 5 in the number (15) they call "fifteen" as being of greater value than the 1, which is actually a 10. Chinese, Japanese, and Korean children who call the same number "ten-five," do not make that mistake (Miura & Okamoto, 2003). As a result, they surpass American children on place-value and also on multi-digit addition and subtraction (Fuson & Kwon, 1992; Song & Ginsberg, 1987). I begin with sources for the solution to the place-value problem.

### Solution by Substitution I: Kindergarten and First Grade

**Source constraints.** The most obvious source is the explicit base-10 count used by Chinese, Japanese, and Korean children. For simplicity, I refer to it as the Asian count. Table 5 shows an abbreviated version of the count with ones, tens, and twenties (two-tens).

Notice that only 10 number names (1 through 10) are used, and that ten appears in every number above 10: 13 is *ten*-three, 23 is *two-ten*-three. As a consequence of their counts, American children think of numbers as strings of 1s, while Asian children think of numbers as multi-digit structures made up of 10s and 1s (Fuson, 1990; Miura & Okamoto, 2003). Call a number "twenty-three" and you will think of it as 23 ones. Call it "*two-ten*-three" and you will think of it as 2 tens and 3 ones. There is no place-value problem if you think this way.

A second source was the abacus, which makes base-10 numbers and patterns visible, tangible, concrete, and, importantly, only represents numbers and patterns. A simpler manipulative with similar properties was designed for the new curriculum.



**Table 5****Explicit base-10 count**

Ones	Tens	Twenties
1 one	10 ten	20 two-ten
2 two	11 ten-one	21 two-ten-one
3 three	12 ten-two	22 two-ten-two
4 four	13 ten-three	23 two-ten-three
5 five	14 ten-four	24 two-ten-four
6 six	15 ten-five	25 two-ten-five
7 seven	16 ten-six	26 two-ten-six
8 eight	17 ten-seven	27 two-ten-seve
9 nine	18 ten-eight	28 two-ten-eight
	19 ten-nine	29 two-ten-nine

A third source was the literature on expertise (Chi, Glaser, & Farr, 1986; Ericsson, 2006; Weisberg, 2006), which shows that experts solve problems using meaningful patterns in their domains of expertise. For mathematicians, the patterns involve relationships between numbers and symbols. “Could children, with practice—and practice primarily with numbers and symbols—learn to think like mathematicians?” was the question that led to the new goal criterion. A critical task constraint was based on “deliberate practice” (Ericsson, 2006). Deliberate here means focused (on a particular aspect of a skill), continuous, incremental (developed in successive steps), and also varied (at each step).

**Criterion constraints.** Table 6 shows the initial to-be-precluded state as current curricula. The goal state was a new curriculum, its name emphasizing its criterion: thinking in numbers, symbols, and patterns.

**Table 6**

<i>Problem Space for Kindergarten and First Grade</i>	
<i>Initial State</i>	Current curricula for kindergarten and first grade
<i>Search Space</i>	<i>Constraint Pairs</i>
	Preclude
	Promote
	1. Non-numeric → Numbers, symbols, patterns
	2. English language count → Explicit base-10 count
	3. Multiple manipulatives → Single manipulative
	4. Split practice → Deliberate practice
<i>Goal State</i>	New curriculum ( <i>Only The NUMBERS Count</i> ®)
<i>Criterion</i>	Thinking in numbers, symbols, and patterns

**Task constraints.** The first two pairs directly address the goal criterion. Thinking in numbers, symbols, and patterns precluded the non-numeric, which meant videos with cartoon characters, as well as worksheets with stories. Word problems were introduced *after* children had mastered addition and subtraction. This was because transfer requires recognition of similarities in elements or structures (Gick & Holyoak, 1983; Holyoak & Thagard, 1999). Without a mathematical model, there is nothing onto which a child can transfer a word problem.

Thinking in numbers, symbols, and patterns also precluded the English count, and promoted the explicit base-10 count. The third pair substituted a single manipulative—called the Count and Combine Chart—for the multiplicity of blocks, cube-trains, straws, etc. used in American classrooms. Figure 3 shows the first chart, all parts of which are movable.

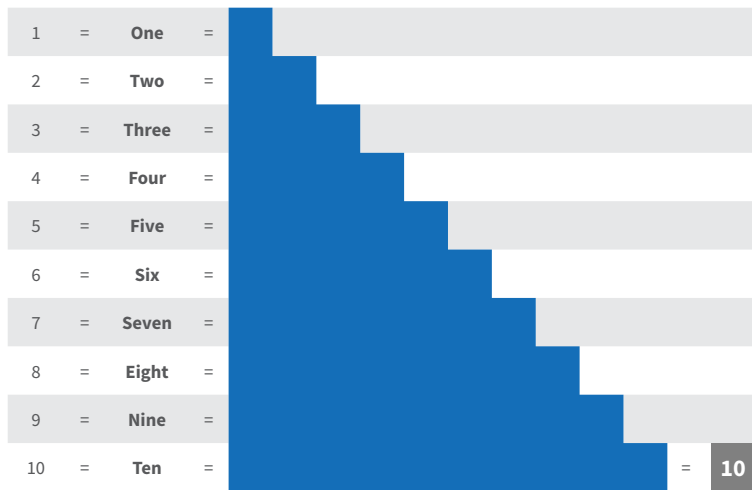


Figure 3. Count and Combine Chart 1 to 10.

Notice that 10 is represented as ten 1s blocks and as a single 10 block. In subsequent charts (above 10), all double-digit numbers were represented by 10s and 1s blocks. Figure 4 shows part of the next chart for the numbers 10 to 15 (ten-five). The similarity in the charts makes the recursive patterning in the count explicit. This helped children transfer what they learned about numbers up to 10 to numbers above 10.

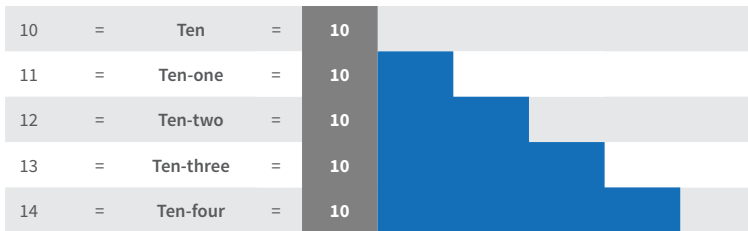


Figure 4. Count and Combine Chart 10 to 14.

Split practice, precluded in the fourth pairing, refers to switching between types of problems and/or materials. Its substitute, deliberate practice, was focused, continuous, iterative, and elaborative. Children practiced the pattern of the base-10 count by chanting and reconstructing the chart. Their chart began this way:

*Number one same as word one equals one block.*

*Number two same as word two equals two blocks.*

*Number three same as word three equals three blocks.....*

They practiced the structure of base-10 solutions for addition and subtraction by combining and recombining the blocks to make different “combinations.” The word combination is intentional: numbers are combinations of other numbers. Figure 5 shows three ways to manipulate the blocks to make addition combinations for five. Using multiple “plus” signs, there are 16 combinations for five. As the numbers increase, so do the number of possible combinations. For example, there are 32 combinations for six, 64 for seven, and 128 for eight.

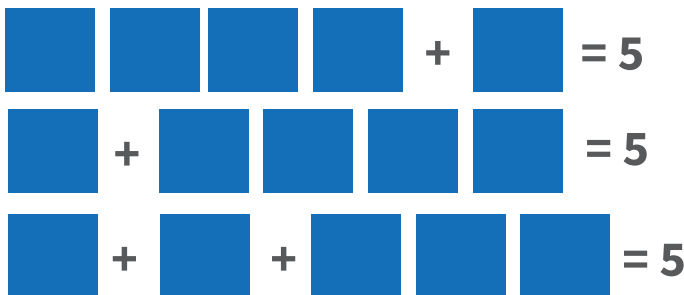


Figure 5. Addition combinations for five.

**Subject constraints.** For kindergarten and first grade, the subjects were place-value, making combinations for/solving single- and double-digit addition and subtraction problems, and number line estimation. In mastering these topics, the children exceeded Common Core standards for kindergarten and first grade, meeting second grade standards for Operations and Algebraic Thinking, and Numbers and Operations in Base Ten (Evans & Stokes, 2015; Haught & Stokes, in press; Stokes, 2013b, 2014a).

### Solution by Substitution II: Second Grade

Continuing to do something new took the form of expanding the initial solution path to satisfy the same goal criterion in a new context, second grade.

**Criterion constraints.** The initial state was current second grade curriculum. The goal was expanding the new curriculum to second grade. The goal criterion remained the same.

**Source and task constraints.** Table 7 shows two new substitutions, again with an Asian source. The Chinese multiplication table (and the way it is recited) was introduced in lieu of the standard American table; multiplication and division were taught simultaneously.

**Table 6**

<i>Problem space for second grade</i>										
<i>Initial State</i>	Current second grade curricula									
<i>Search Space</i>	<i>Constraint Pairs</i>									
	<table border="0"> <tr> <td style="text-align: center;">Preclude</td> <td></td> <td style="text-align: center;">Promote</td> </tr> <tr> <td>1. Standard multiplication table</td> <td style="text-align: center;">→</td> <td>Chinese multiplication table</td> </tr> <tr> <td>2. Recite table as addition</td> <td style="text-align: center;">→</td> <td>Recite as multiplication and division</td> </tr> </table>	Preclude		Promote	1. Standard multiplication table	→	Chinese multiplication table	2. Recite table as addition	→	Recite as multiplication and division
Preclude		Promote								
1. Standard multiplication table	→	Chinese multiplication table								
2. Recite table as addition	→	Recite as multiplication and division								
<i>Goal State</i>	Same goal criterion: thinking in numbers, symbols, and patterns									
<i>Criterion</i>	Extension to second grade									

The table differs from ours in format and in recitation. Each vertical column begins with the square of its number. For example, the two's column starts with 4, and continues (as ours does) in increments of 2. Unlike our table which is recited as an addition series (2, 4, 6, 8, etc.), each column is recited as a multiplication series (two 2s are 4, two 3s are 6, two 4s are eight, etc.). Unlike Chinese children, ours recited each column two ways: “two 3s are 6” and the opposite, “three 2s are 6.” They also recited the related division problems: “ $6 \div 2 = 3$ ” and “ $6 \div 3 = 2$ .” What they were discovering and practicing were patterns.

## Making the Mathematics Toolbox Bigger

As with Picasso and Braque, collaborators made my tool box bigger. Most important were Emil Carafa, the principal of the grammar school, who made the program possible and Catherine Tronza, the teacher who taught me how to write lesson plans.

Also, as with Braque, I collaborated with myself. When I was asked to think about early math, there were three relevant things in my tool box: the paired constraint model, my design skills (I went to Pratt), and the Japanese count. The first two are tools I use on a regular basis. The third, the count, I consider *bricolage*: it was “at hand” to be *noticed as needed* because I learned and used it on a daily basis during the years I worked for J. Walter Thompson in Tokyo.

There is another collaboration, a critical one that I didn’t think about until I wrote this section. It was the curriculum I aimed to replace. Without it, I would have had no place to start. I am thinking this could be true for all innovations. I elaborate on this idea in the discussion.

## DISCUSSION

This paper used a constraint-based problem-solving model to structure the creative process in art and education. The strengths of the model are two: its simplicity and its generality. Problem solving models are inherently parsimonious and reductive; hence the simplicity. In the paired constraint model, the structure of the solution process is the same regardless of the source of the problem or the nature of the solution; hence the generality.

The constraints in the model are paired: one precludes something, the other promotes a substitute. Solutions are iterative, a solution path is constructed step-by-substitution step. The path itself is the innovation, either re-solving/satisfying an existing goal or defining/refining a new one. The process is called solution-by-substitution.

The paper also introduced, as the source of the substitutions, the tool box. The tool box contains basics or inside sources—what an expert knows and what he can do with he knows—and also borrowings from outside sources, noticed when needed to make a tool box bigger (Stokes, 2012, 2014b). Collaborations are borrowings from another expert’s tool box. Direct collaborations, like those between Picasso and Braque, are the most obvious. Less obvious are indirect ones; e.g., Monet collaborating indirectly with Chevreul, noticing the chemist’s color wheel when it was needed. Other innovators collaborated with themselves. Braque used materials and skills from his work as a house decorator; I too used skills (Japanese count) outside my basic tool box. Least obvious—at least to me until I wrote this paper—is what the creator is working against.

Think of this as “Collaborating with the Opposition.” To start breaking a problem down into the structure of its solution, you need something specific to preclude. Cubism replaced specific aspects of representation painting circa 1906; *Only The NUMBERS Count*© did the same with current math curricula. The implication is important. A creator’s biggest collaborator may well be the style, product, or process to be re-specified, re-fined, or re-placed. Why? Quite simply, it supplies the items in the preclude column, without which there is no place to start.

## SUGGESTIONS AND CONCLUSION

### Suggestions

My first and most important suggestion is this: Choose (if you can) what you are working against carefully, *strategically*. What you work against becomes the initial state of your creativity problem. It is where you start breaking the problem down into the structure of its solution.

- My second suggestion is that you draw a problem space like the one shown in Table 8 and that (for practice, at first) you fill it in following this sequence:
- Identify the initial state, along with its criterion.
- Indicate the goal, to whatever degree it can be specified.
- List the components that constitute the initial state in the preclude column.
- Pick one thing to preclude. Move it to the top of your preclude column.
- Select a substitute. Be bold. Try the opposite of what you are precluding.
- See where it leads. If it is generative, it will require or suggest subsequent substitutions. If it goes nowhere, let it go.
- Iterate until your substitutions have constructed a new solution path.

This will take time. It is worth the time-taking. It will clarify your thinking and start you noticing things you now need.

**Table 6**

Practice problem space for innovation	
Initial State	Current situation: Criterion:
Search Space	Constraint Pairs
Preclude	Promote
1.	→
2.	→
3.	→
Goal State	New situation: Criterion:

My third suggestion is simple: Borrow. Borrow a lot. Make your tool box much bigger. The creativity of your solutions depend entirely on its contents.

### CONCLUSION

Conditions change. All solutions are temporary. Creativity problems must continually be structured and re-structured. Consider using constraint pairs as tools for considering and constructing possible solution paths.

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## ABOUT THE AUTHOR

### Patricia D. Stokes, Ph.D.

She teaches and does research at Barnard College, Columbia University. She has practical and business experience in creativity, in areas ranging from the arts to advertising. [pstokes@barnard.edu](mailto:pstokes@barnard.edu)

# Challenges for the Next Generation of Creativity Researchers

► James C. Kaufman · Neag School of Education · University of Connecticut



I see two main opportunities (or challenges) facing creativity in the next century. In a sense, they are perpetual challenges that simply have new shape. The first is that I would like to see creativity researchers better utilize and embrace technology. The internet already has made collaborations across continents easy and allowed data collection at huge levels. I would love to see assessments developed that use the power of both the internet and computer programming. Current technology allows people to be creative in new ways (think of programs like Photoshop), allows once inaccessible resources to be mainstream (we can have top video cameras in our phones), and enables people to share their creativity across the world on websites ranging from YouTube to DeviantArt (Kaufman, in press).

Some researchers (e.g., Kim & Shute, 2015) are already using technology—such as video games—as ways of assessing creativity, both automatically (without needing human raters) and subtly—the person may not even know their creativity is being tested. Given the slow pace at which intelligence tests are adapting technology, creativity assessment may have a genuine opening and chance for an advantage (Kaufman, in press).

We can also harness these tools to continue to collaborate—not just across continents but across fields. There are people who I have called “scholarly bilingual” (Kaufman, 2014b)—researchers who can “speak” the lan-



guage of creativity but also the jargon of other fields, from engineering to business to neuroscience. With their efforts, more collaborations, and better communication of our work to other disciplines, we can work on eliminating the “Tower of Babel” program we so often face and study the same basic concepts across fields. For all of its popularity, creativity is still seen as a soft science, often unworthy of funding or research agendas—I would like to see us work together to change these impressions.

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5

chapters

# Cognitive Style, Creative Achievement, and Creative Environment

► Kuan Chen Tsai · City University of Macau

## ABSTRACT

The current exploratory study focuses from three aspects—person, product, and press—to examine the creative process of Chinese undergraduates in Macau. More specifically, it attempts to understand to what extent these three factors interact with each other, as well as to examine the relationship among cognitive styles, creative achievements, and creative environments. The major finding of the current study is that the innovative cognitive style positively and significantly predicts students' creative achievement. However, the perception of being in a creative environment did not play a mediating role between cognitive style and creative achievement. Several limitations that might affect the interpretation of the findings were also discussed.

*Keywords:* Cognitive style, creative achievement, creative environment, Chinese students, Macau

The concept of the “four Ps” (4Ps)—i.e., creative person, process, product, and press—was initially proposed by Rhodes (1961) as a means to better understand the phenomenon of creativity via identifying the salient characteristics of creative people; examining operational cognitive stages in the creative process; recognizing tangible creative products; and describing contextual factors affecting creativity. The



The major finding of the current study is that the innovative cognitive style positively and significantly predicts students' creative achievement.

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4Ps framework in fact stems from four distinct strands of creativity research, which Rhodes identified in the literature as valid methodological approaches and then operationalized.

Most of the early work on creativity sought to differentiate between (eminent) creative people and ordinary people, which reflects the traditional perspective of personality psychology (Barron & Harrington, 1981; Feist, 1998; MacKinnon, 1962). The cognitive approach then took the lead emphasizing “the internal dynamic of creativity” (Glăveanu, 2013, p. 141). In this process of creative action, creative thinking plays an important formative role (Amabile, 1990; Bear, 1993; Finke, Ward, & Smith, 1992); and—though the specifics of their proposed stages differ somewhat—a number of scholars have deployed similar models to explain the creative process (Allen & Thomas, 2011; Mumford & Gustafson, 1988; Runco, 2009; Simonton, 1983; Smith & Carlsson, 1990; Ward, Finke, & Smith, 1995; Weisberg, 1986). These models generally include two major components: divergent thinking and convergent thinking. In the phases associated with divergent thinking, the main task is to generate ideas (ideation). The phases involving convergent thinking, on the other hand, are devoted to evaluation and assessment of various creative ideas; this is crucial to the optimization of ideas that are practical and novel.

Several scholars of creativity employed a different approach: using regression models to investigate the quantity of creative products devised by eminent creative people, and to look for correlations between creative achievement, age, and different domains (e.g., architecture, novel-writing, or painting; Dennis, 1956; Lehman, 1960, 1966; Simonton, 1975, 1984, 2009). Their findings suggested that creativity is a more domain-general than a domain-specific phenomenon. Amid growing awareness of the complexity of creativity, several authors have recognized that environmental and cultural factors might also be important to consider when attempting to understand it. For instance, social psychologists who study creativity propose a holistic approach, systematically examining a range of contextual factors, and the interaction between the individual and his/her environment, so as to move the investigation beyond the inner mind of the creative person (Amabile, Hennessey, & Crossman, 1986; Csikszentmihalyi, 1990; Gruber, 1988; Harrington, 1990).

Several other researchers have investigated the relationship between cognitive style, creative achievement, and environment. Luh and Lu (2012) found that innovative cognitive style successfully predicted students’ creative achievements, and that passion played a mediating role between innovative cognitive style and creative achievement. The results of several cross-cultural empirical studies generally support the idea that the socio-cultural environment has a significant impact on students’ creative behaviors:

students from countries classified as “individualist” exhibit better creative performance than those from “collectivist” countries (Dineen & Niu, 2008; Mouchiroud & Lubart, 2002; Ng & Smith, 2004; Niu & Sternberg, 2001; Niu, Zhang, & Yang, 2006; Rudowicz, Lok, & Kitto, 1995). Organizational behavior scientists, meanwhile, have mainly been concerned with how working environments affect employees’ creative performance, with the wider aim of improving that performance. They found that support from supervisors and co-workers, availability of resources, and policies conducive to creativity development could all encourage creative performance among employees (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Hunter, Bedell, & Mumford, 2007; Oldham & Cummings, 1996; Unsworth, Wall, & Carter, 2005; Woodman, Sawyer, & Griffin, 1993).

While bearing in mind the importance of the creativity process within the 4Ps framework, the current exploratory study focuses mainly on the other three aspects: person, product, and press. More specifically, it attempts to understand to what extent these three factors interact with each other, as well as to examine the relationship among cognitive styles, creative achievements, and creative environments. It is hypothesized that people with more innovative cognitive styles will have more salient creative achievements. Additionally, it is hypothesized that individuals’ perceptions of whether they are or are not in a creative environment play a mediating role in the relationship between their cognitive styles and their creative achievements.

## METHOD

### Participants

The sample for this study consisted of 243 Chinese students in Macau, chosen by convenience sampling. There were 160 females and 83 males in this sample, with an average age of 20.34 years.

### Measures

**Kirton Adaption-Innovation Inventory (KAI).** The KAI was developed by Kirton (1976) to provide a deeper understanding of two cognitive types: adapters, who prefer making incremental improvements within set boundaries, and innovators, who are willing to go beyond their comfort zones to achieve major change. The KAI contains 32 items with a 5-point Likert-scale ranging from 1 (*item does not describe me well*) to 5 (*item describes me well*). The possible scores therefore range from 32 to 160, and the higher a respondent’s score, the more innovative an orientation that person can be said to have. For purposes of the current study, a score of 96 was treated as cut-off point: respondents who obtained scores of 97 and above (i.e., more than 3.0 per item on average) were coded as innovators, whereas people with scores of 96

and below (3.0 per item or less) were viewed as adaptors. The KAI also tests for three dimensions: Rule/Group Conformity (R), which indicates subjects' levels of adherence to group norms; Efficiency (E), which reflects their levels of concern for detail and reliability; and Sufficiency of Originality (SO), which refers to the likelihood that they will brainstorm creative ideas. The KAI is a popular measure in the organizational research and creativity literature, and a number of studies have supported its reliability and validity (e.g., Bobic, Davis, & Cunningham, 1999; Houtz, Selby, Esquivel, Okoye, Peters, & Treffinger, 2003; Hsu, 2013; Keller & Holland, 1978; Kwang, Ang, Ooi, Shin, Oei, & Leng, 2005).

**Biographical Inventory of Creative Behaviors (BICB).** Creative achievement was measured using the BICB (Batey, 2007), a 34-item questionnaire that evaluates everyday creativity across different domains, including arts, crafts, creative writing, leadership, coaching, and mentorship. The BICB uses a forced-choice *yes/no* format, with *yes* scored as 1 and *no* as 0, yielding a range of possible scores from 0 to 34. Several studies suggest that the BICB has a solid factor structure and is a reliable self-report measure (Batey & Furnham, 2008; Silvia, Wigert, Reiter-Palmon, & Kaufman, 2012). A summary score aggregating the *yes* responses was obtained, with higher scores suggesting greater involvement in creative activities during the previous 12 months.

**Creative Environment Perceptions (CEP).** Mayfield and Mayfield (2010) have developed a parsimonious measure to evaluate employees' perceptions of whether their workplace is a creative environment. It contains nine items covering three dimensions: creativity support, work characteristics, and creativity blocks. Based on the results of structural equation model analysis, the authors found that the CEP attained valid measurement quality. The current study utilized an adapted version of the CEP, with six items rather than nine, each one slightly changed to reflect the non-workplace context. For example, the statement, "My supervisor encourages me to be creative" was changed to, "My teacher encourages me to be creative." A five-point Likert-type scale was used, ranging from 1 "strongly disagree" to 5 "strongly agree." A summary score aggregating the responses was obtained, with higher scores suggesting higher levels of perception that the environment was creative.

## PROCESS

All instruments were translated from English into Chinese by the researcher, checked by two experts, and then administered in Chinese to all the respondents. The researcher obtained permission to collect data from the students, and then conducted three rounds of data-collection in a class setting. The process of completing the package took the respondents about 30 minutes,



after which they were asked to provide their background information, including age, gender, and educational level.

## RESULTS

The means, standard deviations, and intercorrelations among six variables are reported in Table 1. Among six, three represent the respective summary scores for each of the three questionnaires used, and the other three—*originality*, *efficiency*, and *conformity*—were derived from the KAI. The majority of the respondents qualified as innovators, given the cut-off score of 96. The results of correlational analyses show that all correlation coefficients were positive and significant, with magnitudes ranging from weak ( $r = .16$ ) to strong ( $r = .80$ ).

**Table 1**

Means, Standard Deviations, and Intercorrelations of Scores for Six Measures								
Measure	M	SD	1	2	3	4	5	6
1. BICB	12.71	4.72	--					
2. CEP	21.81	3.80	.23**	--				
3. KAI	111.94	11.23	.38**	.52**	--			
4. Originality	46.19	5.44	.38**	.53**	.76**	--		
5. Efficiency	23.78	3.98	.32**	.33**	.80**	.50**	--	
6. Conformity	41.98	5.39	.16**	.31**	.73**	.20**	.42**	--

\*\*  $p < .01$ .

To identify whether gender differences and the two cognitive styles being studied had effects on creative achievement and perceptions regarding the creative environment, this study used a 2 (males or females) x 2 (adaptors or innovators) MANOVA with two dependent variables (BICB and CEP). Table 2 shows means and standard deviations for the dependent variables. In terms of both creative achievement and perceptions of the creative environment, innovators' mean scores were higher than those of adaptors across both genders.

The results of multivariate and univariate ANOVAs are presented together in Table 3. Using Pillai's trace revealed significant effects of cognitive style on both creative achievement and perceptions of creative learning,  $V = .54$ ,  $F(2, 170)$ ,  $p = .009$ . In addition, separate univariate ANOVAs on the outcome variables suggested a significant effect of cognitive style on creative achievement,  $F(1, 175) = 7.72$ ,  $p = .006$ , and a non-significant effect of cognitive style on perceptions of creative environment,  $F(1, 175) = 3.76$ ,  $p = .054$ . Additionally, the results revealed that gender and interaction effects on interaction variables were not significant.

**Table 2**

*Mean Scores and Standard Deviations for Measures of BICB and CEP as Functions of Gender and Cognitive Style*

Group	BICB		CEP	
	M	SD	M	SD
<b>Males</b>				
Adaptors	9	2.19	20.5	2.35
Innovators	12.86	5.28	22	4.04
<b>Females</b>				
Adaptors	8.25	2.75	18.5	1
Innovators	13.02	4.30	21.88	3.71

**Table 3**

*Multivariate and Univariate Analyses of Variance for BICB and CEP*

Source	Multivariate			Univariate					
	Fa	p	h2	BICB			CEP		
				Fb	p	h2	Fb	p	h2
Gender	0.35	.703	.004	0.04	.849	.000	0.71	.401	.004
Style	4.80	.009	.054	7.72	.006	.043	3.76	.054	.022
Gender X Style	0.29	.751	.003	0.09	.770	.000	0.56	.456	.003

Note. Multivariate F ratios were generated from Pillai's statistic. aMultivariate  $df = 2, 170$ . bUnivariate  $df = 1, 175$ .

Another aim of the current study was to examine the effects of students' characteristics on their creative achievement. As such, the criterion variable was creative achievement as measured by the BICB, and the four predictors were age, gender, cognitive style (KAI), and perceptions of creative environment (CEP). A hierarchical multiple regression analysis was conducted, with four independent variables entered into the regression equation in the model. The results of this are reported in Table 4 and indicate that only cognitive style as measured by KAI ( $b = .38, p < .001$ ) was a valid predictor of students' creative achievement.

**Table 4***Hierarchical Regression Analysis Summary for Four Variables Predicting Creative Achievement*

Step and predictor variable	B	SE B	b	R2	D R2
Step 1:				.009	
Age	-.19	.15	-.10		
Step 2:				.010	.00
Gender	-.14	.76	-.02		
Step 3:				.148***	.14***
KAI	.16	.03	.38***		
Step 4:				.149***	.00
CEP	.03	.11	.03		

\*\*\*  $p < .001$ .

## DISCUSSION

According to zero-order correlations, the results of this study indicate that the relationships among cognitive styles, creative achievements, and creative-environments perceptions were positive and significant, with magnitudes ranging from weak ( $r = .23$ ) to moderate ( $r = .52$ ). In terms of the relationship between creative achievement and perceptions of a creative environment, it was found that among the students in our sample, innovators had higher scores than adaptors did. This suggests that, as compared to adaptors, innovators had greater daily creative achievement (as measured by BICB), as well as more awareness of their environment as creative (as measured by CEP).

The results of MANOVA further support our first hypothesis that people with more innovative cognitive styles will have more creative achievements and this is in line with prior studies (e.g., Luh & Lu, 2012). Neither gender nor the interaction between gender and cognitive style had any effects on creative achievement. However, univariate ANOVAs indicated that the difference between adaptors and innovators with regard to perceptions of a creative environment were at the margin ( $p = .054$ ). Our abovementioned finding that only cognitive style was a valid predictor of the respondents' creative achievement further confirms our first hypothesis; however, it does not support our second hypothesis, that the perception of a creative environment plays a mediating role in the relationship between cognitive style and creative achievement.

This study has several limitations that might affect the interpretation of the findings. First, our sample pool was entirely recruited from Chinese

undergraduates in art and design programs, and therefore might not be very representative of other groups—especially insofar as the majority of our respondents were classified as innovators—. On the one hand, this trends to validate the KAI scale, but on the other, it might be seen as contaminating our results. Secondly, this study was cross-sectional and relied on self-report instruments. Although this combination of methods has been validated by other studies (Silvia et al., 2012), the use of a longitudinal or experimental design might be more appropriate for future study of students' creative achievement, as it would allow the subjects to create work that is then evaluated by experts. In light of these limitations, the present study probably underestimates the real effect sizes. Another line of questioning for future researchers might be that, if cognitive styles have a psychological basis, then what type of environments facilitate the conservative disposition of the adaptor, i.e., increases individuals' acceptance of the status quo?

## **CONCLUSION**

The major finding of the current study is that the innovative cognitive style positively and significantly predicts students' creative achievement. However, the perception of being in a creative environment did not play a mediating role between cognitive style and creative achievement. Theoretically, it has been suggested that the intersection and interaction of environment with other variables cannot be separated when examining the possible factors influencing individuals' creativity (Csikszentmihalyi, 1990; Mayfield & Mayfield, 2010). Therefore, there is still scope for further investigation.

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## ABOUT THE AUTHOR

### Kuan Chen Tsai, Ph.D.

He is the author of numerous journal articles. His current research interests include creativity, adult learning, organizational behavior, as well as art and design. [tsaikuanchen@cityu.mo](mailto:tsaikuanchen@cityu.mo)

6

chapters



# Creative Articulation

▶ Jonathan A. Plucker · Talent Development,  
Johns Hopkins University

## ABSTRACT

Creativity is becoming an increasingly popular student outcome in education systems around the world, both as an outcome in its own right and as part of broader models of 21<sup>st</sup> century skills and learning. At the same time, our conceptual models of creativity have become more complex, in large part due to the acknowledgement of the role of social contexts and audience factors in judgments of creativity (e.g., Plucker, Beghetto, & Dow, 2004). However, the field has yet to develop a conceptual model that represents how individuals or groups can convey their creativity to audiences in different social contexts. This theoretical vacuum threatens to stall progress in promoting student creativity. The purpose of this paper is to propose a model of creative articulation that attempts to build on previous theories and models by describing ways in which creators select potential audiences for their creative work and use communication and persuasion to maximize the value of their creative work in the eyes of those audiences.

## CREATIVE ARTICULATION

Most definitions of creativity include some combination of originality and appropriateness or usefulness. For example, Plucker, Beghetto, and Dow (2004) defined creativity as “the interaction among *aptitude, process, and environment* by which an individual or group produces a *perceptible product*



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that is both *novel and useful* as defined within a *social context*” (p. 90, emphasizes in original). But creativity scholars have yet to address comprehensively the question of how one’s creativity is determined to be novel and useful within a given social context, and if an individual or group can influence the determination of whether their product is determined to be creative.

The topic of acceptance and communication of the creative product has received a considerable amount of study in sociology, marketing, anthropology, public administration, management, economics, and communication science as diffusion of innovation, diffusion of technology, and technology transfer (e.g., Kushner, Gibson, Gulick, Honigmann, & Nonas, 1962; Rogers, 1983), but little of this research and theory can be found in the creativity literature. This lack of attention is surprising considering biographical and case study work suggesting that eminent creators engaged in considerable self-promotion and acceptance-gaining behaviors (Gardner, 1993; Robb, 1995). Furthermore, discussions of the educational and classroom implications of the communication and acceptance of creativity are rare and quite dated. Given recent advances in technology-aided communication, especially the use of social networks, the lack of recent conceptual work on the individual’s role in gaining acceptance for his or her creative products is surprising and in need of attention.

This paper explores the complex dynamics of processes involved in the acceptance of creative products which an individual can influence; a fuller discussion, including the role of potential audiences and the environment is beyond the scope of this chapter. The process of attempting to gain acceptance for a creative product will be referred to as the *articulation of creative products* in this paper.<sup>1</sup> The common usage of “articulation,” the formation of vocal utterances as utilized in verbal communication (McKechnie, 1979), is broadened here to represent the processes through which an individual influences the numerous elements that interact to determine the acceptance or rejection of a creative product. This term is used instead of acceptance-gaining, because the attainment of acceptance involves many elements which are beyond an individual’s control—those elements which an individual *can* influence are, therefore, referred to as articulation.

1 In line with the terms used in Plucker et al. (2004), *product* is used broadly to represent any result of creative work, from ideas to patents, novels to recipes, skyscrapers to gardens.

## TREATMENT OF ARTICULATION IN CLASSIC AND RECENT MODELS OF CREATIVITY

Despite impressive, recent growth in models and theories of creativity (e.g., Beghetto & Kaufman, 2007; Sternberg, Kaufman, & Pretz, 2001, 2002), psychological and educational theories that actually incorporate communication or articulation as vital constructs in the creative process are rare. Several theories—both older conceptualizations, such as the Creative Problem Solving (CPS) model (Isaksen & Treffinger, 1985; Parnes, 1981; Puccio, Firestien, Coyle, & Masucci, 2006) and Stein’s (1974, 1975) three-stage process, and more recent models, such as the Investment Theory (Sternberg & Lubart, 1991, 1992), 4-C model (Kaufman & Beghetto, 2009), and 5A Framework (Glăveanu, 2013)—address aspects of articulation, but not yet in comprehensive ways that can help guide improvements in educational practice.

For example, the final step of the CPS model, *acceptance finding*, involves the implementation of an idea generated in order to solve a particular problem. A related model (Basadur, 1987) breaks the CPS stage of acceptance finding into planning and selling the idea. In a simplified version, these stages are combined with the action stage into “solution implementation.” In both the CPS and Basadur models, the process of solution implementation involves a divergent thinking phase, during which numerous possibilities for implementation are created, and a convergent thinking phase, in which the most potentially useful idea is chosen and utilized (Basadur, 1987; Isaksen & Treffinger, 1985). Numerous suggestions are given to aid an individual during the convergent thinking phase, including techniques such as criterion listing, the use of evaluation matrices, and the identification of sources of assistance and resistance.

The role of society in the evaluation and adoption of creative products has been summarized by Csikszentmihalyi (1988) in his systems model of creativity. The interaction of three systems (person, domain, and field) yields a creative product. The *person* takes information from the culture (*domain*) in order to “produce some variation” (p. 330). It is the role of the *field*, which includes those people and institutions that have an influence in a specific domain, to incorporate the most “promising variations” into that domain (p. 330). Each field contains gatekeepers, those persons who exert some degree of control over the factual content of the domain. Csikszentmihalyi’s model is similar to the work of Rank (1932), who felt that “only the community, one’s contemporaries, or posterity” can declare one to be an “artist” (pp. 67-68). If accepted, the “variation” suggested by the individual’s creative process may eventually be added to the information base of the domain. The person-domain-field interaction can then begin again, constantly building upon itself in an ascending spiral.

More recent conceptualizations of creativity, including Beghetto and Kaufman's (2007) 4-C model, Glăveanu's (2013) 5A framework, and Sternberg, Kaufman, and Pretz' (2001, 2002) propulsion model allow for the existence of creative articulation but do not address it directly in their theories and models. For example, the well-regarded 4-C model proposes four distinct levels of creativity: mini-c, personally meaningful creative acts; little-c, representing everyday instances of creativity; Pro-c, creativity leading to and representing professional level expertise; and Big-C, unambiguously creative accomplishments with significant societal impact (Beghetto & Kaufman, 2007). The authors acknowledge that transitions occur between the various types of creativity, and they propose some initial mechanisms for those transitions; they do not, however, address the role of creators in advocating for their work and influencing others' decisions about how the creative value of that work is received (see, specifically, Kaufman & Beghetto, 2009, Figure 1 on p. 7). Glăveanu's (2013) 5A framework comes closest to addressing articulation directly, with its emphasis on actors interacting with their social context and affordances facilitating interactions between actors and audiences. But again, the theory has not developed to the point where mechanisms for these interactions have been posited.

The purpose of the creative articulation model is not to replace these existing conceptualizations but rather to build upon them, with the goals of providing insight into how these hypothesized processes can better model real-world creativity and be fostered in educational settings.

### COMPONENTS OF ARTICULATION

A review of the creativity literature reveals little as to how the acceptance of creative products is and can be influenced. Classic perspectives occasionally mention communication but not the importance of or mechanisms for explaining individual-environment or individual-potential audience interactions. More recent perspectives have accentuated environmental, societal, and potential audience aspects, but a process through which an individual can affect the acceptance of a creative product is not given. Overall, creativity perspectives lack a potential mechanism through which the acceptance of creative products occurs, and when communication is mentioned it is invariably presented as simple, direct, and either verbal or written. Variables such as enthusiasm, experience, and audience selection, all of which may influence the acceptance of creative products, are infrequently discussed. Too much responsibility for the acceptance of the product is put in the hands of potential audiences, and perspectives that include the role of the creative product's communicator deemphasize the positive influence that he or she may exert and/or stress the negative implications that may result from his or

her involvement in the communication stage (Csikszentmihalyi, 1988; Stein, 1974, 1975; Sternberg & Lubart, 1991). Analysis of a product's attributes are suggested, but the benefits gained from an examination of the personal characteristics of the "acceptance-gainer" are rarely analyzed.

To formulate a list of the characteristics, processes, and abilities which constitute successful articulation, a three-stage process was used: First, historical cases of creative production from a wide range of domains were analyzed in order to find basic patterns and themes. Second, the experiences of contemporary individuals who have made outstanding creative contributions to their respective fields to create a hierarchy of processes, and also personality traits. Third, extensive observations of children showed which processes and characteristics were absent in individuals who have not yet learned to articulate.

The resulting hierarchy has two tiers. The general components that make up the first tier are: communication, which involves putting the product in a form that is easily presented to and understood by the intended audience; audience selection, or deciding which group or groups constitute an audience which is likely to accept the product; selecting or creating the proper mood, or waiting until the atmosphere is 'ripe for acceptance' for the creative product; and alliance construction, which can be described as the process of finding advocates who are in a position to aid in the attainment of acceptance, be they peers, mentors, or gatekeepers.

Assuming that communication is strictly verbal or written would be ignoring the numerous ways that people transfer information. The communication component of articulation includes any process which transfers information pertaining to the creative product from the creator to the target audience. These processes attempt to transfer information through at least one of the five senses, for example: scratch and sniff ads in magazines, advertisements on television or social media, food samples at grocery stores, and music played on the internet or satellite radio to help convince you to buy a certain album or product. In each of these examples, an articulator is utilizing a form of communication in an attempt to gain acceptance for a creative product.

Another aspect of communication of the creative product involves the construction of the message being transmitted to the audience. The study of communication and persuasion provide several suggestions: Avoid conflicting elements within a message or conflicting messages within a group of messages (Hovland, 1957); the "content of the message" includes both the actual message and the influence of the product for which you are attempting to gain acceptance; initially communicate items which the audience already

favors or probably favors in order to get their attention and pique their interest (McGuire, 1957).

The concept of audience selection is an integral part of communication, persuasion, and business, where the “selection of markets to be served and the approach to be taken to those markets” is a core component of marketing strategy (Backman & Czepiel, 1977). Audience selection is critical for two reasons: First, approaching all potential audiences simultaneously is impossible; and, second, each audience’s characteristics are unique. The variability of potential audiences and audience members is well documented with respect to order of presentation (Hovland, Lumsdaine, & Sheffield, cited in Hovland, 1957; Janis & Feierabend, 1957), persuasibility (Hovland & Janis, 1959), rate of adoption or ‘innovativeness’ (Rogers, 1983), prior knowledge and message comprehension (Jacobvitz, Wood, & Albin, 1991), and many other traits. “Knowing your audience” may be a cliché, but it is pertinent to the articulation of creative products.

Audience selection can have a tremendous impact upon the articulation process; in marketing, distribution strategy is considered crucial because it involves “long term commitments with other firms and has a long-lasting effect on the firm’s future range of alternatives” (Backman & Czepiel, 1977, p. 3). Due to the importance of audience selection, pre-articulation studies that determine the needs and characteristics of the audience and the characteristics and resources of the articulator are commonplace in marketing and technological fields. A real-life example of the successful use of audience selection is that of American companies that sell sand to Saudi Arabia and other arid countries. By targeting certain manufacturers who require special grades of fine sand that cannot be found in otherwise sand-filled countries, American sand companies have been able to gain acceptance for their product.

Selecting or creating the proper mood would include the investment theory concept of choosing to develop the “undervalued” idea or product (Sternberg & Lubart, 1992), but would also include the individual’s influence in convincing the potential audience that an idea was undervalued, actions of the individual that establish a more favorable or acceptable mood towards the product, and the influence of the environment upon the form of the articulator’s message and how it is communicated. Beveridge (1957) felt that “discoveries made when the time is ripe for them are more readily accepted because they fit into and find support in prevailing concepts, or grow out of the present body of knowledge” (p. 146). However, these discoveries “often encounter some resistance before they are generally accepted” (p. 146). A common method of determining the mood of a potential audience is public opinion polling, although the mood can be ascertained in a number of ways.

Ward (1987) questions the plausibility of creating the proper mood: The alleged ability of marketing communication to “create needs” ignores the fact that 8 out of 10 new products . . . do not reach sales objectives. . . Another alternative, of course, is that consumers are not easily “misled” into purchasing things they do not “really need.” (p. 672)

However, Rogers (1983) believes that the awareness of an innovation may inspire a need, just as it may fill an existing need, and that “change agents” (i.e., articulators) are able to create the perception of a need. Although this topic will be addressed later, both researchers have too narrow of a focus, since the decision to adopt an innovation or accept a product is not based solely on need but also on perceived risk and cost.

An historical example of finding the proper environment is that of Giovanni Boccaccio, the fourteenth century writer who revolutionized literature by creating the novella and serving as the bridge between the literature of the middle ages and the Renaissance. In contrast to the religious themes of Dante’s *Divine Comedy*, Boccaccio’s *Decameron* has been referred to as a “Human Comedy,” one which was written for the consumption of the merchant class (Boorstin, 1992; Branca, 1976). The concept of “selecting the proper mood” is evident in the articulation of the *Decameron*, a series of tales told by 10 young people who fled to the countryside to avoid the plague. The region of Italy in which Boccaccio lived was ravished by the plague from 1346 to 1350, killing at least half of the population. This catastrophe gave Boccaccio the setting for his tales and “created the necessary moral atmosphere” for the tales to be accepted (Chubb, 1930, p. 140), since the religious themes that had dominated life in Italy were giving way to a more earthly outlook.

It was in this societal context that the *Decameron* was accepted; its secular themes and presentation would have been presented to a more reluctant audience a few years earlier. The scholars of the time did not readily acknowledge the excellence of Boccaccio’s work, with even the translators remaining anonymous for many centuries (Boorstin, 1992). In spite of this lack of critical recognition, the middle classes (i.e., Boccaccio’s target audience) spread the *Decameron* throughout Europe in both written and spoken forms, making the novella an accepted and valued work (Branca, 1976; Chubb, 1930).

Alliance construction involves the targeting of individuals or groups of individuals who can help gain acceptance for the creative product. An example of alliance construction is a musician who comes up with a new song or style of music, which, because of its unique nature, does not gain the admiration of the rest of the band. By gaining the support of two other members

of the band, the musician may eventually convince the entire group that they should accept and play the song or style (see Shenk, 2014).

Of course, individuals may also prove to be barriers to acceptance, so the identification and avoidance of potential roadblocks is also a function of alliance construction. Sigmund Freud was especially active in this regard (Gardner, 1993). He actively sought out individuals who he perceived to be threats to psychoanalysis and attempted to discredit and isolate them from the psychological community in Vienna.

Allies are usually members of the targeted, potential audience. For example, George Dantzig, a mathematician who pioneered the use of the linear programming model, met with the economist T. J. Koopmans in an effort to see if there was an economic application of the model. Koopmans became a very excited and enthusiastic supporter of the model, effectively making the transition from potential audience to ally (Albers, 1990).

Csikszentmihalyi (1988) describes the gatekeepers in a field as those people who can exert some degree of control over the factual content of the domain. But diffusion research suggests that the concept of ‘allies’ is more complex: gatekeepers are individuals who tend to adopt innovation first within a given audience, thereby bringing the creative product into the audience’s environment/social network. These gatekeepers are different from opinion leaders, who (in a society that favors change) are the most influential with respect to the acceptance of innovation (Bettinghaus, 1968; Herbert, 1977; Rogers, 1983).

The role of experts can be overemphasized. Rogers (1983) mentions the phenomenon of “overadoption” in which audiences adopt an innovation when experts recommend against it. With respect to the creative product, there are many examples of the experts being wrong: The early readers of Boccaccio’s *Decameron* quickly distributed it to others, heavily promoting a book that academics chose to ignore for more than a generation. Recent research has also questioned the validity of expert evaluations of creativity, although no definitive conclusions have been reached on this point (e.g., Plucker, Holden, & Neustadter, 2008; Plucker, Kaufman, Temple, & Qian, 2009; Runco & Smith, 1992).

The supportive factors which constitute the second tier (Figure 1) include: personality factors, physical factors, motivation, thinking skills, image, communication skills, and other processes and traits which influence articulation less directly than the general components of the first tier. Many of these skills and factors have been mentioned in the literature, independently of articulation, with respect to creativity (e.g., personality factors by Woodman & Schoenfeldt, 1990; diplomacy by Beveridge, 1957), although most research that involves these characteristics and skills has occurred in the fields of com-



munication and social psychology. The list of supportive factors is not meant to be comprehensive, since the study of compliance-gaining messages is still in the formative stages (Miller, 1987).

Taken separately, the elements of the tiers would seem to hold little importance for attempting to gain acceptance for creative products. But when viewed as a series of building blocks, with those abilities and characteristics of the third tier at the base, their collective effect is more substantial. Each of the supportive factors of the third tier influence the use of each of the general components which constitute the second tier, which then have a direct effect upon the articulation process. Using an analogy, an experienced chess player knows that the person who has the most pieces near the end of the match is not automatically expected to win; rather, the player who takes the remaining pieces and uses them in the most effective manner is most likely to achieve the desired outcome of winning the match. Correspondingly, the most proficient articulator of creative products would not have a complete hierarchy of favorable components, factors, and skills but would instead be able to structure his or her abilities and attributes in a way that helps to articulate successfully, regardless of his or her deficiencies. Indeed, variability in message design and communication style necessitate flexible articulative strategies and processes (McCann & Higgins, 1984; O’Keefe, 1991).

For example, researchers investigating interpersonal communication found a considerable amount of variability in the general population with respect to sensitivity to non-verbal aspects of communication (Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979). Therefore, an articulator who finds non-verbal cues to be ineffective with a particular audience may wish to concentrate on other communication techniques and articulative strategies.

### IMPLICATIONS OF ARTICULATION

A more comprehensive understanding of articulation will benefit a number of areas, including creativity theory and research, educational instruction and evaluation, social and emotional development of creative individuals, research dissemination, and management.

Rather than propose another theory of creativity, of which there are already fine examples, this chapter proposes a model of articulation, the first part of a model of acceptance of creative products. Articulation is compatible with many systems and economic views of creativity, yet it can exist and function independently from the creative process. With respect to Csikszentmihalyi’s systems model (1988), the individual would be responsible for producing variations *and* exerting influence on the field’s evaluation process. The ever-spiraling and advancing nature of Csikszentmihalyi’s model, as described above, could be modified to include *descending* arrows that repre-

sent rejection or suggestions for modification of a creative idea or product by the field. With respect to the articulation of Boccaccio's work, questions are raised about the necessity of gatekeepers for a domain; they may help gain acceptance, but other avenues exist as well. Another modification would be necessary if the articulator was not the person from whom the creative products originated, since Csikszentmihalyi designates some of the ownership of creativity to these articulation surrogates. These people may simply be articulating in a creative manner or redefining the product in order to articulate it more successfully.

Including articulation in systems theories (e.g., Sternberg & Lubart, 1992) allows the individual to "convince society" that his or her creative product was undervalued, effectively allowing the "salesperson" to employ articulative skill as it pertains to gaining acceptance for his or her creative product. This would allow the individual who is attempting articulation to influence the perceived supply and demand (or cost and risk) of an idea or other creative product. Each of these theories can incorporate articulation by the individual through expansion of the individual's role or a modification of the individual-potential audience/society interaction.

Programs that attempt to increase personal creativity should include some instruction and practice in the articulation of creative products. An example is that of guiding students through the prototype-construction phase of the invention process, since many students are deficient in certain skills (e.g., using tools, moving from two to three dimensions), which keeps them from putting their ideas into a concrete, communicable form. Individuals also need to be familiar with the process of articulation in order to positively affect the acceptance of their creative endeavors. Future program development involving creativity should take into account the role that articulation plays in the development and acceptance of creativity.

If an individual wishes to articulate his or her creative products, an inability to do so may lead to social and emotional difficulties. A greater familiarity with articulation processes may help individuals to gain acceptance for their creativity, resulting in increased self-esteem and psychological health.

### SUMMARY

Most of Boccaccio's stories are folktales from Europe and the Middle East, many of Shakespeare's plays are based upon classical stories, and Lovelock and Margulis' Gaia Hypothesis can be viewed as a scientific justification of ideas held by some cultures for millennia. Considering the complex interactions involved in articulation, perhaps these creators are popularly associated with these works because they articulated their products more efficiently and, therefore, more effectively.

Systems theories' inclusion of the influence of societal factors upon creativity is an improvement from previous work in creativity, diffusion of innovation, and technology transfer, but these theories and models are incomplete in two ways: First, many deal only with the role of societal factors as they influence the creative process, ignoring the societal factors' impact on the acceptance of creative products; and, second, those theories that consider the role of society in the acceptance of creative products fail to mention a mechanism through which individuals can directly influence that acceptance by exerting some control over the environment and potential audiences.

The articulation portion of this model involves the individual's role in gaining acceptance for a creative product in light of societal, audience, communication, and environmental variables. Although further extension and modification of the suggested hierarchy of components is necessary to better understand this process, an attempt has been made to represent more accurately the nature of the individual's role in gaining acceptance for a creative product. Coupled with the other aspects of the model of acceptance/rejection of creative products, a more comprehensive depiction of acceptance-gaining emerges.

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## ABOUT THE AUTHOR

### **Jonathan A. Plucker, Ph.D.**

He has worked on projects involving educators, schools, and students in several countries and is continually interested in how culture does (and does not) define our beliefs, attitudes, and behaviors. His research examines education policy and talent development, with over 200 publications to his credit. [jplucker@jhu.edu](mailto:jplucker@jhu.edu)



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# Mental Wormholes and the Inner Workings of Creative Thought

► Liane Gabora · University of British Columbia

Most creative outputs are readily classified as belonging to a particular domain, such as art, music, or technology. But does that mean the creative thinking that goes into creative projects respects these conventional domain boundaries? This question provides the departure point for this chapter. It is an important question because the answer has implications for how the creative process works, as well as for computational models of creativity. Next we look at how the creator sifts out from its vast contents those items to incorporate into a creative project and converts these raw materials into a form that “gels” with the project. We then explore the hypothesis that the creative mind forges “mental wormholes” that connect concepts and percepts, often from seemingly disparate domains. Finally, we take a brief look at the strangely non-compositional interactions that take place in these mental wormholes and techniques being advanced to model and understand these interactions.

## DOES CREATIVE THOUGHT RESPECT DOMAIN BOUNDARIES?

I remember as a child placing everything in the world into categories, such as “things that don’t change” (e.g., a rock),



We look at how the creator sifts out from its vast contents those items to incorporate into a creative project and converts these raw materials into a form that “gels” with the project.

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“things that go back and forth between two possibilities” (e.g., a metronome), “things that circle around to their starting point” (e.g., seasons, or music that always goes back to the chorus), “things that spiral around to a slightly different starting point” (e.g., music that is transposed to a different key before returning to the chorus, or a story in which the character changes before returning home), and so forth. Whether a pattern was implemented as musical notes versus words on a page seemed superficial compared to the fact that they were both instances of, say, “spiral”. Amazingly enough, the adults in my life didn’t see this as a profound and useful way of carving up reality.

Of course, reality doesn’t *come* carved up into domains. However, since we all come into this world equipped with sensory apparatuses that parse information in specific ways, and we are educated in ways that reinforce the categorization of knowledge into specific domains (mathematics, music, art, and so forth), it is natural that we come to accept these domains as real, or at least as pragmatically useful social constructs. But that doesn’t mean that they necessarily reflect how we think. There is evidence that people do not think in ways that respect conventional domain boundaries (e.g., musical thought is not restricted to concepts such as rhythm and timbre). Ingredients for creative thinking—such as remote associates (e.g., “cottage” and “cheese”) (Mednick, 1962), analogies (Gentner, 1983), and ‘seed incidents’ (e.g., falling in love inspires a song) (Doyle, 1998)—and inspirational sources often come from *beyond* the problem domain. For example, in one study, 66 creative individuals in a variety of disciplines were asked to list as many influences on their creative work as they could (Gabora & Carbert, 2015). Rather astonishingly, not only were cross-domain influences found to exist, they were more widespread than within-domain influences (see Table 1). Moreover, this was the case even when not just narrow within-domain influences (e.g., painter influenced by paintings) but also broad within-domain influences (e.g., painter influenced by Spirograph toy) are classified as “within-domain influences”.

**Table 1***Creative domain*

Creative Domain	N		CD		WD-n		WD-b		U	
	r	(%)	r	(%)	r	(%)	r	(%)	r	(%)
Painting	44	21 (48)	12	(27)	4	(9)	6	(14)		
Drawing	8	2 (25)	2	(25)	-	-	3	(38)		
Photography	4	2 (50)	-	-	1	(25)	-	-		
Sculpture	5	3 (60)	-	-	-	-	1	(20)		
Music	3	1 (33)	2	(68)	-	-	1	(33)		
Writing	2	2 (100)	1	(50)	-	-	1	(50)		
TOTAL	66	31 (47)	17	(27)	5	(8)	12	(18)		

Notes: Number of participants in each creative domain (N), and the raw number (r) and percentage (%) of influences that were cross-domain (CD), within-domain: narrow (WD-n), within-domain: broad (WD-b), and uncertain (U). Percentages are in brackets. A dash indicates that no examples were present in the data.

These results suggest that even when a particular creative output is categorized as belonging to a single domain (e.g., a painting belongs to the domain of art), the thinking that went into it may well have spanned many domains. In fact, analysis of the data suggested that just about anything encoded in memory can potentially be recruited into a creative thought process.

So a first point to be made about the inner workings of creative thought is that it can incorporate ingredients from beyond the domain in which it will eventually be expressed. This leads to two questions. First, how does the creator sift out from its vast contents those items to incorporate into a given creative thought process? Second, how does it convert this raw material into a form that is amenable to re-expression in a different domain?

### AWARE-RESTRUCTURE-EXPRESS (ARE)

Possible answers to these questions are suggested by a number of theories of creativity, including the *honing theory of creativity* (Carbert, Gabora, Schwartz, & Ranjan, 2014; Gabora, 2005, 2010a, in prep.). The basic idea is as follows: The creative mind is perpetually on the lookout for arenas of creative potential or incomplete understanding that Torrance (1962) refers to as the *gap*. The gap is arousal-inducing (where arousal may be either positively or negatively valenced). The creative process involves sequentially considering this gap from different perspectives, at different levels of detail, such that arousal dissipates. The new perspectives (1) restructure information (radically or imperceptibly) in the region of the gap and (2) suggest a subsequent perspective to look at it from. The finding of new perspectives

may be facilitated by shifting to an associative mode of thought, such that cell assemblies that respond to not just central but also peripheral features of the task are recruited. Since these cell assemblies may previously have encoded memories related to the task but in an atypical way, they can be the gateway to creative solutions (Gabora, 2002, 2010a). Eventually the new perspectives have restructured task-related ideas to the extent that they exhibit an acceptable level of consistency (Gabora, 1999), arousal decreases, and the creative outcome is expressed.

We can refer to this process of becoming aware of an arousal-inducing gap, sequentially restructuring it, and expressing it in restructured form, as the Aware-Restructure-Express process, or ARE. Note that domain-specific operations are *in service of* ARE; for example, one goes through the motions of committing paint to a canvas or words to page due to the arousing effect of the sense of incomplete understanding or creative potential. Findings that creativity can be intrinsically rewarding (Gruber, 1995; Kounios & Beeman, 2014; Martindale, 1984), therapeutic (Barron, 1963; Forgeard, 2013), and that high levels of creativity are correlated with positive affect (Hennessey & Amabile, 2010) suggest that one may be further motivated by anticipation of the pleasant and perhaps even therapeutic impact of the creative process.

### IMPLICATIONS FOR WHETHER CREATIVITY IS DOMAIN-SPECIFIC OR DOMAIN-GENERAL

The apparent domain-specificity of creativity—the fact that those who are eminently creative in one domain are unlikely to be eminently creative in another—may be an artifact of our focus on the external outcome of creative thinking, i.e., the product. When we focus instead on the internally transformative effects of creativity it appears to be much more domain-general; many if not most individuals have multiple avenues for transformative self-expression. This is particularly the case when we consider the creative aspects of activities that are not prototypically creative, such as organizing parties, fixing household appliances, or even deceiving others.

There is evidence that when people express themselves creatively in different domains their creative outputs bear the same recognizable distinctive style or ‘voice’ (Gabora, 2010; Gabora, O’Connor, & Ranjan, 2012; Ranjan, 2014). In one study, art students were able to identify at significantly above-chance levels which famous artists created pieces of art they had not seen before, as well as which of their classmates created pieces of art they had not seen before. More surprisingly, art students also identified the creators of non-painting artworks that they had not seen before. Similarly, creative writing students were able to identify at significantly above-chance levels passages of text written by famous writers that they had not encountered

before, and passages of text written by their classmates that they had not encountered before. Perhaps most surprising, creative writing students also identified at significantly above-chance levels which of their classmates created a work of art, i.e., a creative work in a domain other than writing. The finding that creative style is recognizable across domains is incompatible with the view that creativity is domain-specific.

Not only does a creator's personal style come through in different domains, but an inspirational source leaves a recognizable trace on a creative work in a different domain. In a study in which pieces of music were re-interpreted as paintings, naïve participants were able to correctly identify at significantly above-chance levels which piece of music inspired which painting (Ranjan, Gabora, & O'Connor, 2014; Ranjan, 2014). Although the medium of expression is different, something of its essence remains sufficiently intact for an observer to detect a resemblance between the new work and the source that inspired it. These results lend empirical support to the largely anecdotal body of evidence that cross-domain influence is a genuine phenomenon, and suggest that, at their core, creative ideas are less domain-dependent than they are generally assumed to be.

### MENTAL WORMHOLES

Creativity is often said to involve forging new associations amongst concepts and percepts (Ward, Smith, & Vaid, 1997). Thus percepts and concepts are the building blocks from which creative ideas are generated. A *percept* is a mental impression of something perceived by the senses, such as the sight of a particular kitchen. We often interpret percepts in terms of related percepts we have encountered in the past, i.e., we spontaneously categorize a particular kitchen as an instance of the concept KITCHEN. A *concept* is a mental construct that enables us to interpret the present situation in terms of similar previous situations. Concepts can be concrete, like KITCHEN, or abstract, like VIRTUE. Although concepts have traditionally been viewed as internal structures that *represent* a class of entities in the world, increasingly they are thought to have no fixed representational structure, their structure being dynamically influenced by the contexts in which they arise (Hampton, 1997). For example, you might consider the concept KITCHEN in the context of a doll house, in which case it is tiny.

We can use the term *mental wormholes* to refer to interactions between percepts and concepts from different domains, as schematically illustrated in Figure 1. Since these interactions lie at the heart of the creative act, let us examine them more closely.

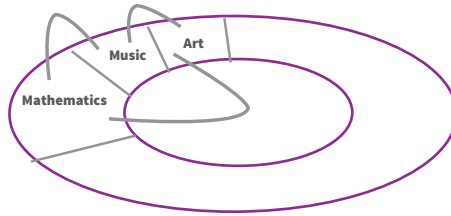


Figure 1. Schematic illustration of three mental wormholes, indicated by curved red lines, connecting concepts in one domain to concepts in another. See text for explanation.

### THE STRIKINGLY NON-COMPOSITIONAL MANNER IN WHICH CONCEPTS AND PERCEPTS INTERACT

Strange things happen in mental wormholes. Concepts and percepts interact with each other in an almost chameleon-like manner, spontaneously transmuting to match their surroundings, or context. Thus a context can alter, sometimes dramatically, how you experience a concept (Barsalou, 1999). Even more strangely, they often interact in ways that are non-compositional, in other words, that violate the rules of classical logic. For example, although people do not rate ‘guppy’ as a typical PET, nor as a typical FISH, they rate it as a highly typical PET FISH (Osherson & Smith, 1981). Something happens when the concepts PET and FISH interact that cannot be formally described using any kind of logical—or even fuzzy logical—function of the typicalities of pets and fish. Not every combination of percepts or concepts exhibits non-compositionality, but the phenomenon is widespread (Storms, De Boeck, Van Mechelen, & Ruts, 1998). Moreover, people not only prefer combinations that interact non-compositionally over those that interact in a straightforward additive manner, but they find them more creative (Gibbert, Hampton, Estes, & Mazursky, 2012).

#### Emergent Properties and Incorporation of Outside Knowledge

One spectacular manifestation of non-compositionality observed when percepts and concepts interact is the birth of new emergent properties. For example, although people do not rate ‘talks’ as a characteristic property of PET or BIRD, they rate it as a characteristic property of PET BIRD. ‘Talks’ is not a property of either constituent concept; it is an emergent property of the combined concept. A combined concept may also exhibit a loss of properties typical of one or both constituents. For example, ‘surrounded by water’, a seemingly central property of ISLAND, is (hopefully) not present in instances of KITCHEN ISLAND.

A related phenomenon is that concept combinations often incorporate world knowledge that goes beyond the constituent concepts themselves (Fodor, 1998; Hampton, 1987). For example, consider the concept TEAPOT, which presumably came about by taking a known object, a pot, and adapting it to be used for liquid. The combining of these concepts gave birth to a new concept, the idea of a spout. Moreover, this process employed knowledge of gravity and fluid dynamics that extends beyond the properties and instances of TEA and POT.

### Entanglement and Interference

How are we to understand the interactions between percepts and concepts at the core of the creative process when we cannot even describe these interactions with standard mathematics? There is in fact a branch of mathematics that is well suited to describing highly contextual interactions. It was first used in quantum mechanics, but generalizations of these formalisms have been applied outside of physics to the description of concepts (and use of these generalizations does not imply that phenomena at the quantum level play any role). Specifically, the non-compositional manner in which concepts interact can be described using formalisms that were developed to describe the physical phenomena of entanglement and interference. The formulae for *entanglement* were developed to describe situations of non-separability where different entities form a composite entity. It uses *amplitudes*, which are similar to probabilities, except that they can exhibit wave-like interference effects. Technically, a composite state is *separable* if the amplitudes describing the state of this entity are of a product form. If this is not the case, it is *inseparable*, and therefore an *entangled state*. Numerous studies have shown that the way in which people use and interpret concept combinations can be described using the formalisms for entanglement, and that concept combination data sets exhibit constructive and destructive interference effects (Aerts, Broekaert, Gabora, & Veloz, 2012; Aerts, Gabora, & Sozzo, 2013; Aerts & Sozzo, 2011; Bruza, Kitto, Ramm, & Sitbon, 2011; Gabora & Aerts, 2002; Nelson & McEvoy, 2007).

### CONCLUSIONS AND IMPLICATIONS FOR MODELING CREATIVITY

Creative thought exhibits some rather spectacular characteristics. First, it often incorporates ingredients from beyond the domain in which it is eventually expressed (e.g., thoughts and ideas from diverse arenas of life may be woven into the creation of a piece of art or music). If anything encoded in memory can potentially be recruited into a creative thought process, the mind requires a means of (1) finding relevant material and (2) converting it into a form in which it is amenable to expression in a different domain. It

was suggested that the domain-specific operations of a creative act operate in service of this Aware-Restructure-Express (ARE) process, which not only drives creativity in the first place but brings about potentially therapeutic cognitive restructuring.

Creative thought involves the forging of what we called mental wormholes: new associations amongst concepts and percepts that potentially come from disparate domains. This interaction may exhibit characteristics that make creativity challenging to model, such as non-compositionality, emergent properties, incorporation of outside knowledge, entanglement, and interference.

By building a model of something from scratch you can put your ideas to the test and see how it behaves under different conditions. Numerous mathematical and computational models of creativity exist (e.g., Boden, 2009; Cope, 2005; DiPaola & Gabora, 2009; Gabora & Tseng, 2014; Gero, 2000; Thagard & Stewart, 2011; Wiggins, Pearce, & Müllensiefen, 2009). With rare exceptions—e.g., some models of analogy and metaphor—these models are restricted to a single domain (e.g., a computer model of musical composition that uses only musical knowledge). A single-domain model is far easier to construct than one that incorporates multiple domains, but because it does not incorporate the weaving in of cross-domain material during the ARE process, it fails to capture not just what fuels the creative process in the first place but the potentially transformative and meaningful personal impact it may have on the creator. Therefore, it may be limited with respect to what it can tell us about how the human mind creates.

If a model is to capture what is fundamental about the inner workings of human creativity it must also be able to describe the non-compositional interactions between concepts and percepts that lie at the heart of the creative act. Though fledgling efforts have been made to develop mathematical models of creativity using the quantum formalism described above (e.g., Gabora & Carbert, 2015; Veloz, Gabora, Eyjolfson, & Aerts, 2011), they have yet to be used in computer programs that generate creative outputs. We are on the way to accomplishing this, however, and a major leap forward in our understanding of creativity may lie at our doorstep.

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## ABOUT THE AUTHOR

### Liane Gabora, Ph.D.

Her research, which employs both experimental studies with humans and computational models, has focused on creativity and evolve of creative ideas. She is also a published fiction writer, co-owns a small mobile app company, and composes piano music. [liane.gabora@ubc.ca](mailto:liane.gabora@ubc.ca)

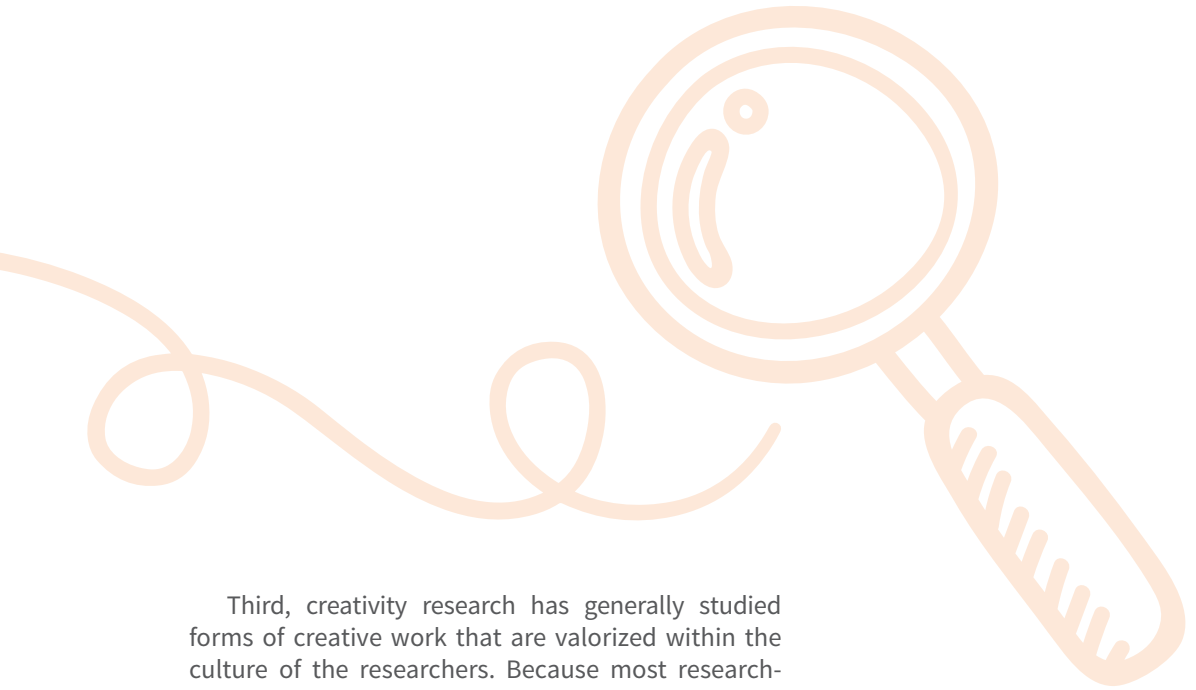
# Three Challenges Facing Creativity Researchers

► Keith Sawyer · University of North Carolina in Chapel Hill



I will discuss three challenges facing creativity researchers, and provide three suggestions for future research. First, creativity research should become more interdisciplinary. At present, the research program is dominated by psychologists. Psychologists have done excellent research and have furthered our understanding of creativity, but ultimately this line of research has strongly suggested that psychological studies of individuals can only explain a portion of the human phenomenon of creativity and innovation. This is because creativity is socially and culturally determined; as a result, creativity research in the future should be interdisciplinary, including research by sociologists, anthropologists, economists, and others.

Second, creativity research has generally focused on static states: visible created products (like paintings or scientific articles) or traits of creative individuals (including personality variables and genetic determinants). But this approach misses the processual, practice-oriented nature of creative work, and the field needs to shift to incorporate studies of creative processes in the future. Creators engage in processes and practices that take place over long periods of time, often without generating any visible products. Such creativity is most apparent in performance-based disciplines that are improvisational in nature—whether staged musical and theater, or the everyday creativity of conversational or argumentative exchange, or teaching, socializing, and disciplining children.



Third, creativity research has generally studied forms of creative work that are valorized within the culture of the researchers. Because most researchers work in European cultural traditions, the research tends to focus on high-status creative work, such as orchestral music composition, written poetry and novels, scientific theories, and technological invention. And yet, many individuals engage in creative work that does not fall into these highly valorized categories: motor engine mechanics; childcare workers with a group of children; members of the clergy ministering to their congregation; carpenters constructing a building; and perhaps more provocatively, criminals figuring out a creative new way to break into a building. In the future, creativity research should take care not to be implicitly and unconsciously influenced by the values held by the researcher's own cultural location, and should study all forms of creativity, rather than focusing only on those that are valued by the elite segments of society.

8

chapters

# Creating in Science

► Manuela Romo · Universidad Autónoma de Madrid

## 1. THE CREATIVITY TRIANGLE

Creativity is a complex phenomenon that requires a multi-disciplinary approach. According to Csikszentmihalyi (1998), for there to be creativity there has to be integration of three triangle vertices: individual, field, and domain/discipline (Fig. 1). A person with particular psychological characteristics—which will be addressed shortly—is also necessary to produce a creative product in a given field or discipline, having previously internalized the contents and rules of that field to make a valuable contribution. However, there will be no creativity as long as the domain, made up of the guardians of the field's door—in Csikszentmihalyi's words—, does not endorse that product as creative. Experts decide whether it is worth incorporating that product as an important contribution to the field or to the discipline. Thus, explaining creativity requires the joint collaboration of psychologists, sociologists, anthropologists, epistemologists, historians, and literary or art critics, among others.

Indeed, talking about creativity in a proper manner would not be possible if we do not start with a product. A criterion of epistemological objectivity demands searching for operative definitions to produce a scientific definition of such an elusive concept, one that has been the object of so much speculation and even palaver. Operative definitions, according to Brigdman (1972), must refer to observable facts, which does not mean that I support an outmoded positiv-



However, there will be no creativity as long as the domain, made up of the guardians of the field's door—in Csikszentmihalyi's words—, does not endorse that product as creative.

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ism; rather, I think it is best to adopt an operative definition of creativity: “creativity is a way of thinking that produces things that have both novelty and value” (Romo, 1997, p. 53). It must be remembered that when scientific investigation on creativity in the United States started, great effort and time was dedicated to defining the criteria of the product, to dealing with the “criterial” problem: What do novelty and value mean? Is it something contextual? and who has the authority to define it? The conferences at the University of Utah on Identification of Creative Scientific Talent kept researchers busy on the subject during the 1950s and 1960s. Those psychologists probably understood that research had to begin there; before setting off to explain the processes that lead to those products or to characterize the type of people who possess those features, we should agree on what makes these products special in the first place.

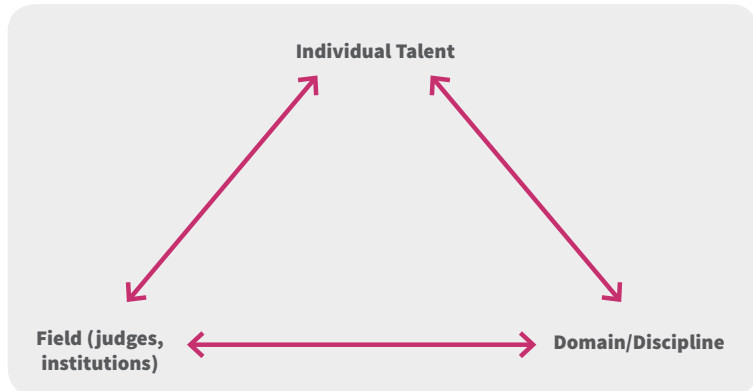


Figure 1. Creativity triangle according to Csikszentmihalyi.

Csikszentmihalyi’s triangle has provided a modern and appropriate version of both the topics under discussion and the conclusions reached at the Utah conferences. Indeed, the triangle’s second vertex refers to the field and to the domain or discipline where the creator produces his or her work, and is in turn transformed by that work: science, technology, philosophy, music, fine arts, literature, cinema, pedagogy, fashion, cuisine, marketing, leadership, etc. Thus, we need to take these works, products, or “things” into account, as I state in my definition, which may be poems, philosophical theories, scientific discoveries, sonatas, films, educational paradigms, social movements, gowns, mobile phones, disposable syringes, lollipops, mops, etc.

These “things” are new and valuable, which means that they contribute to transform a given field or discipline or, in its most transcendent form, to



develop a new one, creating a new discipline. Taylor (1972) called this supreme form of creativity “emergent creativity,” capable of producing additional creative activity in other minds, which entails breaking with a paradigm and producing a new one.

To close the circle defined by creativity, or rather, according to Csikszentmihalyi, who shows us where creativity is located—he replaces the question of *What is it?* with that of *Where is it?*—, we need people to certify that the product meets the criteria of originality and value. These people are the guardians of the domain doors, those who watch over and make decisions about that discipline, and have earned that right because they are the experts. Those who decide that the product is creative and worth taking into account and accepting in a given domain or discipline. Originality is a fairly objective criterion to be acknowledged in any field, but value has a contextual nature; it has its own criteria in each field or domain. For instance, the value of Michelangelo’s *Moses* responds to aesthetic criteria; it imitates nature perfectly, as the Classics used to say art should: the statue of a male in his maturity, the folds of his tunic, the solemn look and conveys feelings of greatness, of majesty for possessing the Tablets of the Law, or of ecstasy for having been in the presence of God. These are some of the elements that, at least I, being the lay person that I am in this matter, have learned to value each time I go to Rome and enter the San Pietro in Vincoli Church. And other aesthetic experiences or feelings I may experience next time, due the value of the artistic work lies also in producing new aesthetic feelings and experiences, in bringing about, somehow, innovative views in the spectator.

And what is the value of Darwin’s natural selection theory? Ultimately explaining the laws of evolution of life on Earth: Chance and need, as Monod (1970) would later summarize in his homonym book. Its value also lies in creating a new paradigm in natural science, which accounted for many anomalies and provided a global explanation for a great deal of empirical data; this paradigm would also have an impact on anthropology, geology, psychology, and especially on the very understanding the human has had of himself from that moment. Here, the domain is made up of various experts, scientists of many disciplines, which confers this work—just like the *Moses*—the nature of genius.

And what about the value of a light bulb? Or that of a mop? Sometimes it is the entire human race who determines the value—in this case, the practical value—of the products, having incorporated them into life everywhere on Earth because they make life easier. Manuel Jalon, Spanish inventor of the mop, said that his objective had been for women to be able to stand up while cleaning the floor (a phrase both misogynist and true in the sixties). Those memes (Dawkins, 2000), those units of acquired information, whether light bulbs, Picassos, or space shuttles, that have survived cultural selection

pressures and have been passed on from one generation to another, are the products of human creation. Those memes are responsible for the cultural advancement—as defined by Dawkins—of humanization, which is how our species has evolved since the hominization process ended and has catapulted us into the twenty-first century.

The field in Csikszentmihalyi's triangle is made up of scientists, philosophers, art critics and artists, musicians, film critics, writers, literary critics, chefs, etc., but it is also made up of a social group of people who decide to buy the latest convertible sports car or the latest iPhone, or, in some cases, it is made up of the entire human race (e.g., in the case of the light bulb, mop, agriculture, wheel, etc.).

However, the real nature of creativity is psychological. There is no creative product without a mind capable of producing it. Psychology studies who the people who create are, what the mental processes are that result in these developed works, what drives people to create, etc. Those cognitive processes, personality, and the motivation and feelings linked to creativity are all studied by the psychologist and define, in essence, the true nature of this dimension of the conduct that is responsible for humanity's cultural advancements and for taking us all the way from the caverns into Pluto.

## 2. THE ESSENCE OF CREATIVITY IS THE SAME EVERYWHERE

When speaking of scientific creativity, we must begin by pointing out that our understanding of creativity goes beyond qualitative distinctions between forms of creation: scientific and artistic, literary, musical, etc.... We believe that creation is the same everywhere, but it is also true that the characteristics of the field or discipline call for certain abilities and a vast knowledge of the discipline itself. (Romo, 2008, p. 157)

Even though in my definition of creativity I consider its psychological nature as essentially cognitive, it must be stated from the beginning that this is an extremely complex dimension of human conduct. In this dimension, one way or another, almost all psychological functions are involved, to a greater or lesser extent, from the most basic processes like perception, to the most complex like analogical thought or problem solving and, from cognitive processes, to those of affective or motivational nature.

Such creative **thought** processes are common in every field of work and have to do with the search and formulation of new problems. The “problem finding” construct as creativity's driving force has been the object of much research since its definition in 1976 by Getzels and Csikszentmihalyi, and

ever since Guilford's (1967), it has been conceived as knowledge with implications in the "sensitivity to problems" trait. Creative thought also entails the use of heuristics defined during the search of solutions, such as presenting various approaches through a flexible thought; the opening of the problem as the ability to keep it undefined and without formulating most of the time that which will enable new approaches, new points of view, and the combined activity between ideas that may trigger the solution. However, this requires resisting closure and tolerance for ambiguity, a mental attitude that not everyone can possess in a stable manner. Analogical thinking, the use of analogies, the ability to connect realities that at first sight have nothing to do with each other, to connect remote ideas—as Mednick (1962) suggested long time ago—is a fundamental process in the arts or in the literature where the product is often a beautiful metaphor but also in the sciences, where both instrumentally and in terms of results play a vital role—as constitutive metaphors such as the selfish gene (Dawkins, 2000)—. Lastly, we must consider "insight" processes or sudden understanding, where the elements of the problem are restructured in original and novel ways producing a creative solution and in which the above-mentioned heuristics have been present (see Romo, 1997 for further details).

In terms of **motivation**, the construct of intrinsic motivation has generated the greatest consensus among creativity researchers, more than any other psychological dimension. Teresa Amabile (1983) points out that an essential requirement for the functioning of the skills relevant to creativity is the motivation towards the task. This motivation must be intrinsic, that is, a motivation based on the love and interest for the work itself and not as a result of external reinforcements or pressures. The additive model of motivation proposed by Amabile (1990) assigns an important role to external motivation, which attaches itself to intrinsic motivation; this is obvious from the biographies of eminent people. It is clear, for example, that wanting to live off their creative work without having to engage in other activities for income is a fundamental motivation for all artists. However, extrinsic motivation favors creativity when motivation for the task already exists, an intrinsic motivation. For Amabile, it is the positive affect which produces the reinforcement that acts as mediator in the mental processes favoring creativity.

In this regard, when speaking of **affects**, we should mention that of flow. It is a complex affective state that is produced in intrinsically motivated tasks. Thus, in creative activities that produce an experience with very diverse and very pleasurable nuances, the individual will work harder in his or her activity searching for this special state.

Csikszentmihalyi (1988) has analyzed flow experience from an empirical perspective. During that emotional state, the individual is completely

absorbed, possessed, pleasantly excited by the creative work, completely oblivious to the external world, where the notion of time and even of oneself is lost; conscience and work are fused together; there is no fear of failure. Finally, Csikszentmihalyi tells us that the self expands when the process is over. Flowing is an extremely pleasant experience, and the aesthetic feeling is tied to it.

As for **personality**, in what follows I will mention the features whose presence has been systematically ascertained in the many forms of creative expression through case studies or psychometric empirical works by way of inventories or personality questionnaires.

### **Perseverance in the Face of Obstacles**

Dostoyevsky used to say that genius is maintaining patience. The mystery of creativity is something as prosaic as an effort sustained for many years. This feature entails investing a great amount of energy in one's work to overcome both external and internal obstacles to creative realization. The study of creative productivity in people suffering serious personal crisis has proven a true connection between resilience and creativity (Romo, 2009a). The most significant and current example among scientists that comes to mind is that of the English physicist Stephen Hawking.

### **Ability to Take Risks**

Creative personality welcomes challenges; in its field of work it takes risks. It is normally a calculated risk and even if there may be failure, the fear of failing will not block projects. Sternberg (Sternberg and Lubart, 1997) proposes an investment theory of creativity: Just like a stock market investor, the creator invests in the world of ideas, buying ideas low where the rest do not think it is worth investing and selling them high, when they have developed them and turned them into generally valued ideas. Every great creator that has broken previous schemes and founded new paradigms has taken great risks, such as suffering rejection, derision, isolation, exile, and even jail, but their work has been recognized in the end—like Darwin and Galileo—.

Charles Darwin had to face numerous challenges before and after publishing his theory of evolution. His work *On the Origin of Species* (1859) took him twenty years of preparation. While he gained the recognition of the scientific community with normative works, he dedicated himself to preparing his defense against foreseeable criticism. The delicate subject of extending the evolutionist explanation to our species took him twelve years longer with *The Descent of Man*. However, none of his precautions saved him from rejection and personal discredit (Gruber, 1974).

### Tolerance to Ambiguity

In cognitive terms, tolerance to ambiguity refers to an attitude of resisting the inertia of formulating and solving problems immediately or dominating uncertainty. This trait has ample meaning in creative personality. I will later talk about complex and paradoxical personality, as well as about the synthesis of the 10 opposite pairs in the creator's personality according to Csikszentmihalyi (1998). However, the tolerance trail to ambiguity had already been defined and empirically contrasted in psychometric studies with creators in the 1960s and 1970s at the University of California's *Institute of Personality Assessment Research*. Special emphasis has been given to psychological androgyny. In masculinity/femininity tests, both men and women show certain ambiguity, perhaps due to the great variety of interests they share, both typically male and female, which can be found in this type of tests.

### Openness to Experience

"I have no special talent. I am only passionately curious," Einstein used to say. For the scientist, creativity is related to the sensitivity to new things, to that which is discordant with established schemes. This openness entails knowing, testing, searching, and going about keeping our eyes peeled.

Carl Rogers has laid the most emphasis on this personal trait of creativity: the disposition to be open to experience, both inside and outside the individual. In the most recent "Big Five" personality model (Digman, 1990) the openness of mind feature appears systematically highlighted in every study with creative people.

### Self-Confidence

The presence of the previous features goes hand in hand with a good amount of self-confidence to face the unexpected, the uncertainty, the obstacles, and the failure, or to accept inner conflicts. Without a good self-concept, especially regarding everything that surrounds the individual's creative activity, creativity is not possible. In the presence of pathologies—as in the case of Van Gogh—there is no doubt about the importance of the creative activity itself and the need to sustain it.

### Independence

This trait has many sides. The cognitive style found in the creative individual, no matter the field, entails not letting oneself be conditioned by given perceptual structures. Such independence has a strong correlation with flexibility of thought (Romo, 1986), which, at a cognitive level, is the freedom to look for new approaches, to abandon mind sets, and to distance oneself from conventional

paths when dealing with problems. It is also independence in social conduct, associated with an autonomous, rebellious, and at times marginal behavior. In his *Creating Minds*, Gardner (1995) talks about the creator's marginality.

Independence is related to self-confidence. There is certainly interdependence among all the trait mentioned, also among them are motivation and thought to generate—in an integrated manner—this cultural good of humanity, as we have previously defined it (Ferreiro et al., 2008).<sup>1</sup>

We believe that creativity is unique and complex at the same time. In psychological terms, it is the processes themselves which explain the creative behavior, which may manifest itself in cooking, making a plan to make the person of your dreams fall for you, managing the economy of a household, or making up a bedtime story for children. The creative processes enclosed in these examples are the same processes that make the great works of the human mind possible, those that have survived cultural selection and are valued as masterpieces, whether they are works of art, scientific theories, spectacular technological breakthroughs, sonatas, poems, etc.

We must talk about common mental processes in the sciences or in art, in extreme creativity that has gone down in history or in everyday creativity. According to Boden (1991) H-creativity or historical creativity always entails P-creativity or personal creativity, and, from a psychological point of view, there are no qualitative differences. It is obvious that the abilities of creative thought are combined with the abilities of the domain, of the sphere where the individual produces his or her contributions, and it is also clear that both abilities are greatly developed in h-creative people, but there is no need to talk about different processes. Psychological processes essential to creativity are the same wherever creativity is found (Romo, 2008b).

### 3. GOING BACK TO THE DOMAIN'S SPECIFICITY

Acquiring the abilities of a given domain or the infrastructure for the field, as I have called them (Romo, 1997), is a long process, even if some have stated that some geniuses may have, innately, an unusual development (musical memory in Mozart, spatial imagination in Einstein, etc.). Similarly, being able to master the intricacies of a field, given the current development knowledge, is a long and laborious process that takes over ten years (this is the time it takes for an amateur to become a chess master or a cook to become a good chef). The psychological processes of creation presuppose these infrastructure abilities and interact with them.

1. An extensive discussion on the personality features of the creative scientist can be found in Chapter 7 of my book *Epistemología y Psicología* (Romo, 2008).

It is obvious that, with the level of development disciplines have attained since the Copernican revolution, it is impossible for any human mind, no matter how privileged, to be creative in several domains at a time. The last universal genius was Leonardo da Vinci, perhaps the most creative person of all time—this is why we celebrate World Creativity and Innovation Week beginning on his birthday—. However, nowadays such a figure is impossible: The enormous development attained by scientific disciplines would require several lifetimes to dominate the many different fields. What we do find is an ample variety of interests that, together with the great creative dedication in a given field, is combined with the presence of desirable hobbies: Einstein's dedication to the violin, Desmond Morris' painting (see Fig. 2, below), Marie Curie's social commitment, Ramon y Cajal's drawing, etc.

The 10-year rule, stated by Hayes (1981) and confirmed by Gardner (1995) in his seven studies of great creators in the modern era, has demonstrated that ten years or 20,000 hours of sustained work—as I like to put it—is roughly the time necessary to dominate a field and not only know it, but exercise the skills it demands in combination with creative thought's abilities to produce the first masterpiece. Without this, it is impossible: The muses take a long time to come down from Mount Olympus!

Gardner (1995) has explained better than anyone what this domain specificity is regarding cognitive abilities in his theory of multiple intelligences and his masterful book *Creating Minds*. Indeed, the author has clearly proven that creativity is not possible without possessing one of these domain intelligences in a high degree. It is worth remembering the domain abilities or intelligences Gardner (1995) highlighted for each of the seven great creators of the modern era he researched: mathematical logic for Einstein, intrapersonal intelligence for Freud, interpersonal intelligence for Gandhi, visual-spatial intelligence for Picasso, musical intelligence for Stravinsky, kinetic-corporal intelligence for Graham, and linguistic intelligence for Elliot.

Other componential models like that of Amabile (1996) have studied how the abilities of the field are in constant interaction with the abilities of creativity. If we turn to historical studies, we find that MacKinnon (1975) and Roe (1952), in their research with different types of creative professionals such as architects, social or natural scientists, have already explored the issue of the domain's specificity.

In addition to intrinsic motivation, flowing, and personality features already mentioned above as being present, in general, in creativity in any domain, there are multiple studies that attempt to define in a differential manner the characteristics of a given type of creativity (Kaufman & Baer, 2005). I will briefly refer to the studies on personality features and affects

focusing on the population under study: scientists and artists; it must be noted that the results of said studies are not conclusive.

The most controversial subject and one that has been the object of much analysis is that which relates madness to artistic creativity. Jamison's (1993) book *Touched with Fire* presented interesting data on the incidence of psychotic disorder among artists. Runco (2006), for his part, confirms the incidence of bipolar disorder, depression, and suicidal tendencies, especially among poets. The myth of the genius artist has arisen from this connection that has had bitter moments throughout history with important peaks, such as the Romantic Period (Romo, 2009b). As Charles Baudelaire declared: "Be beautiful and be sad."

Neuroticism is perhaps one of the most controversial features, especially in the artistic domain. Anxiety, emotional instability, and impulsiveness have been highlighted as frequent characteristics in artists. In a thought-provoking meta-analysis, Feist (1998) finds a greater sensibility and emotional instability among them; as they experience more intensely affectivity and have a weaker control over emotions than scientists.

Regarding Extraversion, artists have been said to have a withdrawn and even a surly personality. In this same vein, Mackinnon (1975) had already found that most creative architects were less inclined to social contact. Interestingly, among scientists, Feist (1998) concluded that the most creative scientists show more extraversion, which tends to be greater in social scientists than in natural scientists.

As for the Responsibility factor, Feist (1998) also found differences in studies among scientists and artists. He concluded that factors related to responsibility, such as organization, persistence, or discipline, seem to contribute more to scientific excellence than to artistic excellence.

Without denying the empirical evidence of these studies and the fact that an artist's archetypal personality is quite different from that of a scientist, we must not forget the construct of the paradoxical personality of the creator, whatever the field. This construct was enunciated by Maslow (1973) as the reconciliation of opposite impulses in the self-actualized person and that Csikszentmihalyi (1998) aptly articulates in his work with over 90 eminent individuals known for their creativity in different fields. Csikszentmihalyi talks about 10 pairs of opposites that occur only in creative people, alternating at different times. These are the 10 dialectic tensions that the creator has learnt to harmonize in his or her personality:

1. Combining intense work with relaxing pauses. Investing a great amount of physical energy in what they do, but alternating with rest periods.
1. Tending to be mature and naive at the same time, depending on the requirements of their activity at each time.



1. Combining the playful love for what they do with the discipline and responsibility that hard work demands.
1. Alternating fantasy with a profound sense of reality, risk with a prudent criterion.
1. Manifesting extraversion and introversion. Tending to work alone but looking for contact with relevant people to share and develop ideas.
1. Showing humility and arrogance, being aware of limitations while remaining convinced of their capabilities.
1. Presenting psychological androgyny, behaving in both masculine and feminine ways, surpassing gender role expectations. Whether male or female, showing independence, analytical, and assertive behavior, but also sensitivity, intuition, and openness.
1. Integrating rebelliousness with respect for tradition. This dialectic aptly reflects the “essential tension” in the scientist as described by Kuhn (1982).
1. Being both passionate and objective. Showing a high involvement in their work, but tending to value results impartially.
1. Being exposed to a great amount of suffering, although experimenting great pleasure too. Thus, living in an affective world with a great number of forces in tension.
1. Hopefully, the model we just described can help us go beyond the specificity of the domain as far as personality is concerned.

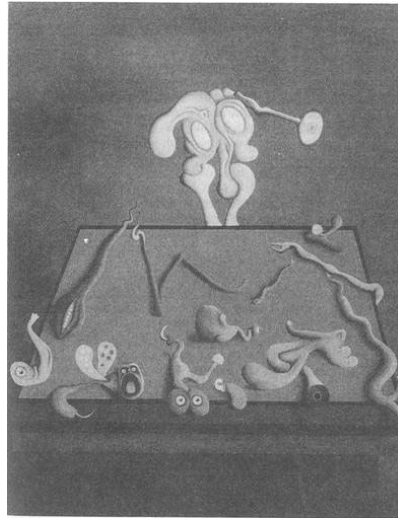
#### 4. SCIENCE IS NO LONGER WHAT IT USED TO BE

The notion of science and scientific activity experienced a radical change since alternative epistemological positions started to gain relevance in the 1960s. Ever since Thomas S. Kuhn's *The Structure of Scientific Revolutions* (1962/1975), where the notion of “scientific revolution” was coined and since the crisis of classical epistemological conceptions such as positivism and falsifiability held by science philosophers, scientific thought started being considered in a more naturalistic manner. Thus, a new discipline emerged, Metascience, where historians, sociologists, and psychologists of science approach the study of scientific activity as a human activity in development, as the study of what scientists do and not what they should do, which is what philosophers have traditionally focused on. As a result, its image changes radically. The ivory tower that had served as the abode of the scientist crumbles, its dweller mythologized as the impenitent seeker of truth, who formulates his theories based on objective observation and cold logic (Romo, 2008a).

Pierre Thuillier (1990), in his book *D'Archimède à Einstein: Les faces cachées de l'invention scientifique* (From Archimedes to Einstein: The Hidden

Faces of Scientific Research), states that the subjectivity of science has been hidden from us, the human side of the scientific creator that needs to take risks, rely on a certain conception of nature, postulate relationships that may be nonexistent, formulate bold and even reckless conjectures, and go as far as “manipulating” facts.

In this new epistemological perspective, the myth of the search for the truth and knowledge as the sole objective of pure sciences will fall. The dichotomy between natural and human sciences is diluted; the gap between explanation and narration, as objectives of physical and human sciences respectively, is overcome. Ever since we have come to learn that in the world of subatomic particles the observer is conditioning the observation results, the myth of objectivity in Physics has been compromised and scientific explanation, in general, does not distance itself much from narrative. We have here another link between science, the humanities, and the arts. As Bruner stated: “In a very deep sense, science is not so different from narrative” (Bruner in Preta, 1993, p. 142). Indeed, we agree with Bruner that the objective of science, like any human cognitive activity—such as art—, is to build worlds, not only to discover them.



*Figure 2. Blind watchmaker.* Desmond Morris combines in this painting his artistic and scientific work to do research on nature.

## 5. THE SCIENTIST AS “ARTIST”

### 5.1. Beauty vs. Truth?

*Science, considered as a project that is carried out progressively, is as subjective and as psychologically conditioned as any other human enterprise.*

Albert Einstein

The above-mentioned new conception of science has ended the myth of the objectivity of science and its eminent attribute as an enterprise in search of the truth. Deductive logic is not systematically applied and observation ceases to be considered as objective; rather, it is conditioned by a given theory, and theories are constructs of, or narrations about, reality.

In addition, this subjectivity Einstein talks about comprises aesthetic experience. As I have stated in my book *Psicología de la creatividad*, “the truth is not science’s privilege, and beauty is not art’s privilege either” (Romo, 1997, p. 59). If we want to understand the nature of human knowledge in depth we must go beyond the dichotomies art/science, beauty/truth, imagination/logic, emotion/reason, and so on.

Art does not have as its sole objective the search of beauty either. Art is also a way to search for the truth, to deepen the knowledge of the world and of one’s self.

The origins of science and art are fused in a syncretic thought where logic and fantasy, emotion and reason, and beauty and truth are conjugated rather than differentiated attributes. This syncretism is found as far back as the Renaissance—in Leonardo, creator in all the areas of knowledge—and in the craftsmen of the first Scientific Revolution; but we also find in contemporary scientists this same fusion of aesthetic feelings in scientific creation when they state that their work is a way of capturing their irresistible attraction for the harmony of the world. “Intellectual passions” drive or maintain research activity, but they have, in addition, a logic function indispensable for science (Polanyi, 1964).

### 5.2 Syncretic Thought in the Origins of Science

The epistemological crisis in the explanation of science in the twentieth century, triggered by the introduction of notions such as complexity and chaos, favored the emergence of a new concept of science, as I have said before, more relativistic than the classical conceptions. Feyerabend (1992), on his part, has gone even further by stating that current science is not superior to Aristotelian science, comparing it to other forms of knowledge such as myths or religion.

Even though current science may have a dimension of dogma, as the Catholic religion had during the Counter-Reformation, science is not religion nor myth; however, scientific knowledge indeed has its roots in myths and both have their roots in curiosity, in epistemological motivation, and in the need to conjure the fear of powerful natural phenomena. The bison of Altamira combine art with a pragmatic function of driving away fear. Science and art are two products of the genus Homo that have provided the backbone of the process of humanization.

The Chichen Itzá pyramid in Mexico is a beautiful example of this scientific syncretism. This is a case of astronomical syncretism, with its agricultural applications fused in the harmony of an architectonical work and a religious cult. In the twilight of the days of the fall and spring equinoxes, the sun, as it sets, draws a meandering figure that “descends” the stairs of the pyramid until reaching the head of the deity of Kukulkán, the “feathered serpent”, located at the base of the pyramid.

An esoteric moment in the religious arena, it signaled important dates for planting and harvesting. Even though Chichen Itzá may be the most beautiful place in the world to contemplate these astrological phenomena, it is not the only one. In many other cultures besides the Mayan, scientists and artists combined their work to adore their gods producing spectacular and beautiful light and shadow phenomena on their religious buildings during the days of solstice and equinox.

### 5.3 Scientists and Aesthetic Experience: The Aesthetic Values of the Copernican Revolution and of Current Science

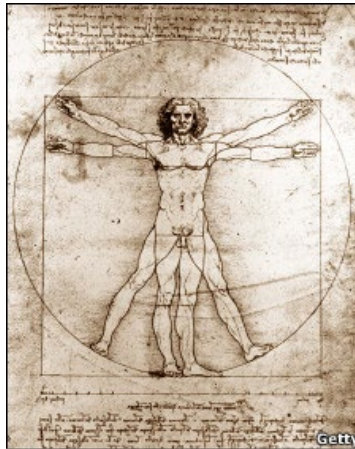


Figure 3. *L'Uomo Vitruviano* by Leonardo da Vinci.

The first theory of Kepler about “inscribed bodies” that explained the orbits of the planets was nothing but an attempt to extend the geometric harmony of the five perfect solids, defined by the Pythagoreans, to the understanding of the universe. For Kepler, in this mystic understanding of science, geometry was God himself. It was quite frustrating for him to accept the ellipses theory he arrived at from the empirical data on the movement of planets and accept the rejection of his inscribed bodies theory. He said that in the garden of the universe he had to settle for a cartload of manure.

In Galileo’s case, the influx of aesthetic principles in the explanation of the universe was even greater. He rejected the elliptical orbits of the planets defined by Kepler, a rejection that extended to Kepler himself—he even refused to meet with him—, while he continued being obstinate about the notion of circular orbits in spite of their evident rejection of the data on planetary movements. The circle was still being conceived as the perfect figure. Here, art—or, better, the aesthetic criteria prevailing at the time—betrayed science in Galileo’s case (Romo, 2008a).

The consolidation and development of the Copernican Revolution, starting with the great work of Newton, was also infused with aesthetic and mystical feelings. The music of celestial spheres and the mathematical perfection of the movements of the universe from Newton and Laplace faithfully reflected that disciplinary syncretism.

In modern science, physicists and mathematicians have discussed this aesthetic feeling linked to scientific concepts: Max Planck talks about the deep aesthetic emotion that the idea of the absolute produces for him in his work as a physicist.

Michelson, author of one of the crucial experiments for the theory of relativity, spoke about his fascination for the study of light given its aesthetic angle: “If I were a poet, at the same time as a physicist, I’d be able to convey the pleasure, the satisfaction and even the reverence that this topic inspires in me. And I must confess that the aesthetic angle of the topic is not the one that interests me the least, given that I feel particularly fascinated by every aspect of light” (in Root-Bernstein, 2002, p. 364).

For Richard Feynman, it is only possible to satisfy the longing that leads us to understand the mysteries of the universe when our experience and our emotion are reconciled with our knowledge. “Sometimes he talks about religious experience when contemplating the harmony of the laws of nature. Sometimes, he speaks about the passion of love, like in his amusing autobiography *Surely You’re Joking, Mr. Feynman!* when he declared to have fallen in love with his theories. And he compared his relationship with them to the relationship with women: When you start seeing their defects it is too late to abandon them” (Romo, 2008a, p. 161).

Paul Dirac, Nobel Prize in Physics, states that mathematical beauty is a guarantee of truth. And in mathematics the most popular example is that of Poincaré. This author was, incidentally, a great scholar of creative processes based on his own introspective study. He wrote about these processes and even gave a conference on the subject before the Psychological Society of Paris, in addition to inspiring Hadamard's book *An Essay on the Psychology of Invention in the Mathematical Field* (1945). He was able to notice some of the relevant topics for the understanding of creativity, such as the art-science fusion. Poincaré says that the mathematician looks for the vision of truth inside him guided by an aesthetic sensibility, by a sense of mathematical beauty of the harmony of numbers and shapes, of geometrical elegance. In this combinatorial thinking as the essence of the creative process, the selection criterion of the product is the aesthetic one: "Useful combinations are precisely the most beautiful" (Poincaré, 1910, p. 332).

The reflections of physicist David Bohm since the 1950s on scientific creativity go beyond the field of science. In his work *On Creativity*, he tackles the topic of aesthetics in scientific research.

And, in a more technological and current version, it is worth mentioning Steve Jobs, who always highlighted his aesthetic interests in his Apple creations. In his famous conference at Stanford University, he admitted that from his brief journey at university, calligraphic studies would come in handy much later when building models of digital typographic fonts for Mac's operating system, such as *Serif* or *Garamond*, which others would later copy, Jobs used to say. Again, we find knowledge transfer and remote connections as tools of creative processes.

Let's end this review of the aesthetic experiences of eminent scientists with Einstein:

It has been repeatedly said that I have been inspired by Mach's philosophy. It is not true: I have not been inspired by the principle of the economy of thought, I have been inspired by something different; by my belief that the architecture of the laws of nature needs beauty and harmony. And relativity provides that. (in Marina, 1993, p. 325)

To sum up, it seems that the distance between physics or mathematics and the fine arts is shortened when we achieve an understanding of their profound meaning. Other disciplines show, more clearly, their syncretic nature. Architecture is midway between art and science. Music searches for a synthesis between aesthetics and arithmetic harmony (Romo, 2008a).

## 6. TOWARDS A NEW EDUCATIONAL PERSPECTIVE FOR THE SCIENCES

I would like to end this chapter by talking about the usefulness of this analysis for our society. In the end, it is creativity that has taken us all the way from the caverns into Pluto. The most important applied version of this theoretical digression must be in the field of education. This understanding of science must have instructional consequences at school to make learning science easier and pull it closer to that integrative nature, moving away from the super-specialized and compartmentalized way of teaching science that—in general—does not do justice to its true nature.

The links between arts, sciences, and technologies are as strong nowadays as they were in the Renaissance. Root-Bernstein and Root-Bernstein have emphasized this matter when speaking about an integral, comprehensive, and interdisciplinary education, whose objective is to form well-rounded, cultivated people, such as Renaissance's polymath, not specialists in segregated knowledge. Psychologists know that innovative people participate in a great number of activities and have many different interests, and they develop them with greater skill, as we have seen. It is there that lies the key of a creative education and an education for creativity (Root-Bernstein, 2002).

The challenge that education and modern life face consists of reconciling poetry with physics, art with chemistry, music with biology, dance with sociology, and other possible combinations between aesthetic knowledge and analytical knowledge, and in this way helping people to feel what they want to know and know what they want to feel. Feynmann realized that no scientist that calls himself that thinks only about the world; he must feel it too. Gropius (Bauhaus founder) said that the true artist not only feels the world, but also knows it. Both aspired, in sum, to the kind of active understanding that lies at the very core of creativity. And that is too, at the same time, the totality that those who aim to understand and teach science and art must achieve. (Root-Bernstein, 2002, p.386)

An interdisciplinary approach will favor knowledge transfer and analogical thinking (Fairweather & Cramond, 2010). Many of us think that this is creativity's most important psychological function. The use of pedagogical analogies will make learning new concepts easier and, in addition, will foster the student's creativity.

We live in the age of interdisciplinarity. After the disciplinary super-specialization process that Copernican revolution was to bring about for many centuries, we are now going back to the reunification of the areas of knowl-

edge. Cropley (2001) states that the ideal creative student has a helicopter vision that entails mastering one area of knowledge while at the same time maintaining the connection of this area with different fields. This is the comprehensive and integrative approach that a creative education of the sciences must adopt. Creativity in adults is highly dependent on how those abilities were exercised in childhood. I believe school is a good quarry of creative minds.



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## ABOUT THE AUTHOR

### **Manuela Romo, Ph. D.**

She has centered her research on creativity during more than thirty years and has published the results of her work in numerous articles and research papers. She is author of five books, among which is her famous *Psicología de la Creatividad* (Psychology of Creativity). [manuela.romo@uam.es](mailto:manuela.romo@uam.es)





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# A Strategy for Promoting Creative Behavior in Scientists-in-Training

► María Antonia Padilla Vargas · Centro de Estudios e Investigaciones en Comportamiento · Universidad de Guadalajara

## ABSTRACT

Setting out from the characterization of creativity in science as the development of *novel* and *effective* behaviors that satisfy the criteria of *fluidity*, *originality*, *flexibility*, and *elaboration*, we propose the *Training Strategy to Elaborate Novel and Effective Research Questions (EEEPINE)* designed with the objective of fomenting creative behavior in new researchers. This strategy has demonstrated its usefulness (it has been effective for training students at different academic levels—undergraduate, master’s, doctorate—to elaborate and justify new research questions) and versatility (having been used successfully with both individual students and groups of students simultaneously). Also, it has made it possible to foment the elaboration and justification of *novel*, *effective* research questions in different disciplinary areas.

*Keywords:* creativity in science, training new researchers, elaborating novel and effective research questions



The EEEPINE has demonstrated its usefulness and versatility, and has made it possible to foment the elaboration and justification of novel, effective research questions in different disciplinary areas.

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## CREATIVITY IN SCIENCE

With regards to the generation of basic knowledge, creativity in science is defined as the ability to discover new problems and formulate hypotheses that permit their resolution (Aktamış, Şahin-Pekmez, Can, & Ergin, 1999; Hu & Adey, 2002), while in the case of the generation of applied or technological research, it is the intellectual capacity to produce an original (novel) project with value at the social and personal level, designed with a specific proposal in mind that utilizes the information produced by researchers in the area of interest and knowledge previously acquired by the scholars involved (Hu & Adey, 2002). To the criterion of originality some researchers add those of suitability and functionality (Cropley & Cropley, 2008; Cropley, Cropley, & Sandwith, 2005; Haller, Courvoisier, & Cropley, 2011). This implies that in order for a scientific product to be considered creative, it must be effective; that is, it has to fulfill a social proposal.

In relation to creative behavior as such (not the products so generated), Guilford (1950, 1967) considered that for a behavior to be considered creative it must fulfill four criteria: *fluidity*, *originality*, *flexibility*, and *elaboration*. *Fluidity* refers to the amount of new ideas (pertinent) that an individual can generate. *Originality* implies that the ideas proposed are novel (i.e., not proposed previously), while *flexibility* demands that the person be able to employ more than one focus to find solutions to a problem, i.e., can generate distinct types of ideas. This entails that individuals must have the ability to create new forms of problem-solving, preferably non-conventional ones that incorporate strategies which include ingenious combinations of existing knowledge (Hu et al., 2002). This ability to construct upon the foundations of existing ideas in a given field is what Guilford (1950, 1967) has labelled *elaboration*.

Taking Guilford's proposal (1950, 1967) as a base, Torrance (1966, 1974, 1990) designed an instrument that has been widely used to evaluate creativity: Torrance's Test of Creative Thinking (TTCT). It is important to clarify that while Guilford's proposal and Torrance's instrument were originally elaborated to measure creativity in general, various researchers later used their assumptions and criteria to design psychometric tests and studies in efforts to identify creative behavior in science (Hu et al., 2002; Bermejo, Ruiz-Melero, Esparza, Ferrando, & Pons, 2016; Pekmez, Aktamis, & Taskin, 2009; Sak & Ayas, 2011; Skinner, Foulds, & Cousins, 1994).

The area of scientific creativity stresses that what distinguishes this type of creativity from creativity in general, and from artistic creativity specifical-

ly, is the vast amount of information (theoretical, technical, experimental) that is required to generate an original idea (Baer, 1998; Dunbar, 1999; Han, 2003; Lin, Hu, Adey, & Shen, 2003). For if scientists do not have the necessary knowledge concerning a specific field or discipline, they run the risk that the problems identified and/or hypotheses proposed would turn out not to be pertinent. A second risk is that through unawareness scientists could work to resolve problems that other researchers have already solved, thus wasting valuable time and resources.

In addition, because science is a collective enterprise, all data generated must be inserted into the existing corpus of knowledge in the field. Therefore, the people who do science must be familiar with both existing findings in their discipline and the questions that still need to be analyzed or the problems pending resolution, since the ultimate objective of science is that the knowledge produced by each individual scientist contribute to developing and strengthening a specific field. Thus, the work of individual scholars cannot be isolated or fragmentary, but must help solidify their scientific discipline (Padilla & Fuentes, 2017). It is imperative for researchers to keep this in mind, but it is also fundamental for those responsible for training new scientists and for researchers-in-training. This aspect will be discussed in detail in this chapter in the section titled “The Training of New Scientists.”

### IS IT CONSIDERED PERTINENT TO SPEAK OF CREATIVITY IN SCIENCE?

Before responding to the question of whether it is pertinent to characterize scientific behavior (or scientific practice) as a creative activity, we must first mention a central concept of Ribes' interconductual proposal, namely, intelligent behavior. According to Ribes (1989), a behavior can only be classified as intelligent if it satisfies two criteria: (a) it resolves a problem or produces a desirable or required result or consequence; i.e., it is *effective*; and (b) it is not a simple repetition or copy of an effective behavior realized previously; i.e., it is *variable (novel)*.

Combining the elements of *effectiveness* and *variability* produces a 2×2 matrix that can serve to classify the behaviors that individuals can perform: (a) if the behavior is variable and effective, it is considered *intelligent*; (b) if it is effective but not variable (i.e., if it repeats intelligent acts emitted in the past), then it is characterized as *routine*; (c) if it is not effective and variable, it is deemed *creative*; and (d), if it is neither effective nor variable, it is catalogued as “*foolish*” (see Table 1).

**Table 1****Classification of the Types of Behavior that Can Be Performed**

	Variable	Not variable
Effective	Intelligent behavior	Routine behavior (habits)
Not effective	Creative behavior	“Foolish” behavior

Note: Modified from Ribes, 1989, p. 58.

Examples of each type of behavior in scientific practice could be the following: Designing an original (novel) strategy that leads to reducing suicide rates in adolescents would reflect intelligent behavior, while a routine behavior might involve testing the efficiency of that strategy in a population distinct from the sample examined in the original study. In this sense, it is important to clarify that the latter type of behavior is very useful in adaptive terms in daily life, since organisms constantly perform routine behaviors—e.g., driving, bathing, etc.—that allow them to devote their attention to aspects that are vital for subsistence. Routine behavior is also useful in science due to its association with what Kuhn (1962/2006) calls *normal science*, in contrast to *revolutionary science*. Returning to examples of the different types of behavior shown in Table 1, a “foolish” behavior might involve testing a strategy that has proven ineffective several times in reducing suicide rates in adolescents, despite the negative results always obtained. This type of behavior is considered “foolish” because it entails wasting time, energy, and resources (an example from everyday life might be kicking a car that ran out of gas).

We purposely left the case of creative behavior for the end because, according to Ribes (1989)’ proposal, behavior can only be classified as *creative* if it is variable and does not include a criterion of success or fulfillment; that is, behavior that is not designed to resolve a problem or fulfill a concrete demand (since this would suggest it is non-effective). In this framework, the only types of behavior that could be considered creative would be manifestations of art (e.g., painting, music, dance, etc.), since these are the only cases which involve behavior that satisfies the criterion of variability (novel, original), but without fulfilling a demand, resolving a problem, or satisfying some previously-stipulated criterion of success; that is, it need not be effective.

It is important to clarify that while having technical abilities may improve artistic performance, it does not determine whether or not the product is



considered creative. As Cropley and Cropley (2008) point out, Vincent Van Gogh's paintings had technical deficiencies that the painter corrected upon enrolling, at the age of 32, in the Antwerp Academy of Art to learn how to express his talent by manipulating light and color. Van Gogh did not have to learn to make original or novel paintings (he already knew how to do that), but only to elaborate them with a better technique.

In light of this, it has been argued that characterizing scientific behavior as creative may not be the best strategy for describing what this activity really entails. Some believe that a more adequate term for this would be *intelligent behavior*, since several of the authors cited herein stipulate clear criteria of fulfillment when classifying this type of practice (even though they call it creative behavior), namely, formulating *novel* problems with hypotheses that allow their resolution (Aktamış et al., 1999; Hu et al., 2002), or generating *original* and *effective*—i.e., socially-valuable—products (that solve some type of problem) (Cropley & Cropley, 2008; Cropley et al., 2005; Haller et al., 2011; Hu et al., 2002), among other kinds.

A scientist's work consists of generating new knowledge or products (which entails displaying *variable* behavior), while adapting to strict disciplinary criteria but without losing sight of the central objective; that is, resolving theoretical, empirical, and/or technological problems (which means that their behavior must be *effective*). Plucker, Beghetto, and Dow (2004) summarize this perfectly in their definition of creativity, which characterizes it as “the interaction among *aptitude, process, and environment* by which an individual or group produces a *perceptible product* that is both *novel and useful* as defined within a *social context*” (p. 90, emphases in the original).

Because of the rigorous criteria that most scientific disciplines impose to judge the validity of the products generated by scientists (what Plucker et al., 2004, characterize as the social context that validates products as novel and useful), the exercise of scientific practice is deemed the area where it is easiest to identify the occurrence of intelligent behavior, a phenomenon that can be identified with special clarity during the training of new researchers, where it is feasible to detect the process of the generation of new ideas. The following section discusses this in detail.

### THE TRAINING OF NEW SCIENTISTS

Training new researchers is fundamental to both the development and strengthening of all scientific disciplines. One of the central objectives in training new scientists must be to ensure that once this process concludes, those new researchers will be equipped to work independently of their instructors (i.e., show intellectual independence). One of the main indicators which demonstrates that researchers can work independently from their

mentors is that they are able to posit and justify their own research questions. These questions (and their corresponding justification) must be *novel* or *original* (i.e., not proposed before) and *viable* (i.e., feasible in the sense that the human and technical required resources exist), as well as *useful* and *effective*. The fact that new research questions have to satisfy the criteria of utility and effectiveness implies that they must derive from existing knowledge in the specific discipline in which the new researchers intend to work, since achieving usefulness demands that a research question be based on the latest corpus of knowledge in a particular field and be framed in a specific theoretical approach. Otherwise, the knowledge generated would be so fragmentary or disconnected that it could not be linked to the findings of a concrete discipline. Moreover, if the research question involved had the goal of resolving a social problem (not just generating basic knowledge), in addition to the aforementioned criteria, it must also have social value; that is, it must improve the quality of life of people (or of organisms in general). This entails, in turn, that it be effective.

Although the variables involved in elaborating and justifying novel and effective research questions have not been studied systematically, work in this field reveals the difficulties that undergraduate and graduate students encounter in their attempts to accomplish this (Padilla & Fernández, 2014; Padilla, Fuentes, & Pacheco, 2015; Padilla, Solórzano, & Pacheco, 2009; Padilla, Suro, & Tamayo, 2010; Padilla, Tamayo, & González, 2010; Padilla, Tamayo, & González-Torres, 2013). The root of this difficulty seems to lie, among other elements, in deficiencies in the reading and writing skills of researchers-in-training, since generating and, above all, justifying an original, pertinent, viable, and useful question inevitably demands the careful reading and comprehension of numerous texts and articles in the area of interest. This means not only identifying the key points of the texts reviewed and establishing potential links between those materials and the topic of interest, but also deriving novel (original) approaches from the literature. Thus students must develop, among other talents, the ability to construct arguments (and not simply repeat information from texts) and adequately justify their research questions.

As a consequence of deficiencies observed in undergraduate and graduate students as they attempted to elaborate and justify (suitably) novel and effective research questions, a strategy was designed that has shown its usefulness for training researchers in the abilities required to perform these tasks. This approach has demonstrated its utility—i.e., it effectively helps train students at different academic levels (undergraduate, master's, doctorate) to elaborate and justify new research questions—and versatility (since it has been used successfully with both individual students and groups; Pa-

dilla & Fuentes, 2017). Moreover, it is suitable for enhancing the elaboration and justification of novel and effective research questions in different disciplinary fields (Padilla & González, in preparation). In short, it is a strategy that has concretely improved students' ability to propose research questions that are novel (original), viable, useful, and, above all, pertinent and effective, because, (a) they derive from articles analyzed previously; (b) they are justified as a function of earlier findings; and (c) they delineate clearly the type of theoretical, empirical, and/or technological problem to be resolved.

The following sections describe the *Training Strategy for Elaborating Novel and Effective Research Questions (EEEPINE* for its initials in Spanish; for a full description, consult Padilla and Fuentes, 2017). Due to space limitations, this article presents only a brief overview of the different activities conducted to teach researchers-in-training to elaborate and justify novel and effective research questions.

Activities to be carried out: Baseline (diagnostic test): Session 1 and Session 2; Exercise 1: Session 1 and Session 2; Exercise 2: Session 1 and Session 2; Evaluation: One Session only. Conducting the required activities requires at least four experimental articles (the more texts used, the better the results) from a specific disciplinary area (e.g., biology, chemistry, psychology, etc.) that examine interrelated topics and, preferably, are of central importance to the concrete area or topic of interest. It is important to emphasize that the articles selected must be well-written in the sense that: (a) the research question is described clearly and includes a detailed explanation of the links between the independent and dependent variables, (b) the importance of the research question is well-argued and substantiated in the same paragraph that states the research question, and (c) there is a detailed examination of the empirical evidence related to all key aspects of the research question (in this regard, see Padilla & Fernández, 2014). Obviously, if the articles chosen have deficiencies in these areas, they will not be effective for the training process.

Returning to the materials required for the activities involved in this training strategy, each student must receive general information on the kinds of paragraphs found in experimental articles, the types of variables that can be manipulated and measured in the disciplinary area of interest, and the types of research questions that it is feasible to formulate in a certain field of science, among other basic orientations. These preparatory steps are designed to provide them with the background knowledge and guidance required to enhance their ability to adequately elaborate novel and effective proposals (for this stage of the process, we suggest using the guide provided in Appendix A). We also suggest providing a guide for elaborating and justifying research questions (like the one provided in Appendix B). Finally,

participants will need paper and a pen to take notes and write their proposed research questions.

The concrete activities to be performed are described in the next section (see Figure 1). We recommend organizing these activities on 7 different days to avoid fatigue, but ideally on consecutive days to minimize the possibility of students forgetting the lessons learned previously. The following list shows the activities recommended for each day of the course.

### Day 1: Baseline (Diagnostic Test), Session 1

This section allows students to identify some of the key elements of a research article that are required to perform the Baseline activities in Session 2. Here, they must read an article and take notes, if they desire.

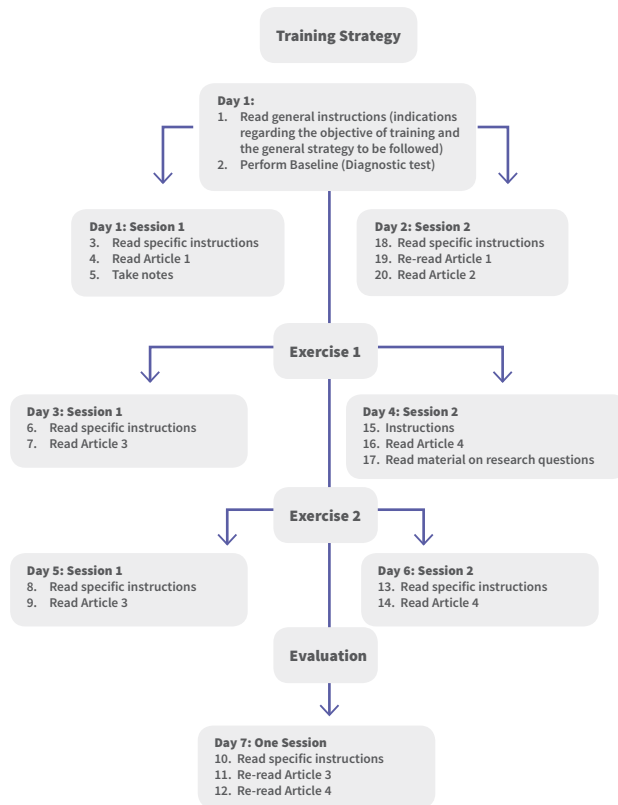


Figure 1. Scheme showing the minimum activities required to teach researchers-in-training to elaborate and justify *novel* and *effective* research questions derived from articles previously read and analyzed (modified from Padilla & Fuentes, 2017, pp. 15-16).

### Baseline (Diagnostic Test), Session 2 (Part 1)

The objective is to determine each student's initial level of performance on this type of task (i.e., pre-training). It is designed to permit a reliable measurement of performance improvement upon completing all activities included in this training strategy. Students will now read a different article and then answer the following questions: What research question is proposed? What type of question is it? What independent and dependent variables are identified in the text? The final question can be answered in accordance with the classification provided in Appendix A.

### Day 2: Baseline (Diagnostic Test), Session 2 (Part 2)

Based on the two articles read in Part 1, students will perform the following activities:

1. Elaborate a novel and effective research question derived from the articles read.
2. Specify at least one independent and one dependent variable distinct from those in the articles read previously.
3. Describe evidence that supports the question they posit.
4. Develop arguments that justify the question proposed.
5. Describe the kind of participants that would be studied to resolve to the research question, together with the procedure involved and the expected results.
6. State the problem (theoretical, empirical, or technological) that they think their proposal would resolve.
7. Explain how they believe their results could be linked to the research question.

### Day 3: Exercise 1, Session 1

Here the objective is to help students learn to identify the types of paragraphs found in the introduction to an experimental article and other key elements included in that section. This involves the following activities:

1. Reading a new article.
2. Reading a text that deals with research questions (the material in Appendix A can be used as a guide in preparing this activity).
3. Answer the same questions as in Part 2 of Baseline.
- 4.

Also, they must identify the sections of the article that present the following elements: definitions, evidence, formulation of questions and objectives, approaches derived, or combinations of two or more of these elements (the material in Appendix A can also be used as a guide for this activity).

#### **Day 4: Exercise 1, Session 2**

Here, the goal is to continue developing the ability to identify the central elements that make up an experimental article. The activities to be performed are the same as those in Session 1, Exercise 1, but with a different article.

#### **Day 5: Exercise 2, Session 1**

In this session, students will learn to re-elaborate some of the elements of an experimental article. Therefore, they will re-read the same article reviewed in Session 1, Exercise 1, and then answer the following questions based on their reading: How does the Introduction relate to the research question in the text? How is the study justified? How is the evidence presented in the Introduction linked to the results? Then, they will propose a different task to the one utilized in the article to measure the same variables and suggest the study of a variable that is not contemplated in the text, but that is relevant to the area examined. Finally, they will be asked to formulate a novel and effective research question that: (a) includes the variable proposed, (b) elucidates the dependent and independent variables, (c) states the problem (theoretical, empirical, or technological) that they have designed their proposal to resolve, and (d) elucidates alternative results based on what the author presented in the article analyzed.

#### **Day 6: Exercise 2, Session 2**

The objective now is to continue developing the students' ability to re-elaborate some of the elements that make up an experimental article. Thus, they will perform the same activities as in Session 1 of Exercise 2, but with a new article.

#### **Day 7: Evaluation, One Session**

Here, the goal is to verify what the students have learned through their experience with this training strategy. This can be achieved by comparing their performance in this section to the results of the Baseline phase. Therefore, they must perform the same activities as in Session 2 of the Baseline phase (i.e., on days 2 and 3) by elaborating a novel and effective research question based on their re-reading of the articles used in Exercises 1 and 2. Carrying out the same activities as during Baseline, but with new articles, will allow the instructor to compare their performance before and after taking the training provided in Exercises 1 and 2.

It is important to emphasize that while this strategy includes some training in certain reading and writing abilities that are indispensable for researchers-in-training to adequately interact with technical texts (such as identifying the central elements of experimental articles and elaborating arguments,

rather than simply repeating the information they have read), the principle objective of this strategy is to develop the ability of scientists-in-training to propose novel and effective research questions derived from findings in their area of interest, not simply to improve their ability to read and write as such (i.e., learning grammatical rules, correct orthography, etc.) Though these are also necessary qualities of competent researchers, they fall outside the objectives of the proposed strategy.

As a result, the evaluation of students' performance will be based on the following criteria: (a) whether the research question they posit is novel, (b) whether the independent and dependent variables proposed are novel and adequately derived from previous readings related to the disciplinary area of interest, and (c) the degree to which the justification of the research question proposed is pertinent in terms of existing findings in the field. Finally, instructors must ascertain whether students' proposals will be effective; that is, if they will resolve some concrete problem (theoretical, empirical, or technological) in the discipline (we suggest using the material in Appendix C as a guide for this activity).

### FINAL CONSIDERATIONS

We consider that the central value and usefulness of the *Training Strategy to Elaborate Novel and Effective Research Questions (EELPINE)* lies in its ability to develop *intelligent (or creative)* behavior in researchers-in-training through its procedures and exercises that make it possible to instill in new scientists the behaviors that various authors consider fundamental to all creative scientific practice, namely, *fluidity*, *originality*, *flexibility*, and *elaboration* (Hu et al., 2002; Pekmez et al., 2009; Sak et al., 2011; Torrance, 1966, 1974, 1990).

This is because the strategy proposed includes activities that run from an initial diagnostic test right through to evaluation. Also, it encourages students to propose various novel ideas for realizing new research projects (thus satisfying the criteria of *fluidity* and *originality*), while also leading them to integrate multiple focuses in their proposals for ways to resolve a problem (thus satisfying the criterion of *flexibility*). Finally, their proposals must be clearly derived from findings in their disciplinary area of interest (to fulfill the criterion of *elaboration*). Satisfying these criteria is achieved because the first step in this strategy obliges students to read and analyze various articles and then derive their own novel proposals from them. In this way, researchers-in-training learn that for science to be useful it cannot be conducted "in a vacuum," but must be framed in, and derived from, the corpus of knowledge that exists in their area of interest. Another central goal, of course, is to emphasize that the primary objective of all research proposals is to resolve a theoretical, empirical, or technological problem in the field of interest; that is, their work must have social value.

In closing, this strategy clearly complies with the stipulations established by Chiang and Tang (1999) in their division of *creative* behavior in science in two parts or states. On the one hand, they emphasize that researchers must be capable of acutely observing and classifying phenomena, occurrences, and events; on the other, they stress the importance of developing the ability to design novel experiments based on their observations and classifications. We maintain that the strategy proposed herein satisfies the criteria cited by first exposing new researchers to phenomena, occurrences, and events of interest to the disciplinary area in which they are being trained (by reading and analyzing relevant literature) and then encouraging them to develop their own novel and effective research questions derived from them.



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## ABOUT THE AUTHOR

### **María Antonia Padilla Vargas, Ph.D.**

Has published alone or as co-author 9 books, 15 book chapters, and several articles in national and international indexed journals. Has presented nearly 200 papers at specialized national and international academic meetings.

**[tony.padilla@academicos.udg.mx](mailto:tony.padilla@academicos.udg.mx)**



# Appendix A

## ► IDENTIFYING THE CENTRAL ELEMENTS OF TECHNICAL TEXTS

(from Padilla & Fuentes, 2017, pp. 118-120)

The introductory section of an experimental article is made up of different types of paragraphs that, as the text advances, become more specific to the research problem. Some paragraphs define and delimit the area of interest and the critical concepts for the study; others synthesize information from the literature relevant to the problem. In others, the author presents proposals and contributions to the field of study. In the introduction, especially, but also throughout the article, you may find more than one paragraph of each type, in different order, but the element that articulates them and gives them coherence is always the research question posited.

In this section, you should review an experimental article to identify the type of research question proposed and the variables (independent and dependent) specified. You will also identify the types of paragraphs included in the introduction, as well as the most important evidence that the authors present to justify their research question, and aspects relative to the results obtained upon completing the study.

The following describes the types of paragraphs you may find in the introduction of an experimental article, with their respective definitions.

## **TYPIFICATION OF PARAGRAPHS OF THE INTRODUCTION TO AN EXPERIMENTAL ARTICLE IN THE FIELD OF EXPERIMENTAL PSYCHOLOGY (PACHECO, PERS. COMM., 2009)**

### **Definitions**

This category includes paragraphs that describe terms, processes, and behavioral phenomena in the area of interest, specifically those related to the research problem.

### **Evidence**

This category considers paragraphs that describe the procedures employed and the data obtained in other experimental studies related to the research problem.

### **Derived approaches**

This category includes paragraphs related to the definitions and evidence presented, with statements that elucidate contradictions, relations among definitions, or between definitions and variables, that are not contemplated in the research area. In these paragraphs, the author does not simply paraphrase or cite relevant literature, but makes concrete contributions that justify the research problem.

### **Formulation of questions and objectives**

This is where we find paragraphs that elucidate clearly the approaches from the previous category as they relate to the variables that the authors propose evaluating empirically, together with the relations they intend to identify among them. These are usually presented in the form of conjectures, questions, working hypotheses, or experimental objectives.

### **Combinations**

Paragraphs that include phrases from the different categories just described (definitions, evidence, derived approaches, or questions formulated).

For various reasons, a researcher may posit different research questions. In each article you read, you must identify the research question posited and its type, based on the following typification:

## TYPIFICATION OF RESEARCH QUESTIONS IN THE AREA OF EXPERIMENTAL PSYCHOLOGY (VIRGINIA PACHECO, JAIRO TAMAYO, AND MARÍA ANTONIA PADILLA VARGAS, PERS. COMM., 2010)

Types of research questions*	Definition
1	Research question that repeats elements evaluated in the articles reviewed.
2	Research question that does not propose manipulating variables; posited out of curiosity or observation.
3	Research question that seeks to demonstrate the effect of a technique, instrument, or method proposed previously in the articles reviewed (systematic evaluation, replication).
4	Research question that proposes manipulating variables previously evaluated in the articles reviewed; minimal change in the value of some variables.
5	Research question that proposes manipulating variables previously evaluated in the articles reviewed; considerable changes in their observable values or elements.
6	Research question that proposes manipulating variables not evaluated in the articles reviewed.
7	Research question that proposes applying the principles of a theory to resolve a social problem (related to technological research).
8	Research question that proposes applying the principles of a theory to resolve a scientific problem (related to basic research).
9	Research question that seeks to test new techniques or methods that entail an empirical or theoretical advance.

\*With the exception of type 1, the rest presuppose manipulating variables and establishing relations among them.

Another important element in a research report is the set of variables. You must identify the dependent and independent variables in each article you read. To accomplish this, you can use the following information:

## TYPES OF VARIABLES IN THE AREA OF EXPERIMENTAL PSYCHOLOGY

*Variables* are observable characteristics or discernible properties of an object of study that can have different values or be expressed in distinct categories (i.e., vary). When identifying variables, it is important to keep in mind how they are measured, the values they may have, and the need to distinguish clearly between the two types: the independent variable and the dependent variable.

An *Independent Variable* (IV) is the property of a phenomenon that, it is assumed, can influence, modify or affect other variables. The objective of an experiment is to evaluate this capacity. The IV is the treatment or condition that the experimenter manipulates directly to identify how it affects the values of the dependent variable(s). It is also the criterion utilized to define the experimental groups. Independent variables may have more than one value.

A *Dependent Variable* (DV) is one whose values depend on, or are influenced by, changes in the independent variable. The dependent variable covaries with, and reflects, the effect of the independent variable. Generally-speaking, in psychology the dependent variable corresponds to the behavior that is the object of study. Unlike the independent variable, it is not manipulated by the experimenter, but is only measured.

In addition to the variables just mentioned, while conducting any kind of study, one must be aware of the possible presence of *Extraneous Variables* (EV). These are conditions that the experimenter does not manipulate, but can control by recognizing, eliminating, or equalizing them. Examples of extraneous variables include: the academic history of study participants, their age, gender, or socioeconomic level, etc., and certain environmental conditions in the space where the study will be conducted, such as noise, climate (heat, cold), among others.

Let's take a look at a simple example: Some educators state that academic development can be improved by pointing out the types of errors that students make while performing a task, and then asking them to correct them.

The following study was designed to test this assumption: 40 6<sup>th</sup>-grade students were chosen and divided into two groups of 20 students each. Both groups were asked to resolve 20 operations: 10 addition and 10 subtraction problems per day for 15 consecutive days. Observations showed that the results of the addition and subtraction operations by the students in the two groups on day one showed similar numbers of errors.

Beginning on day two, the researchers explained to the students in Group 1 the errors they had made, and asked them to correct them. The students in Group 2 did not receive any feedback; their answers were simply gathered and checked every day. The results of the operations performed by the two



groups on day 15 showed that most of the students who received error correction resolved almost every operation correctly, while those in Group 2, who did not receive correction, maintained levels of error similar to those seen on day one of the study.

In this example, the independent variable was the feedback given to the students in Group 1. In this case, the variable had two values (with feedback and without feedback), while the dependent variable was the performance of the students in resolving the arithmetical operations. The study results mention that not all participants in the group that received error correction improved their performance to the same degree (that is, the effect of the IV on the DV was not the same in all subjects). This could be due to extraneous variables, such as the students' different academic histories (since this possibility was not mentioned in the study, it seems clear that it was not controlled for).

### **REGARDING RESEARCH QUESTIONS IN THE AREA OF EXPERIMENTAL PSYCHOLOGY**

The research question is one of the first methodological steps that a researcher must perform upon undertaking a project. It must be formulated clearly and precisely. Selecting the research question is the central element in both quantitative and qualitative milieus. Its function is to make explicit the theoretical and empirical assumptions of the researcher's approach or framework. The purpose of the research question is to orient and delimit the project; it is the axis that articulates the entire procedure.

The research question thus proposes an inquiry into some phenomenon. It must be expressed concisely so that the researcher can logically elucidate the methods, procedures, and instruments that will be used to perform the study.

Research questions can be of various kinds. A research question of the experimental type must be composed of, at least, an independent variable (that will be manipulated) and a dependent variable (that will be measured).

Research questions must be novel, pertinent and effective. The aspect of novelty entails that the phenomenon cannot have been analyzed previously, or that it will be examined from an optic not adopted before. Pertinence means that the question must be derived from existing knowledge in a specific area, and that the topic to be examined is relevant to a concrete discipline. Finally, effectiveness implies that the research question will resolve a theoretical, empirical, or technological problem; that is, it has social value.

You now have more information on the nature of variables and of research questions. This will allow you to improve your performance when performing the activities required by this training strategy.

## Appendix B

- **GUIDE FOR ELABORATING AND JUSTIFYING A NOVEL, PERTINENT RESEARCH QUESTION IN THE FIELD OF EXPERIMENTAL PSYCHOLOGY**  
(from Padilla & Fuentes, 2017, pp. 49-53)

The following scheme presents a series of questions that will help students elaborate and justify a novel, pertinent research question:

**1. What is your experimental question?**

*Describe the topic you plan to study.*

**2. What is/are your independent variable/s?**

**3. What is/are your dependent variable/s?**

**4. What evidence from the articles you read previously provides support for your question?**

**5. What arguments justify your proposal?**

**6. What kind of subjects/participants is required?**

*Indicate the characteristics your subjects must have for your experiment to adequately address the experimental question; e.g., the appropriate age or level of schooling.*

**7. What is to be measured? What will be recorded? How?**

*Indicate the information to be gathered or recorded from your subjects' performance; e.g., the time required to perform a task, the number of times that something will be said or done, the way in which this is done, or the times that a task will be performed correctly or incorrectly.*

**8. What results do you think will be obtained if the experiment is carried out?**

*Summarize (numerically, if you wish) the data you anticipate gathering.*

**9. How do you think your data will answer your experimental question?**

*Describe why you believe that your proposal is adequate for answering your research question, based on the evidence mentioned previously.*

**10. What type of problem—theoretical, empirical, and/or technological—do you think your proposal will be able to resolve?**

Using this list of questions as a guide, students will compose and justify a novel research question derived from their readings. It is important to emphasize that they are not to do this simply as if they were answering those questions, but rather as if they were writing up the first draft of a formal research proposal.

Once the proposed research question has been elaborated, students are to answer the following questions:

- 1. Based on the studies described in the articles you read, do you consider that the question elaborated there is novel? Why?**
- 2. Based on the information you used as the foundation for elaborating your research question, do you think that the study you propose is pertinent? Why?**
- 3. Do you consider that the results of the study you proposed will have repercussions for the development of the area of knowledge in which your question is based? Why?**
- 4. Do you consider that the proposal is effective, i.e., that it will resolve a theoretical, empirical, and/or technological problem? Why?**

# Appendix C

## ► GUIDE FOR EVALUATING PERFORMANCE IN ELABORATING AND JUSTIFYING A NOVEL AND EFFECTIVE RESEARCH QUESTION IN THE AREA OF EXPERIMENTAL PSYCHOLOGY

(Activities Corresponding to the Baseline: Diagnostic Test in Session 2 and the Evaluation Session) (modified version of Padilla & Fuentes, 2017, pp. 121-123)

### ELABORATION OF A NOVEL RESEARCH QUESTION

Activity	Characteristics
<b>Propose a new research question</b>	The question proposed is novel and contains at least one Dependent Variable (DV) and one Independent Variable (IV); also, it specifies how the two variables are related.
	The question proposed is novel, but contains only one variable.
	The question proposed is novel, contains a DV and an IV, but does not explain how they are interrelated.
	The question proposed is not novel (i.e., it repeats the question from one of the articles reviewed).
Propose a novel Independent Variable (IV)	A novel IV pertinent to the research question elaborated is proposed.
	A novel IV is proposed, but it is not pertinent to the research question posited.
	The IV proposed is not novel.
Propose a novel Dependent Variable (DV)	A novel DV pertinent to the research question elaborated is proposed.
	A novel DV is proposed, but it is not pertinent to the research question posited.
	The DV proposed is not novel.

## JUSTIFYING THE PROPOSED RESEARCH QUESTION

Activity	Characteristics
Describe evidence that supports the question proposed	At least two distinct pieces of evidence are described and are pertinent to the research question proposed.
	Only one piece of pertinent evidence is described.
	No pertinent evidence is described.
List arguments that justify the proposal	At least two arguments are mentioned that elucidate clearly the importance of the research question posited for the development of a disciplinary area. Mention is made of findings from other researchers that were used as the basis for formulating the question proposed.
	Only one pertinent argument is mentioned to elucidate clearly the importance of the study.
	No arguments are mentioned; or those provided are not pertinent.
List arguments to justify that the proposal could resolve some theoretical, empirical, and/or technological problem	At least two arguments are mentioned that elucidate how the proposal could resolve a theoretical, empirical, and/or technological problem.
	Only one argument is mentioned to elucidate how the proposal could resolve a theoretical, empirical, and/or technological problem.
	No argument is mentioned in this regard, or those mentioned are not pertinent.

**Note:** If a more complete guide is required to evaluate the performance of the researchers-in-training in all aspects listed in the guide in Appendix B, consult Padilla and Fuentes (2017, pp. 121-123).



# A Main Challenge in Creativity Research

► Robert Sternberg · Yale University



I believe a main challenge is to figure out how to measure creativity in individuals in a way that is reliable, valid, and nontrivial. The kinds of tests that have been used have failed on the “non-triviality” component, measuring skills such as thinking of unusual uses of an object. We need to go beyond such tests to tests that measure creativity in more life-meaningful settings.

# 10

chapite



# Creativity in Psychological Theories and the Place of History

► José E. García · Universidad Católica, Asunción, Paraguay.

## PSYCHOLOGY AND ITS HISTORY

The history of psychology, as a differentiated and specific field of research, analyzes the conditions in which psychology emerged and developed as a science and profession, as well as the conceptual and theoretical variants that emerged in the course of its historical evolution. A great diversity of issues and problems arise immediately for consideration of the researcher, which has generated diverse ways of reconstructing the temporary variations in the discipline. The studies oscillate between what is called a *history of psychological ideas*, focused on changes in theoretical terms, constructed models and their intellectual roots, to a *critical history* of psychology, attentive to the interactions of psychological products with the social environment and the cultural determinants responsible for its configuration. The first texts that were conceived, concerning the knowledge and the disciplinary practices, and that also pursued the express purpose of placing psychology in a historical dimension, arrived at bookstores at the beginning of the twentieth century, both in Germany and the United States. Among these initial works highlights the two volumes produced by the American psychologist James Mark Baldwin (1861-1934), *History of psychology: A sketch and interpretation* (Baldwin, 1913),

the three of the British psychologist George S. Brett (1879-1944), *A history of psychology* (Brett, 1912-1921) and the work of the German philosopher Otto Klemm (1884-1939), also called *A history of psychology* (Klemm, 1914). These books recently fulfilled the first century of its relevance (García, 2014). Such works and many of the present ones devote special attention to the representatives of the discipline that emerged in ancient times and were inextricably linked to philosophy, beginning with classical Greek culture, as well as to research advances made in European countries and the United States. The basic conception of these approaches is not only the recognition of the historical background that underlie the contemporary development of psychology but also the great ideas that emerged from speculation, theorizing and research of their respective authors and the lasting and apparently imperishable influences which the same produced.

However, attention to psychological movements coming from outside the core countries, including Latin America, Africa, the Arab States, and Southeast Asia, received considerably less attention. When psychology produced in those nations is described by first world scholars, and even by autochthonous authors, is almost always at the cost of completely ignoring their possible originality and validity. Initial expectations about psychology established in these regions of the world seemed directed toward the purpose of reconstructing what appeared to be a process of passive absorption with little hope of discovering creative advances. The first reconstructions that could be reasonably identified as *historical* in relation to Latin American psychological production appeared in the first decade of the 20th century and referred to the emergence of then recent Argentine experimental psychology, its protagonists and main research lines (Ingenieros, 1910). Later, in the mid-twentieth century, the first evaluation of psychology at the continental level, included in a very ambitious work for the time (Foradori, 1954), which contemplated the narration of psychological advances in chapters structured by countries, was known. The situation has substantially changed over the past two decades. There has been a progressive strengthening of historiographical research and an increasingly consistent effort towards consolidation of national or local histories, whose distinctive sign is the deepening of psychology in a single country or regions, cities, institutions, scientific or professional groups and sectors with shared knowledge or practices. The purpose has been to explore in depth the particular and unique of these.

In the context of national histories, that is to say, those that reconstruct the circumstances, particularities and advances of psychology as verified in the geographical context of a single country, either as a whole or focused in their respective regions, there are many unknown questions to answer. In a first impression, what these histories promote is the systematic knowl-

edge of the pioneers, including in this category the authors of the first texts whose themes are identified with the psychological objects recognized at the time. They also deal with institutional events such as the founding of laboratories and journals with an open general thematic but receptive to the dissemination of psychological knowledge. In a more advanced phase, the specialized publications that harbor a more or less clear pretension of disciplinary congruence are considered. Also important are other events such as the establishment of the first courses or programs for university training, the organization of congresses and societies, and other similar events. This information is a fundamental part of any temporary reconstruction, since history itself as a formal discipline operates conceptually on this kind of information, and with respect to it exerts its interpretive projection.

But the look of modern historians point further and deeper. In spite of the traditional view, history is not only an ordered reconstruction of events and characters plotted in a punctilious, neat and exact chronological sequence. Besides that, which of course is essential as without factual data is implausible to do science, history reserves for itself a precise exegetical and critical function, which implies recognition of the right and the need to exercise some degree of personal discussion, consented within certain precise limits that prevent an eventual overflow of subjectivity. This condition allow us introducing the proper judgments of the historian, often assuming a certain discourse of value-cutting that attempts, in a very specific sense, to draw valid conclusions from the numerous facts presented and discussed. The aspiration is even to use them, and in the appropriate scenarios, with some didactic purpose, implicit or declared.

When the scope of discussion is transferred to the general history of science or that of psychology in particular, we can expect the addition of new objectives and problems. These become manifest at various levels. One of the dimensions in which the development of psychology could be analyzed is identifying stages of its historical process. It would then be possible to assume that the unique particularities that are distinguishable in a national or local history could, at least in principle, come to form some sort of cluster or conglomerate of factors that also reveal themselves when studying psychology in other different geographical contexts. That is the sense, for example, with which some authors tried to establish periodicities or sequences in the historical evolution of research and the pursuit of practical applications. These attempts, of course, are nothing new, since we would simply have to remember the traditional division of psychology in a pre-scientific and a scientific stage, a criterion that has been maintained in many of the pioneering texts that focus on the history of the discipline, despite the accumulation of a variety of criticism for its apparent simplicity. Some authors proposed

divisions with the simplest objective of arrange the temporal chronology according to some simple, basic and accessible criteria, but others tried to identify regularities, processes and underlying conditions that, more than noted objectively, could be recognized in diverse social or cultural contexts, that is to say, in the psychologies developed in other countries.

The implicit view is that psychology study as cultivated in different spheres holds the potential to lead to some form, albeit attenuated and imperfect, of future prediction. There lies the great utility of orientations as that of Azuma (1984) when fixing regularities in the evolution of psychological science in a non-Western country, Japan in his specific case. The theoretical framework proposed by this author divided the sequence into five successive stages. His point of view was quite influential, since researchers from different latitudes and realities used it for the analysis of certain national psychologies or homogeneous geographic regions, some very unlike the Asian reality, and with variable depth pretensions. Among those who used this scheme to base their own studies we can mention García (2004), who analyzed Paraguayan psychology, Mpofo (2002) who wrote in relation to sub-Saharan Africa and Oakland, Feldman and León de Vilorio (1995) about Venezuela. In Latin American psychology, periodization have been tried according to dissimilar criteria as regard countries such as Argentina (Klappenbach, 2006), Colombia (1986) and Paraguay (García, 2005).

A fundamental component for this kind of studies is the possibility to find typical features in national psychologies that are specific enough to postulate qualitative differences in relation to the overall process of evolution of the discipline. That is to say, some particular aspect that may not be common to any other different geographical region than the place from which proceeds the analysis. Therefore, at the time of inquiring about aspects related to the universality of psychological constructs, which is where point the schemas that identify stages, highlights the efforts to locate particularities, that is, characteristics and processes that are not repeated in other contexts. In this case we allude to the idiosyncratic nature of national psychologies. If this is feasible or not to be proving in the strict level of historical research, and if there is a basis to expect a possible replication, is a fairly open and debatable subject on which much discussion remains pending. However, its simple suggestion indicates a singular awareness regarding the fundamental terms of the problem. It's clear that, by proceeding in a similar way, we are supporting nothing less than the ambitious purpose of using the history of psychology (and eventually other disciplines pursuing the same purposes and using similar methodologies) as a source to draw lessons from the processes followed by science in its temporal evolution and, if possible, the discovery of

regularities in universal psychology or idiosyncratic peculiarities in national psychologies.

According to this point, García (2011) claimed the field of history as the appropriate instance for the encounter with the intellectual roots that underlie the discipline, whether observed in the global context or in the local dimension. To this end, he discussed the foundations and objectives that should be pursued in the study of one of such national variants: Paraguayan psychology. Among the goals for this study was to analyze the presence or absence of the necessary elements for the establishment of a native or idiosyncratic psychology in that country. To them it should follow the closely related purpose of trying a prospective on the future course that psychology could take, from the foundations provided by current developments. These searches touch the field of what have been called *indigenous psychologies* and *folk psychologies* or *common sense psychologies*. The former are defined as the study of psychology from the point of view of their ecological, historical, philosophical and religious perspectives (Kim, Yang & Hwang, 2006), which at the same time places them in a close complement with the second, which are based on a daily rather than scientific appreciation of the mind (Hutto & Ratcliffe, 2007) and is based therefore on the ordinary understanding of the social collective.

Extending this purpose to different scenarios, and proceeding on the basis of well-defined objectives, many important benefits could be drawn from such a study, which is suitably integrated and evaluate psychology in its main dimensions. It could lead, for example, to the recognition of intellectual traces in the different theoretical approaches currently in force, studying how the transmission of concepts from one author to another occurs, either as a passive dogmatic reproduction or in its active adaptations to the surrounding cultural milieu. The interest would be directed to the articulation of the psychological knowledge with the particular concepts, traditions and particular views that eventually prevail in the communities that act as recipients of these theoretical formulations. In this way, it will be necessary to establish the degrees in which psychological knowledge can be considered a faithful reflection of the thought, attitudes, emotions and habits typical of the settlers of a specific place and in a concrete historical moment.

When it is argued in these terms, is clear that we also refer to a central element that defines the contours and possibilities of scientific productivity: creativity. If we want to recognize the originality of both the constructs and theories used by any science to address and explain the sectors of reality with respect to which sets its objects of study and the versatility that these acquire in adapting to cultural variants, it's evident that we don't talk about

anything else. The nuances and veils imposed by culture, although relatively irrelevant in the context of the natural sciences, are of paramount importance for a discipline such as psychology. Analyzed in this perspective, the story will have to serve mainly two central intentions: 1) To study the processes responsible for the configuration of psychology in the different cultural backgrounds that host it, while evaluating the originality of the proposals, their relationship with the general scientific knowledge and the novelty that they imply with respect to the understanding of both the communities of origin and the recipients and, 2) to encourage the discussion on the indigenous production of the discipline. From this point of view, the history and the study of scientific creativity are complementary instances.

### **CREATIVITY, HISTORICAL RESEARCH AND ITS INHERENT DIFFICULTIES**

Talk or write about creativity is much simpler than defining it unequivocally. And this is because creative acts, in their very conceptual essence, are running the search for novel intellectual paths, not previously explored or transited. This circumstance makes that any measurement through standardized procedures, also prove very complicated. The reason is obvious: how can it be possible to evaluate with previously stipulated criteria what is, in fact, being formed and constituting as unique and different at each moment? This is a very complex question to resolve. Based on the work of the American researcher Joy Paul Guilford (1897-1987), psychology began to integrate divergent thinking, a conceptual equivalent of creativity, into the current lexicon of intelligence during the 1960s. Guilford (1952) had mentioned this construct in his discussions since at least a decade earlier. An important point in his conception was that divergent thinking is characterized by the search for new cognitive orientations and happens spontaneously, covering unthreaded pathways and illuminating many possible solutions for a given problem, through the analysis of not previously observed facets. For very obvious reasons, this notion gained a fundamental relevance in the educational applications of psychology, although its implications and scope go much further. For this reason, the study of this problem forms one of the most important agendas of contemporary psychology, and not a few understood its importance in fields such as primary and secondary education. It also constitutes a fundamental element for the analysis of consolidated scientific theories.

A simple way in which concepts about creativity can be clarified to be used efficiently in research is dividing its scope into two related but relatively independent dimensions: a) creativity seen as a product and b) creativity understood as a process. Psychologists and educators, for their manifest and

practical interest in the study of behavioral habits and cognitive strategies, and also for the understanding of the thought processes that are directly involved in their origin, focus their priority interest in the second of the meanings. One of the sectors with a more systematic and consistent use of the approach centered on processes and mechanisms is the psychology of science, whose object of study concerns the variables related both to the production and execution of scientific novelty. Among its interests are included the elucidation of the familiar, ontogenetic, cultural and social conditions that lead to the emergence of great creators in science, art, politics and other domains. This deferential attention to the processes is highly profitable at the scientific level, which can be seen in the unveiling of the cultural and biological variables that lead to the formation of genius and the emergence of innovators in basic science and technology, who periodically burst with refreshing proposals.

In the history of psychology, however, the most appropriate and plausible is the study of products, that is, the results of scientific creation in their conclusive forms. Here we refer to research and theories, systems of ideas and representations of reality as crystallized material elaborations. Consequently, the analysis is taken not in the most dynamic sense that would imply the mental activity of the creator as an attempt to objectively reflect a part of reality, the psychological in this case, but in what implies the evaluation as finished elements, contemplated in the singularity of its historicity and its own characteristics. The history of psychology, indeed, would not have options to proceed otherwise, for it is only possible to access sources in their final state, finished and definitive, and away from the processes or subjective conditions that engendered them. That is, no researcher has the ability to reproduce the history as a film that conveys the optical illusion of being before moving scenes, setting the vivid details of the action and making the viewer could be able to rewind the tape again and again in reverse, at their will, to appreciate more closely the innumerable details. Although paradoxically, and in order to give meaning to his activity, the historian strives precisely to discover or deduce in a truthful manner the keys that encloses the intellectual production, studying processes that appear to us static in their sensorial appearance at least, although not in the meaning of thought, whether it be a letter, a document, a monument or a published text. And it's important to understand why.

Creativity can be articulated with history in several different ways. The meaning of historical processes lies both in moment and content. In this respect, the moment, that is to say *when* something happens will have direct and immediate repercussion on *what* can be qualified as important. In this

second case is that we talk about the content. That's why opening a judgment on the potential that holds an idea or a scientific theory as a creative production depends not only on the content or relevance of the idea itself. We must remember that any thought is strongly embedded in the constraints imposed by the social environment. Nor can we ignore the historical context. It would not make sense point towards an essentialist conception, which seeks the meaning of the creative act in itself as if it were an Aristotelian *entelechy*, estimating the novelty inherent to a concept but without taking into account the context in which it occurs. It must be understood that creativity itself is a relational phenomenon, that is to say, it's linked to other aspects of the surrounding environment, with which it should necessarily be confronted to properly estimate its value. That's why comparative frameworks can't be avoided. In other words, the relevance of ideas becomes evident only when there is an articulated group of committed people with the same type of questions, problems or set of possibilities towards which the created object or thought are related and constitute a special reference. In this way, a critical mass of information and shared interests is also generated (Runco & Albert, 2010).

The conception of the creative process as a biblical miracle, where God engenders the universe from nothing, without the aid of antecedents or previous elements, a vision that still persists in some sectors of the population, is not only profoundly unreal, but also wrong. And it is particularly so in the domain of scientific production, where many contemporary philosophers of science followed the path open half a century ago by Kuhn (1970) with the study of scientific revolutions and the cultural formation of the paradigms, proving convincingly that the emergence of new outlooks does not necessarily imply the production of drastic ruptures with previous thinking. Moreover, young theories often assume part of the components that come from previous intellectual models, giving them different meanings to insert into new clusters of ideas. The most realistic view of the creative process in science, then, is not that of the absolute overcoming of the former by the recent, but that of the relative transformation. A little is discarded and new revelations are taken advantage of. This point has important implications for our argument.

Taking a few examples will help to clarify things. The history of psychology has been, to a large extent, a search for the clues leading to development of theoretical thought, that is, how ideas emerged in a distant past conceptualized as classical persist in time, although undergoing several kinds of metamorphosis. These transmutations allow some old concepts to persist in modified forms, as part of the assumptions underlying modern science. This is not deny their novelty in any way, but establishing a different and more complex combination between the new and the old. That is, where invention



could popularly be presumed absolute, the study of history allows checking the stability of some elements, along with the addition of others. The point is to distinguish where the true novelty lies and how to recognize it. Contiguous to it we also discover, in fact, the phenomenon of creation itself. To be exact, what could be classified as new or creative is what will constitute an invention in the real sense, being able to become also an effective adaptation when it comes to an idea. From this point of view, the history of psychology provides essential inputs to advance in the analysis. A very important part of the modern evolution of psychological science is the continual and persistent reappearance of a small group of concepts which are revealed again and again in conceptions of mind and behavior, with formulations varying according to the new intellectual environments, but retaining a very evident common basis and foundations. García (2015) called them *breaches in psychological thinking*, quoting as examples some strong doctrines such as dualism, the innatism of ideas and the appealing of learning and experience, among others that act as sources of knowledge.

In physical reality, breaches are deep furrows that open into the ground, such as cracks caused by large earthquakes or trenches excavated in wars as a defense against the enemy's advances. In the case of psychology, the concept of "breaches" is used as a colorful metaphor referring to very determinant intellectual influences, which by their strength and permanence cannot be easily ignored. Several possible examples can be mentioned. The dualistic thoughts that have been current since the days of Pythagoras and Plato to the modern cognitive psychology and Noam Chomsky's psycholinguistics are well known, as well as the discussion concerning the phenomenon of learning and experience that made their appearance with Aristotle and continued in the empirical philosophies of John Locke and his followers, being very present in the behaviorally oriented psychology of learning. Years ago, Tigner & Tigner (2000) described how some of the Aristotelian precepts on cognition were fluidly inserted into the *triarchic* theory of intelligence conceived by Robert J. Sternberg (1949- ). Recently, Dumont (2010) summed up in great detail how many of the central proposals of psychoanalysis, which are usually presumed examples of originality attributed to Sigmund Freud (1856-1939), were indeed already incorporated, almost in identical detail, in the work of previous authors. Examples of other antecedents could be multiplied by heaps. Then, judging from the presented data, it seems clear that absolute novelty, understood as a creation that is not based on previous efforts, is far from being a real phenomenon in psychology. However, we all distinguish when finding a new theory in the introductory texts the presence of some elements that seem to us new, or that we had not previously recognized. We would hardly be willing to agree that these are merely simple passive adapta-

tions of earlier ideas. In such cases there always seems to be something more. What may be the components that explain the sense of novelty that theories provide is one of the most interesting issues to be explained.

It's clear that history has an important role to play in weighing how much creative or not to be reckoned the theories built in the disciplinary field of psychology, but it's a role on whose scope is necessary to form a clear and cautious idea. In fact, the function we propose for this historical view doesn't have the accuracy or very tight precision that we accustom with statistically testable hypotheses. The level of analysis is different and has a more explanatory and evaluative characteristic. Its purpose is to analyze critically the theoretical developments and their interaction with the social environment that produces and welcomes them. Of course, there are other methods and aspects in the historical research of psychology that can benefit from numerical certainties that mathematics make possible, such as the widely used bibliometric method for quantitative research in scientific literature, for example. In the case of history as an interpretative mechanism, the utility will come on the side of hermeneutics and will be essential to form a critical judgment of the following aspects that directly concern creativity:

- 1) In what appears to be the most obvious application, thorough knowledge of the history of psychology facilitates the discovery of concordances between ideas, concepts, and approaches, addressed problems, raised objectives and used methodologies. This is the simplest and most obvious way in which studies on the temporal development of the discipline can contribute to a better understanding of these similarities and differences, abandoning the naive approach that the creation of new theories is always an absolute beginning. History puts all knowledge into perspective, and in this way is possible to discover the relationship and dependence of ideas with their specific cultural framework.

- 2) The historical and systematic study of the theories allows us to analyze, in a comparative way, to what kind of questions responds the use of two or more psychological constructs that could have apparent similarities, large or small, among themselves, although with a contextual variation in the class of problems which lie at the basis of either theoretical speculations or empirical research. For example, the concept of dualism used by Plato (427-347 BCE) was justified in the context of a philosophy of metaphysical cut that, for an ontological requirement, needed to keep separate the two planes of reality to which it alluded. In contrast, the psychophysical dualism of Rene Descartes (1596-1650) responded to a different logic that sought to preserve the studies of biological functionality under the hegemony of physiology, while the phenomena of consciousness remained open to the scrutiny of rational and aprioristic analysis.

3) Scientific theories do not emanate from a timeless emptiness. On the contrary, they arise and shape in concrete cultural and social contexts. These differ to a greater extent the more they are separated by stages and the different geographical contexts. Consequently, theories are intellectual answers to diverse epochs and societies, with traditions, social organization and ideals of life potentially dissimilar. This premise may provide valuable insights into the forms and degrees in which unequal societies assimilate similar points of view or share common intellectual elements. A brief comparison between seventeenth-century British society, in which John Locke (1632-1704) conceived the basic assumptions of the associationist theory of mind, with nineteenth-century Tsarist Russia where Pavlovian reflexology emerged, which also made the principle of association one of its fundamental explanatory axes, can shed some light on the diverse ways in which two great creators belonging to disparate collectivities and times managed to incorporate principles analogous to the essential of their theoretical constructions.

4) Historically, psychological theories originated in academic settings of the first world and then were transplanted to intellectual and university circles, and also in the popular discourse of developing nations. The followed direction goes from the “center” to the “periphery”. Such importation is usually done very directly and without the necessary adjustments of local adaptation, lacking this way a rigorous verification of the assertions and without checking whether they reflect the psychological reality in the receiving communities. That is to say, although it may be right within certain limits to postulate the validity of universal processes and mechanisms as part of human psychological functioning, the inherent and determinant influence of culture is unquestionable and cannot be diminished. Language, thinking styles, social cognition and attitudes, prejudices and stereotypes, while sustained on established physical foundations and evolved mechanisms of the brain are, at the same time, a living reflection of the typical cultural contingencies of the recipient environments. Therefore, the psychological theories that are diffused and reproduced in a passive and automatic way to any social group, for more variable that this may be, will be abdicating of the basic condition that serves to evaluate its true relevance as an element for the understanding of the human cognition, always linked to a specific historical condition. This is the only way in which theories should be discussed. And it also constitutes an essential part in the critical assimilation of those who receive, accept and use them in new and divergent contexts.

5) The creativity of psychological theories is determined by the emergence of complementary concepts to those already existing in them, the fusion with indigenous knowledge and the accommodation of foreign approaches to the new cultural and historical realities of the place that receives

them. This is the sign that marks the true maturity of psychology and the most efficient way of specifying the originality of theoretical constructs. At the same time, is the antechamber to a reversal movement, that is, the production of knowledge originating in the environment of growing societies and their subsequent projection to developed countries. This does not happen often, and of course is understandable that it is so. The so-called “Third World” has so far been a very uncritical market for the importation and consumption of psychological models, with passive absorption most of the time, or with variable or incomplete degrees of assimilation according to the respective cultural milieu and considered psychological orientation.

Certain characteristic Latin American approaches such as the *psychology of liberation*, of the ill-fated Ignacio Martín-Baró (1942-1989) (Martín-Baró, 1995), are a sample of what we say. Although this orientation rests on a particular appropriation of the Marxist dialectic, which is essentially a European production, has instituted a contribution of relevance from Latin America to the rest of the world, attracting the attention in the academic cloisters of Europe and the United States. To the extent that psychology can establish itself as an effective instance of reflection, understanding and research of the surrounding reality, it will have fulfilled its task of assimilating the basic conditions of the social and cultural environment to translate them into explanatory theories that lead to an in-depth understanding, and eventually, transform it. This is the ideal point for psychology, and must be achieved by an exchange between historical considerations and the present reality. The better it can get close to the central objective, it will have achieved the most useful and realistic measure of creativity for psychological theories.

## CONCLUSIONS

Science constitutes the knowledge sector that best identifies itself with critical thinking and corrective self-evaluation, reviewing itself continuously and establishing its judgments on the basis of evidence and verification. All disciplines that deliver valuable contributions to human knowledge and well-being depart from a shared assumption: that the search for solid and protected by certainty knowledge, only allowed by empirical demonstration, is the only way to achieve a reliable representation of both the external world and subjective reality. These practices are the basis and guarantee not only for a better and more exact understanding of the universe and society, but also for the efficient development of technological applications. As a science, psychology is oriented with identical objectives. That's why is important to overcome any obtuse dogmatism, and the permanent prioritization of novel intellectual constructions that accompany social and cultural changes in a way that guarantees their effectiveness as explanatory resources. For psy-

chologists is extremely important to understand not only how creativity operates at the individuals' level but also the way in which the subjective processes that lead to the creation of theories are explained, clarifying the mechanisms that act in their production. In this second variety of research, history and psychology constitute strategic allies. Its field of analysis thus becomes one of the most relevant and promising for the whole broad spectrum of science.

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## ABOUT THE AUTHOR

### **José E. García, PsyD.**

He published book chapters and articles in psychology journals. His main current research areas are the history of psychology in Paraguay and Latin America, evolutionary psychology, political psychology and the academic training of psychologists. [joseemiliogarcia@hotmail.com](mailto:joseemiliogarcia@hotmail.com)

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# Imagination and Invention: Creativity Perspective from the Psychology of Individuation of G. Simondon

► Lina Marcela Gil Congote · Universidad de Antioquia (Medellín, Colombia)

## ABSTRACT

Individuation in the work of the French philosopher Gilbert Simondon consists of making the inner and outer world compatible through invention processes. When facing a new problem, a (physical, biological, and collective) being displays its potentials and transforms itself as it transforms its surroundings (transduction). In the human realm, psychism arises as problems associated to sensation and perception, to affectivity and emotivity are solved; and action as a development of new functions that only happen among, thus configuring transindividuation, thanks to significations shared with others. By proposing the dimension of technicity, the author moves to the characterization of invention from the concretization of technical objects in their mediation function between nature and mankind, between the natural and the artificial. A technical object not only has a mode of existence, but, simultaneously, it has possibilities of individuation, of insertion and naturalization in culture (“community of technical objects”). Through creativity, this



When facing a new problem, a (physical, biological, and collective) being displays its potentials and transforms itself as it transforms its surroundings (transduction).

becomes an environment of individuation, always in relation to the alter, that is to say, by opening community transindividual horizons.

Keywords: image, perception, symbol, psychic individuation, transindividuation, technicity.

Throughout Gilbert Simondon's thought (1924-1989), psychology has occupied a central role; it is not only a matter of a recent compilation of writings (2015), which presents a historical account of the way in which different schools have conceived psychological processes: sensation, perception, affection-emotivity, memory, learning, and intelligence; throughout his work he also alludes to the concept of the psychic individual. Taking into account the approach he proposes, his proposal may well be characterized as a psychology of psychic and collective (transindividual) individuation that always occurs within an environment.

The aim of this study is not to make explicit the bases and scope of Simondon's psychology. However, it is pointed out that the proposed analysis on creativity is based on a psychology of individuation, which is greatly influenced by phenomenology, especially by Maurice Merleau-Ponty. It also keeps a dialogue open with the ethological tradition of development and Jean Piaget's genetic epistemology, among other sources cited by Simondon. Such sources enable us to understand the psychology of individuation and the problems therein posed, as a hinge between philosophical and scientific psychology.

## I. ON INDIVIDUATION

Simondon emphasizes the process by which an individual (a molecule, a crystal, a plant, an animal, a human, or a technical object) is not the sum or encounter of matter and shape, but a constant progression of information that is broadened and organized as a structural and functional unit. In the physical, vital, and psychic-transindividual levels, problem resolution is a source of individuation: As individuality differentiates itself from the environment, they both conform a meta-stable system (in internal tension and resonance) in which to deploy their potential (what is preindividual) and to mutually transform each other (transduction). In contrast to the physical level, potential is endless at the biological level because life reproduction mechanisms enable the existence of new beings from the intrinsic information belonging to the individual.

When the problems posed by the individual or by the environment cannot be solved by the primary instinct source, sensation, or affectivity alone, somatopsychic factors emerge as a by-product of a division and a differentiation of functions. This differentiation makes possible both the transit from perception to action and the organization of primary affections

into an affective-emotive dimension beyond adaptive ends. All of the above enables the individual to pose problems to himself and to create bonds with others. In some animals there are degrees or situations that can be called psychic: “Mankind . . . , in particular thanks to the help of symbolism, appeals more often to psychism. . . . Animals are better equipped to live than to think, and men to think than to live. But both live and think, in a regular or exceptional manner” (Simondon, 2009, p. 242n).

Amidst this continuum between animal and human, the author is especially interested in perception as a psychic operation that is at the base of individuation processes and which carries in itself the development of imagination and invention. After going over these Simondonian categories, the concept of creativity—which appears in his work indexed as creation—will be reserved to the human dimension, thanks to the deployment of self-awareness that can transcend over time by means of symbolic and material works that carry technicality. Such technicality is understood as transindividual, accumulated knowledge, resulting from the capacity to pose problems and to solve them, to gather the past and to project a future, feasible for one and for all. These categories—imagination and invention—also devise a horizon for an epistemology of creation, of creativity, which will not be addressed in this text (cf. Vargas, 2014).

## II. IMAGINATION AND INVENTION

Simondon proposes a theory of image that follows a cycle through “successive phases of a single genesis process” (2013, p. 10), seen as a subset of relative autonomy within the subject (structural and functional subset of psychic activity): anticipation-perceptive-motor relationship-memory-invention. In terms of phases: anticipation, experience, and systematization. The cycle begins with the object’s anticipation through motor tendencies; then, in the encounter with the object, incident signals appear, which precede perceptive-motor signals. Thanks to symbols, lived experiences, with their affective-emotive and cognitive components, are kept even when the object is missing.

Simondon does not place himself in a deterministic nor indeterministic position, since he considers that in both cases there is a dark zone, an unexplored process. He intends to explore it when he deals with the genesis of images and points out that “perception is an operation of individualization of images/shapes. These images/shapes (...) are invented in the perception process” (Carrozzini, 2015, p. 41).

The image cycle theory is supported or complemented with the theory of communication which does not deal with the encounter of a transmitter and a receiver, but with realities that are mutually affected and live the influx

of what is undetermined. Information is an operation in which “(...) local reality, the receiver, is *modified in its development* by the *influencing reality*” (Simondon, 2010, p. 159). If everything is determined, how to introduce variations in the information operation, in communication, in perception? In the image cycle, the subject (local reality) becomes a generator of signals, not only a receiver; it is an activity that allows for anticipating, gathering, keeping, “recycling” what comes from the environment (influencing reality): “The progress of communication from the simple relationship [*rapport*] with the environment to internal communication in an individual capable of inventing can be conceived as the appearance of new degrees of freedom” (p. 133). To understand this cycle, Simondon proposes three levels of image: *a priori*, *a praesenti*, and *a posteriori*.

In the first case, the motor part has an endogenous, hereditary component; an *a priori* image is an anticipation of a motor and perceptive activity, even though it does not have a direct reference to the environment. For Simondon, motricity precedes sensoriality and “therefore, there is a true biological basis of what is imagined, prior to the experience of the object” (Simondon, 2013, pp. 41-42). These are motor spontaneities prior to the stimulus-response scheme and work as organized initiatives. In some cases it is a prefiguration that triggers instinctive activity: perceptive “*patterns*” that play the role of triggering stimuli. There is also a phenomenon, named *Prägung* (*imprinting*) by ethologists: a “learning that is carried out completely and at once (...); a conduct is now virtually ready; it only requires an objective support” (p. 43). Here, the image also plays a role of anticipation: it is the case of some pigeons that have preformed conduct (hereditary coordination) of following their mother, which can even be another animal or a human. This means that the response is triggered even though object selectivity occurs randomly to a certain degree. In these examples or modalities also occurring in animals, Simondon wants to show that perceptive information is different from the image, even though the latter plays the role of conduct anticipation.

*A praesenti* images emerge in the relationship between a local activity (individual) and an influencing information (environment) by means of the operation of a cognitive pre- and intra-perceptive scheme, in which motor tendencies are grouped in configurations. For example, a child playing with a doll, which could simply be a rag doll (rather than a sophisticated shape), or the anticipation of hunting conducts in a kitty with any toy or a thread ball. In these cases, the organism and its body scheme anticipate movements from motor images that hold an innate character and have objective support. They are short-term anticipations according to each situation.

In perceptive-motor experiences, *a posteriori* images act as “response schemes” between organism and milieu, as learning. The affective-emotive

aspect completes the organization process in its resonance, acting as a key point, “*analogous to the external milieu*”(p. 26). Images-memories are produced, which due to their emotional intensity, allow to organize and to reactivate behaviors, not only to evoke experiences; it is the link between “motor endogenous energy” and information coming from the milieu (p. 28) and the way of a “mental universe” under tension.

To sum up, there are levels at the genesis of the image and its dynamism: a primary, instinctive level (e.g., escape, aggression, by means of innate *patterns*), responses to typical situations that compromise the organism as a whole, according to the “perceptive equipment and . . . motricity” of the species concerned (Simondon, 2012, p. 253). The shift from milieu to territory, from situations to objects, occurs while there is no restriction for vital categories such as attack or defense. The degree of quantitative and qualitative information is broadened, that is to say, perception and integration capacities permit being closer to psychic factors and starting intelligent behaviors. That is how it is possible to gradually—rather than abruptly—go from the biological to the psychic. The secondary level, psychological, works as a mental *analogy* of the primary, where desire, motivation, conscious anticipation, and an action plan to adapt to the object intervene: “The psychic image is the affective-emotive symbol of the object, which contains the association of a distinguishing feature and of a reaction modality of the subject” (Simondon, 2013, p. 29). When the object is present, there is a passage from a state of independence to one of interdependence. The third level is reflexive, formal, where the subject dominates its relationship with the milieu: Objects become “frameworks or supports of relations” (p. 52).

The first level is resources, instinct; at the second level there is activation of schemes: Basic training and experience are required; at the third level there are no resources, but giving or production of schemes: Because of deliberate, intentional structures, the subject displays reporting acts with which he gives sense. The first two levels are infrastructure, a superposition of innate and learned things, which means no sense can be given at all without an experience of the world and an inherent capacity to give sense, without ignoring the participation of both conscious as well as unconscious aspects.

Sensation enables capturing information from the sensory organs; it is a relationship with space, with the body, and progressively with objects, taking into account that “an object is a stable set of properties, grasped as independent from the milieu in which it is found” (Simondon, 2012, p. 105); it is a discontinuity, a singularity of the milieu, that requires a sensory-motor adjustment from the individual. Its complementary activity, perception, enables integrating the plurality of sensation and organizing the world; it is because of this that Simondon questions the concept of good

shape from the *Gestalt* theory because for him perception is the resolution of a problem, of a disparity between inner and outer world; it is an active gesture: “Perception is not the acquisition of a shape, but the resolution of a conflict, the discovery of a compatibility, the *invention* of a shape” (Simondon, 2009, p. 349). Between the individual’s previous information and the milieu operates a preindividual dimension (non individuated reality) to which he appeals to organize and produce a *perceptive unit*, disposing of the potential information available in each situation, beyond withdrawing and acquiring a previously organized shape.

It is possible to talk about inventions in detour conducts or when using instruments from the environment to solve a problem, to the degree in which images that make available data compatible with the senses are displayed, that is to say, an individual’s operative models are organized. With the invention emerges (extrinsic) compatibility between the milieu and the organism, and between the subsets of (intrinsic) actions; it is enlargement of instants from previous learning and it uses “moving, separable images” within a field of “unfinished” aims and learnings (Simondon, 2013, p. 72). It is for this reason that problem resolution by means of inventive imagination is an amplifying operation that occurs within a territory, under the perception of objects that display or trigger intelligent responses, not only as a threat or as an escape<sup>1</sup>.

The invention could then be considered as an organization change of the system of adult images leading the mental image, by means of a change of level, to a state of free images that make it possible to restart a genesis: the invention would be a rebirth of the image cycle, which makes it possible to address the milieu with anticipations resulting in adaptations that had not been possible with primitive anticipations, and then a new internal and symbolic systematics. (Simondon, 2013, p. 26)

A process of image formalization takes place leading to symbols: “In the study of image genesis, we will call symbols to those images-memories resulting from an intense interchange between the subject and a situation” (p. 11). The intensity of such experience implies that the subject has given something and the image preserved is like a fragment of that situational reality; thus, the image can be “reactivated” and the intensity acts as a

1 Images operate as anticipations of the object: They exist a priori and in that sense they are also different from concepts, which exist a posteriori, from experiences. Images are configurations, groupings of features, potential characters (not a specific object) with a role in instincts analogous to the role of concepts in the learning of more elaborate conducts.

“tendency to reconstitution of the primary unit” (p. 12); one symbol seeks another to supplement it, in a search for fundamental unit, much like the myth in Plato’s Symposium.

Simondon conceives the image—in a dialog with Mircea Eliade—in the realm of the individual, binary, and most primitive that leads to its increasing complexity: “A symbol exists where there is formalization of traces” (p. 147); others are required for this, a *tertium quid*, a third party, e.g., the Father, the Law, Society, Nature, etc. It’s a shift from binary to collective structures: “The ternary structures actually allow individuals of the same group to communicate, insofar as they formalise the experience of interaction and provide a universal ground corresponding to the intellectualised, adult, vigilant and conscious expression” (p. 146).

However, not all symbols are of this nature. There are images that reach the house of conscience without being invited; it is the numinous, between objective and subjective, “quasi-organisms” that can appear, present themselves when they are not expected, and lead to decisions, also operating to our regret.<sup>2</sup> The image implies “anticipation aspects (projects, vision of the future), cognitive contents (representation of what is real, certain details seen or heard), and finally affective and emotive contents; the image is a sample of life, but remains partially abstract because of the incomplete and partial appearance of the sample” (p. 16). It is the conjunction of anticipation, cognitive data, and affective resonance.

The image-memory then evolves into a symbol: Univocity gives the option of at least two tendencies, key points of strength, potentialities; “symbols are ‘absolute objects,’ separated from the empiric circumstances of their appearance, but that have preserved their power, their expressive capacity, their capacity to signal potentialities . . . ; in the symbol, what is successive becomes simultaneous, the individual reaches its universal scope” (p. 154). The power of the symbol comes from being preserved after having lived the experience with the object: “The symbol is only a pseudo-object, loaded with all the potential energy of a metastable system, ready to initiate a structural change” (p. 153), by means of a saturation process. It is expressed in verbal images, turns of phrases, outfit, art, and technical objects, as germs operating not only as production or evocation, but also allowing to capture networks, connected realities, information about cultural groups and backgrounds, regulations, and functioning schemes, especially when expressed through concretizations.

2. To this order belong the archetypes, a concept present in Mircea Eliade and Carl Gustav Jung: “(...) is like a scheme of the imagination, a cast of images that belong to the past of humanity (and perhaps to pre-human stages of the future of the species)” (Simondon, 2013, p. 146). The archetype is “overdetermined,” “it resists a rational analysis” because it does not correspond to a concept or single image: “it condensates multiple situations in a single representation” (Simondon, 2014, p. 74).

### III. TECHNICITY AND CREATIVITY

In the gradual formalization process already described, that goes from images to symbols, the transmission and technical evolution is possible in a cultural and historical context, absent in animals even though they experience “psychic situations” and are able to develop “instrumental mediations” (cf. De Beaune, 2004). Recourse to symbolization and communication through practice, object manipulation or formulation of concepts and theories facilitate the expression and capture of technicity, that is, the inventive, creative force present in human productions, a gesture that remains from the resolution of the problem that originated it and turns into information available for future inventions. Likewise, there are possibilities of formalization of something that is not operative but affective-emotive; in this sense, Simondon refers to the invention of a set of morals, with rules, values, and roles that act as modulators in a social system (cf. Simondon, 2013, pp. 181-184), or creations that are not technical objects proper, but rather procedures, methods, or ways of doing that have proven effective, and whose technicity remains in different situations and times. Also broad is the creative power that opens the aesthetic dimension, by means of artistic works that raise participation, the resonance of the pre-individual available in the work, beyond the artist’s intention (cf. Stiegler & Rogoff, 2010; Imaz, 2014; Pardo, 2010).

The image, as motor anticipation, unfolds according to different cultural contexts contributing an amplifying metamorphosis of the object, be it by identification with an imaginary world where others act in place of the subject, in a set where the splendor of the real is multiplied, be it by a recourse to the wonderful or supernatural, or finally by a real action on a working matter in a free time situation; but, in all cases, the effect of anticipation as *a priori* image is an amplifying proliferation stemming from a single origin located in the subject; such proliferation multiplies in the future the paths and forms; it is analogous to growth, maturation, a development comprising differentiation and supplement of the being; it acts towards the future the amplifying projection of the potentialities of the subject’s present. (Simondon, 2013, p. 67)

Notwithstanding the possibilities identified, for the author the image cycle finds its climax in the invention of technical objects; while perception depends on the milieu and its effects take place in the presence of the subject, in concretization (*functional gain*) the effect is in the object, has cumulative character, and incorporates some of the nature that exceeds practicality and usefulness: The image cycle expands and unfolds beyond the individual by



means of inventions distinguishable from the subject that produces them. It is the sharing of trans-individual knowledge, a universality that is not limited to the time and space where it was created; it is a virtuality that “consists of a permanent possibility of reincorporation in ulterior works or creations in the form of schema or element, even if the individuality of the created object is not preserved in the course of ensuing inventions” (p. 185). Insofar as the object is the bearer of technicity—that is, of information available for others to resume, supplement, or dispose of new inventions—the conditions of the expected problem are cleared.

In a network or community of created objects, “a creation” Simondon (2014) always conceives progress with the integration of technique and culture. That is why, in his opinion, the study of invention surpasses general psychology and takes on historic, economic, social, and political dimensions that surround the use, reception, diffusion, and operation of the technical object by means of a technical mentality capable of capturing and sensing in its way of existence, “which consists in resulting from an invention that condenses as an object a beam of information contained in the reality of an image reached at the end of its coming about” (p. 200). Finally, the object is the materialization of an image, a continuous spectrum beyond cultural and temporal barriers; this constitutes its technicity, which by definition is trans-individual: This is the “mental and practical universe . . . in which human beings communicate through what they invent” (Simondon, 2007, p. 263); it is source of “latent significations”: cognitive, conative, and affective-emotive (Simondon, 2013, p. 20).

Following Simondon, creation in the realm of technicity is creativity, organization, and self-organization capacity that allow the subject to pose problems, benefit from the past, and anticipate a future in resolution, always counting on the presence of the undetermined: “The relation with the technical object begins *under the reason*, . . . close to perception, close to bodily action” (Simondon, 2014, p. 441); it is not a mere operative or rational process. Thus conceived, the image cycle provides valuable elements for psychology, not only in the study of basic processes such as sensation and perception, attention and memory, to understand why creativity structures individuation processes, but also for the possibilities it opens to promote environments of imagination, invention, and creativity to unfold in its potentialities and expressions of technicity. In Simondon’s works, with individuation processes, there is an explicit idea of a technical culture that overcoming productivity and obsolescence criteria at the service of human aims: the various modes of thinking—religious, technical, aesthetic, ethical, social and political, scientific, and philosophical—converge in problems solving and allowing individuation. Simultaneous, problems are solved in

the difference (individualization) and in the transindividual by shared significations, material, and symbolic creations of a psychic being that in its self-awareness displays creativity in function of a destiny of humankind of which feels and knows himself responsible for.

Applications derived from this Simondonian theoretical framework in psychological processes and creativity are a matter of future investigations, also keeping in mind that there are not many direct references on the topic (cf. Alloa, 2015; Barthélémy, 2010; Beaubois, 2013; Forest, 2009; Goudeaux, 2013; Rossi & Chausovsky, 2013; Van der Tuin, 2014), contrasting with the extensive bibliography on the technical and technological dimension of his work. The study of the psychology of individuation, especially in pedagogic environments of formation (cf. Vargas & Gil, 2013, 2015), is a path to making technicity unfold as creativity, through imagination and invention, so that psychic and collective individuation takes place simultaneously in its potentialities.

How to promote and renew this image cycle? For Simondon “there is a propaedeutic of invention but not a method for inventing . . . , at best an ethics of invention and a gymnastics of the inventor to stay active” (2005, p. 156). If *ars inveniendi* refers to method as a predetermined aim, this goes against the “freedom of action,” proper of invention (p. 151); hence, “true learning . . . is the acquisition of a number of well-integrated schemas that give the adult human being a power of plasticity and permanent inventive adaptation,” allowing, in turn, to be more aware of the results produced by the very action on the environment (Simondon, 2014, p. 240). It is about promoting open methods of explorations and investigation to go from the univocity to the plurivocity of representations and attitudes, that is, to broaden the richness of communication with the environment, updating the information available, instead of reinforcing prejudices, stereotypes, and rigid responses or cultural clichés, or with such an emotional load that polarizes perception towards a predetermined aim, taking into account that affective-emotive reactions “define and fixate the value of images, which are part of the basis of behavior organization “ (Simondon, 2013, p. 110).

This opening favors the path of intuition, not only of reason:

The term intuition is frequently used when the perception of a state implies that the subject takes into account a great number of data at the same time, without giving in to any discursive operation nor any exploration; this is what Pascal calls the heart, which responds to problems to be solved that comprise a very large number of very subtle principles; . . . application of the spirit of subtlety. (Simondon, 2007, p. 91)

It operates frequently in the clinical method, from listening and keen observation, even though many times there is no awareness of the process that has led to certain conclusion. That is the case, pointed out by the author, of the capacity of a mother to perceive her child's health condition; while a doctor compares a child to other children, within certain standards, a mother relies on a rich image of her child in multiple conditions. Between intuition and critical, reflexive, spirit takes place the (intellectual, scientific, artistic, technical) invention as problem resolution in multiple ways, to give place to something new, emerging, that did not exist before or existed only potentially, in that mediation between the self and the world, the abstract and the concrete, the past and the future.

In sum, imagination and invention are concepts that allow us to think of creativity from individuation theory, within a cycle of the image that goes from motor anticipation to the concretization of technical objects. The presence of the undetermined, of fate, allows the creation of new, emerging links that combine with previous available information. The path is open to delve deeper into the possibilities of formation and deployment of the potentials relative to the modes of primary thinking, intuition (Hogarth, 2002), and passivity (Vargas, 2016) that take part in the creative act, in learning, in decision making, and, in general, in psychological processes leading to the individuation of the self and the other in a common environment of (trans-individual) action.

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## ABOUT THE AUTHOR

### **Lina Marcela Gil Congote, Ph.D.**

She has had a professional practice linked to the clinic, to consulting, to the institutional practice of the profession in the university context in which he participated in research on teaching and learning. [marcela.gil@udea.edu.co](mailto:marcela.gil@udea.edu.co)

# Exploratory and Transformational Creativity, as well as the Combinational Variety. A Challenge in the Research of Creativity

► Margaret Boden · University of Sussex



For psychologists studying creativity in the new century, one priority should be the consideration of exploratory and transformational creativity, as well as the combinational variety—which is the only one that is normally mentioned (Boden 2004).

Since exploratory creativity involves the navigation and exploration of already-accepted styles, with no fundamental rule-breaking, it is less difficult to study than transformational creativity is. But even here, the style (or conceptual space) involved must be clearly specified by the experimenter/observer. That is easier said than done, when the styler in question has any real depth or interest (i.e., not noughts and crosses).

One question that might be asked is to what extent subjects spontaneously try to *push* the style, or to *test its limits*. Such testing is a primary precursor of transformational creativity, in which one or more rules are radically changed, or even broken, so as to generate structures that were simply impossible before. Again, distinguishing between a minor and a major amendment to a stylistic rule is a matter of judgment, on which experts can disagree.

The “experts” involved should include, for example, art historians and specialist scientists. But even they may



disagree on whether a transformation has actually taken place. Even if they do agree about this, they may disagree about the value of the results.

For people trying to build computer models of creativity, whether for the purposes of psychological science or computer art, a key problem is that of *relevance*. Lacking a human sense of relevance, most computer-generated combinations are judged by humans to be worthless, and—at least in the arts—most computer-generated transformations too. In some scientific areas, criteria—or “fitness functions”—can be stated clearly enough for the computer to judge worthiness reliably. Hence, evolutionary AI can be used in designing aircraft engines, for instance. But without a clear fitness function, artistic transformations will remain very difficult to evaluate. (Exploratory models are less problematic, because the style is already accepted, indeed valued, by the cultural group concerned.)

In short, there’s plenty of work to be done!

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# Sublimation: The Basic Mechanism for Creativity

► Kátia Barbosa Macêdo · Pontificia Universidad Católica de Goiás, Brazil

## ABSTRACT

The aim of this chapter is to investigate the mechanism of sublimation from the point of view of Freudian psychoanalysis and from Dejourian work psychodynamics. This theoretical chapter discusses sublimation as the basic mechanism of the entire process of creativity, focusing on the possibility of a person to obtain direct or indirect pleasure from the use of this defense mechanism. We will start with a brief overview of the emergence of the concept of sublimation under Freud's psychoanalytic theory. Subsequently, the relationship between work psychodynamics and sublimation is discussed. It is pointed out that pleasure comes from five sources: the satisfaction of a desire, autonomy and freedom, the constitution of an identity as a worker, the transformation of suffering through recognition, and the transformation of suffering through sublimation. Our most important contribution is the comparison between psychoanalysis and work psychodynamics related to the process of sublimation and creativity. In the former, there is an intrapsychic approach and sublimation is understood as the transformation of anguish. In the latter, there is an interpersonal focus, and sublimation is understood as the possibility of transforming suffering into pleasure.

*Keywords:* sublimation, psychoanalysis, work psychodynamics, identity, creativity



This theoretical chapter discusses sublimation as the basic mechanism of the entire process of creativity, focusing on the possibility of a person to obtain direct or indirect pleasure from the use of this defense mechanism.

## SUBLIMATION IN THE PURSUIT OF PLEASURE: THE CONTRIBUTION OF FREUDIAN PSYCHOANALYSIS

Freud stated that desires and drives are the source of creation. According to psychoanalysis, anguish is the result of unsatisfied desires, mobilizing the entire psychic apparatus of the individual in search of alternative forms of satisfaction.

From the wide variety of mechanisms used by artists to create a piece of art, Freud highlighted sublimation as the most important, since it allows the satisfaction of the pleasure instinct.

The word pleasure (*placere*, in Latin) means to please and delight. It also makes reference to joy, glee, satisfaction, goodwill, and fun. Therefore, it describes that pleasant sensation when something is born inside us, a pleasant emotion that results from accomplished activities, and also from being approved and accepted by others (Michaelis, 2008).

The German word *lust* has two meanings: pleasure or joy and also desire or need. Thus, the principle of pleasure is also a principle of desire, for the psychic apparatus does not do anything other than desire.

The concept of sublimation often appears in the psychoanalytic literature. From the Latin *sublimatio*, it means to become pure or sublime. The term also refers to a process postulated by Freud to explain human activities with no apparent relation to sexuality, but which are triggered by sexual impulse. Freud described as examples of sublimation artistic activity, intellectual research, and work as a component of the civilizing process (Mijolla, 2005).

The notion of sublimation evolved throughout the work of Freud. In the beginning, it was based on the idea of ennoblement: work “from within the desire itself” that requires the previous transformation of the psychic energy oriented to satisfy the desires (Macêdo, 2013). Throughout his work, Freud resorted to the notion of sublimation to explain certain types of activities derived from a desire that could not be explicitly expressed because of the possibility of being censored (and perhaps excluded).

In the first part of his work, also known as the First theory of drives, Freud used this term to refer to a successful human activity, especially in the artistic and intellectual fields, which would generate public recognition and which would have, as it has already been pointed out, no apparent relation to sexuality. The person would creatively transform the energy of the sexual impulse in the form of sublimation, and thereby he would obtain indirect satisfaction.

Freud considered sublimation to be the highest mechanism used to obtain satisfaction, albeit indirectly. He also underlined its importance in the creation and maintenance of civilization. Therefore, sublimation presents

itself as a privileged destination: The derived instinctive psychic energy grants a gratification or pleasure, although indirectly expressed in an action or object that is culturally valued by society. The genesis of the ability to sublimate depends as much on the constitutional dispositions of the individual as the events that took place in his or her infancy.

Freud experimented with different forms of art (e.g. painting, sculpture). Nevertheless, he had the work of the writer and that of the poet, *der Dichter*, in mind when he referred to the nature of artistic ability in general. For the Father of psychoanalysis, art and literature would be remnants of the primary process, and the artist would have privileged access to unconscious elements. Freud (1908/1986) realized that their voice had no borders or languages: It was a voice in the world that would become part of it by taking possession of a cultural heritage, millennial literature and poetry. In other words, it would be built on the work of subjectivity.

Freud dedicated several of his works to art. In the present chapter, we discuss some of them on the basis of their relation to the subject we are exploring. These works are presented in Figure 1.

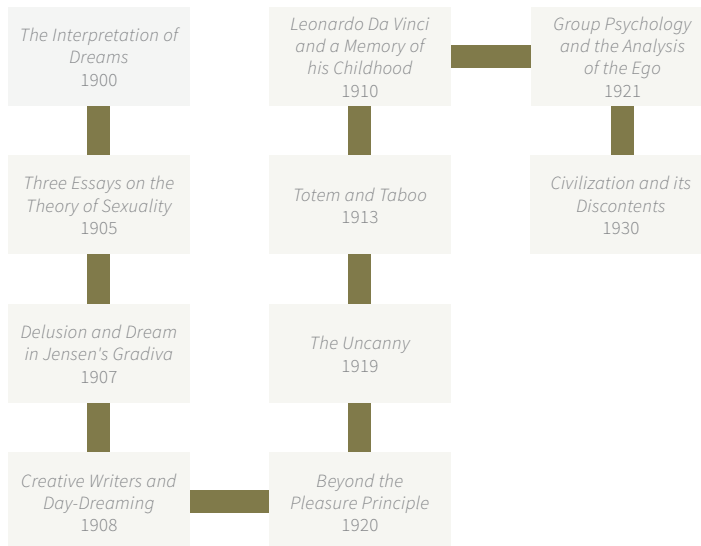


Figure 1. Works by Freud in which he discussed the process of creativity and sublimation.

Freud studied the works of famous writers such as *Oedipus King* by Sophocles and *Hamlet* by Shakespeare, both of which were discussed in “The Interpretation of Dreams” (1900/1986). In “*Three Essays on the Theory of Sexuality*” (1905/1986), he presented his first definition of sublimation, as a principle of aesthetic elevation common to all men, but in which, according to him, creative individuals and artists were fully gifted.

Sexual drive makes available exceptionally large amounts of energy for cultural work, and this is possible thanks to the peculiarity, quite prominent in sexual drive, of being able to displace its goal without lowering its intensity. This ability to replace the original sexual goal by another goal, which is no longer sexual, but is psychologically related to it, is called sublimation. (Freud, 1905/1986, 187;

“*Delusion and Dream in Jensen’s Gradiva*” (1907/1986) was Freud’s first literary analysis. He worked under the assumption that delusions and dreams are also realizations of desire. Although he cautioned the readers to “not forget that the insistence on the writer’s childhood memories derives basically from the assumption that the literary work, such as day - dreaming, is a continuation or a replacement of the role of play in childhood” (Freud, 1908/1986, p. 157).

In “*Creative Writers and Day-dreaming*”, a short essay published in 1908/1986, Freud laid the foundations of what could be called a psychoanalytic aesthetic. He asserts that there is a genetic continuity between the child’s play and artistic creation. In this essay, Freud compares the creative work of the writer with the child who plays and teaches creatively. This action, based on a previous pleasure, gives him joy and allows him to play with the imponderable. Freud states that the artist is a dreamer, and he bases his arguments on the concept of pleasure-displeasure and the principle of reality; he concludes that daydreaming is a conscious fantasy. He also analyzes the relationship between play, fantasy, and poetic writing, tracing back its origin in memories. According to Freud, past, present, and future are united by the desire that runs through them, which is the creative energy of the poet and the writer. The writer, in the present, looks back at his past experiences, uses that material for his writing, and throws them into the future.

These assumptions are found again in “*Leonardo Da Vinci and a Memory of his Childhood*” (1910/1986). Here, Freud tries to unveil the psychosexual development of Leonardo by conducting a biographical study on Da Vinci’s life. Even though there were few available data at the time, two contributions stand out: first, the affirmation that “the artist’s creation also offers an outlet for his sexual desire” (Freud, 1910/1986, p. 120) and, second, a definition of

the concept of sublimation, which is quoted below and will be revisited in the following pages.

Observation of men's daily lives shows us that most people succeed in directing very considerable portions of their sexual instinctual forces to their professional activity. The sexual instinct is particularly well fitted to make contributions of this kind since it is endowed with a capacity for sublimation: That is, it has the power to replace its immediate aim by other aims which may be valued more highly and which are not sexual. (Freud, 1910/1986, p. 72)

In “*Totem and Taboo*” (1913/1986), Freud pointed out the importance of repressing forbidden impulses in order to make the creation of norms and laws of civilization possible. The repression of these impulses and their sublimation is fundamental for the constitution of society.

The sublimation of instinct is a particularly evident aspect of cultural development. It is what makes possible the superior psychic activities—scientific, artistic, or ideological—, and plays a very important role in civilized life. People become independent of the acquiescence of their object, diverting from their sexual ends and transforming that instinct into an impulse with an inhibited purpose (Freud, 1913/1986, p. 112).

In “*The Uncanny*” (1919/1986), everything that is intimate and familiar in us appears as a great surprise. It is an explosion of what must remain hidden, but which comes to light and creates a feeling of anguish in the individual when he perceives the horror that is within himself, upon facing the anguish of his transience and finitude, that is, his human condition.

As he advanced in his research, Freud was forced to revise and expand some concepts, and the theory developed at this stage became known as the Second theory of Instinct. This theory was presented in “*Beyond the Pleasure Principle*” (1920/1986), where the discovery of the death instinct was one of the main additions. Freud stated that the energy available for sublimation came from both the life instinct (*Eros*) and from the death instinct or aggression (*Thanatos*).

The idea of the renunciation of drives (1913) was developed in “*Group Psychology and the Analysis of the Ego*” (1921/1986), and later in “*Civilization and its Discontents*” (1930/1986), where the author conceptualized civilization and presented his reasons for the discontents of civilization; he stated that these discontents are originated in the pressures exerted by civilization to the renunciation of the drives that the individual must go through in order to participate in groups and society. According to Freud:



ing, as well as the experiences of pleasure and suffering, and the function of recognition.

According to Dejours (2012), work is the term that conceptualizes the relationship between subjectivity, politics, and culture. All work involves a human mobilization. Work is primarily derived from creativity, wit, discovery, and revelation. Work would be precisely what is not traditional, but new. Work is not only an activity, but it is still a social relation, as it expands into a human world characterized by relations of inequality of power and domination. Dejours (2012) states:

Work is based on a central mental and psycho-affective coupling of all individuals and their entire personality, and it is socially connected with their collective commitment to work. Being intelligent at work requires personal effort, by forcing oneself to convert and work as a consequence of sensitivity. Work is a specific form of personality involvement to deal with a defined task (pp. 24-29).

Work can play an important role in the building of identity: It is the very foundation of mental and somatic health. According to psychodynamics, there will always be a gap between work as stated in the manuals and the concrete reality of the situation. Work would attempt to fill in the gap between the prescribed work and the reality.

As work colonizes all the subjectivity of the individual, it does not end when a person leaves the workplace. Dejours (2012) states that there are two conceptions of work: *poiesis*, or “work of production,” which is the action carried out by people around the world with a view to their transformation; and *Arbeit*, or “work for development,” which is related to the work requirements imposed on the psyche. Thus, to work is not only to produce; it is a privileged way of becoming oneself, a privileged space of psychic drama.

The organization of work determines the relationship between desire and motivation (Dejours, Abdouchelli, & Jayet, 1994). The pleasure that is derived from the meaningful and symbolic content of work is absolutely necessary for its completion and for the attenuation of fear. The adjustment of man to work requires not only a task of exceptionally interesting content, but also an adaptation of the pleasure obtained in the work to the desire of the professional individual. This allows people to face the particularly harmful conditions of work and to tolerate fear every day.

The mobilization of the intelligence of the body opens the way in which the harsh test of subjectivity is processed in the elaboration, that is to say, the connection with thought. . . . Thus, sublimation is

the development of the relationship with reality (*Arbeit*) and the perlaboration of the division, leaving a surplus of psychic energy in the world that is put into practice in the form of the quality of work (Dejours, 2012, p. 157)

Work psychodynamics uses the term *experiences of pleasure-suffering* in order to emphasize the ambivalent and complementary character of work, and the fact that both occur simultaneously in the working life of the workers.

Pleasure is mixed, sometimes in great proportions, with anguish. This anguish is related to several factors: anguish over performing poor work, anguish over taking risks that will not work over time, anguish over important information being kept hidden, anguish over forgetting an event at work, anguish over being responsible for an incident or accident, anguish over subordinates and operational personnel whose doesn't want to be s threatened by error or neglect. (Dejours, Abdoucheli, & Jayet, 1994, p. 106)

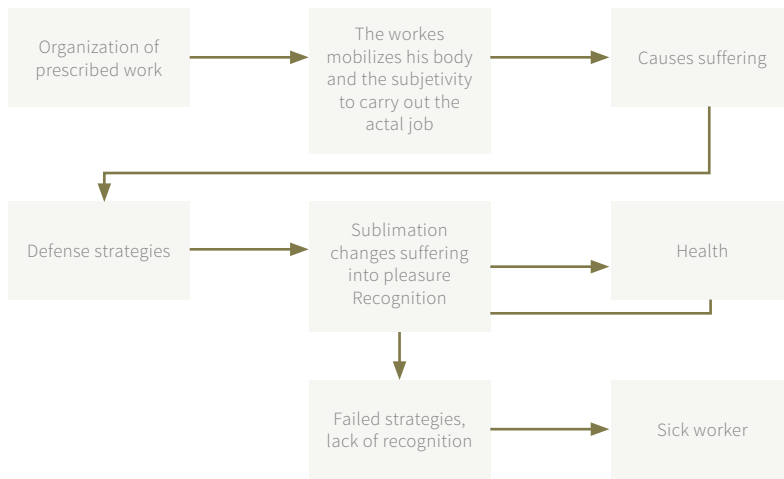
All work is carried out in a relationship between individual work and collective work; it is in this intersection that suffering is found. According to work psychodynamics, suffering has two possibilities: pathological suffering, which will become a disease, and creative suffering, which is challenging, positive, and constructive, and, once it is overcome, becomes the creative process through coping strategies by sublimation. The result of these strategies is to obtain the recognition of superiors (by means of technical recognition) and that of their peers or coworkers (by means of recognition of beauty).

According to Dejours (1993), creative suffering allows a person to transform suffering into a pleasurable experience through the use of the sublimation mechanism. On the other hand, pathogenic suffering is not capable to turn an internal psychic movement into something socially acceptable or pleasurable. When the worker can no longer benefit from the work to master his suffering and transform it into creative work, his destabilization occurs. This interaction is illustrated in Figure 3.

Dejours analyzed the sublimation process in several works, including "*Travail, usure mental*" (1987), "*Aspects sychopathologiques du Travail*" (1987), "*Psychologie clinique du travail et Integral Tradition*" (1996), "*Plaisir et souffrance dans le travail*" (2009), and also "*Travail Vivre*"(2012), among others.

Dejours (1993) states that suffering can have two different fates: on one hand, sublimation, as in the example given by this author (1993) in the activi-





**Figure 3.** Graphical representation of workers' subjective mobilization against the organization of work and its consequences for their health.

ty of combat pilots, where sublimation was used as a defense and allowed for new changes in the organization of work; on the other hand, workers submitted to repetitive tasks, who used instinctive repression, self-acceleration, or defensive ideology of the profession as defenses against suffering. These defensive strategies expel the desire of the subject and favor alienation and submission to the control of the other (Dejours, 1987).

Dejours (1987) states that, in a situation of aggression against the ego, the individual defends, in the first place, the desire and the possibility of sublimation. He does this by producing phantoms that allow him to create a connection with the reality that is difficult to bear. The author affirms that, through the study of the defense mechanisms used by workers, it is possible to unveil or understand their suffering. Thus, a fundamental separation is established between a "collective defense" produced by sublimation and simply adaptive mechanisms: If the collective defense of sublimation maintains a relation of relative continuity with desire, the collectives that were originated in strictly adaptive defenses have a greater tendency to break with the expression of desire. This is because sublimation, guarantor against suffering, unlike other defenses, is a satisfaction of a drive, while indirectly promoting experiences of pleasure.

Sublimation occurs from the moment that suffering comes from work, mobilizes intelligence, and creates an outlet. Work acquires a sense, since it contributes something new to the organization and becomes the passage from suffering to pleasure. Sublimation triggers social recognition and in-

terferes with the identity and mental health of the subject. Suffering becomes creative when work is recognized and all the personal investment becomes meaningful. The transformation of suffering into pleasure follows from both sublimation and recognition. In order for sublimation to occur in the workplace, certain conditions must be met:

- **Psychic Conditions**

First of all, we must desexualize partial drives. Secondly, there must be a change of object in the drive, implying a particular competence towards a desire to understand the reality of work. Each work situation is disconcerting for the individual and forces him to mobilize his curiosity, which will be rewarded by the insight gained.

- **Organizational Conditions**

The environment in which *epistemofilia* (desire to know and love for learning and discovery) takes place is the same in which the process of sublimation is carried out. In this setting, the individual should be able to understand the organization of the prescribed work and the organization of the actual work.

- **Ethical Conditions**

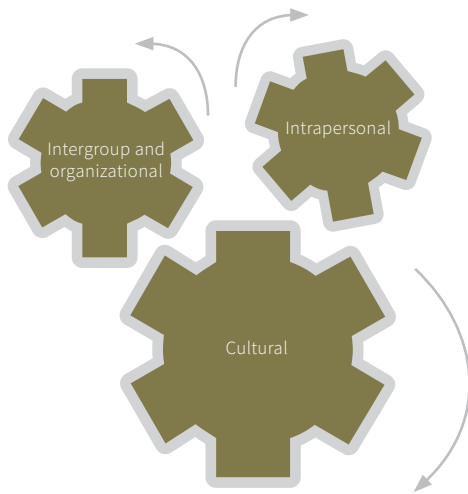
The relationship between the current organization and prescribed work is always controversial, as individuals always oppose the latter. Creative attitudes and attempts to carry out new experiences at work will lead to suffering that will come at a high psychological cost and will compromise the health of the person.

- **Social Conditions of Sublimation**

For sublimation to occur at work, the employee's coworkers must accept his contribution. The appreciation of his activity by his own colleagues is of great importance, since his superiors rarely recognize it.

For Dejours (2014), sublimation can be broken down into three levels: intrapersonal, intergroup, and cultural. Figure 4 shows the three levels of sublimation according to work psychodynamics.

The first level (intrapersonal level) involves the individual's relationship with himself, as he experiences in body and mind feelings, perceptions, thoughts, and emotions related to work. This is the individual level of sublimation. In the intergroup or organization levels, sublimation involves the relationship between the individual and his supervisor, his colleagues, and/or his subordinates. In this interaction, the possibility of being accepted as a participating member of the group plays an important role. He can be relegated to a secondary role, only through the possibility of obtaining the recognition of others. This recognition is crucial in creating the worker's identity and is a strong indicator of the experi-



*Figure 4.* Representation of the three levels of sublimation according to Dejours.

ence of pleasure related to work. When recognition does not occur, it leads to suffering in the workplace.

According to Dejours (2014), the most common type of sublimation is found in these first two levels. It has a powerful influence on identity and mental health. But there is a third and broader level of sublimation: one that is interactive or inter-relational, since it involves a relationship with culture and civilization.

Sublimation is present in the workplace as long as there is a focus on quality and an effort to respect professional ethics. Work cannot be neutral with respect to mental health: Either it brings out the best of the employee through sublimation, or it brings out the worst, through ethical suffering, damaging his self-love and leading to possible suicide attempts.

Dejours and Abdoucheli (1990) state that there is no exact match between desires and objective conditions for their satisfaction in the workplace. The individual expects retribution, whether objective or symbolic, in the form of recognition. For the employee, it is only fair that the contribution of people who work and strive to do their work well—with much energy, passion, and personal investment—should occur. Recognition plays a key role in the experience of pleasure in the life of the worker.

Once the quality of my work is acknowledged, my efforts, my anguish, my doubts, my disappointments, and my discouragement acquire meaning. All this suffering has not been in vain; not only

did it contribute to the organization of work, but it also made me a different individual than I was before recognition (Dejours 1999, 34).

The worker expects to be acknowledged for the usefulness and the quality of his work. Therefore, the recognition of work is what allows the transformation of suffering into pleasure. One of the basic points in the working world is the judgment of others. The opinion of family and community provides the individual with the social recognition he has set for his own life. This fact is known as sublimation (Dejours, 1993). Thus, it can be said that sublimation triggers social recognition, interfering with the individual's identity and mental health.

### **CLOSING REMARKS**

The aim of the present chapter was to discuss sublimation and creativity from the perspective of Freudian psychoanalysis and work psychodynamics. These theoretical approaches were useful in providing support to address this issue. Dejours has succeeded in deepening Freudian concepts and using them as lenses for understanding the dynamics of the relations between workers and work, calling attention to the interpersonal factor and the meanings attributed to work and working. He also highlights the importance of analyzing the uses that the management and organization of the work can have on the results of the sublimation process.

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## ABOUT THE AUTHOR

### **Kátia Barbosa Macêdo, Ph.D.**

She has worked in psychology and psychoanalysis, and develops research focusing on mental health and work, psychoanalysis and contemporaneity, psychology and culture. Her approach is based on psychoanalysis and clinical psychodynamics of work. [katiabarbosamacedo@gmail.com](mailto:katiabarbosamacedo@gmail.com)







**Psychology and Creativity in Action**

**part**

**two**

# 15

chapters

# Cognitive and Physical Bridges: The Relational Content of Associative Learning

► María Angélica Fonseca & Andrés M. Pérez-Acosta  
Universidad del Rosario (Bogotá, Colombia)

## Note From the Author

This chapter is based on the blog [“The relational content of associative learning”](#). The main ideas of this chapter were presented in the paper *“El contenido relacional del aprendizaje asociativo: Una agenda pendiente”* (The relational content of associative learning: A pending agenda) at the symposium on Classic Conditioning in Latin America, 45th Congress of the Brazilian Society of Psychology, Belo Horizonte, October 2015.



Figure 1. Cherrapunji, India. Living bridge of the War-Khasis.



“What is left to research?”  
If we asked this question about the basic psychology of learning of the twenty-first century, the answer would be: The relational content of associative learning is what is left to explore in depth.

“Do not speak ill of the bridge until you have crossed the river,” an old proverb goes. (Is there such a thing as new proverbs?)

In India, the community of the War-Khasis in Cherrapunji knows this very well. Their bridges are built from the roots of a certain kind of tree indigenous to the region. Far from those dazzling modern bridges—steely, aerodynamic, exuberant, proud—the War-Khasis’ bridges have not been millimetrically conceived, meticulously controlled, nor ornamentally stylized, but this does not mean they have stopped being totally functional, unbeatably friendly with the landscape, safe, cheap (very cheap), highly resistant, and, above all, perfectly capable of connecting two sides! The bridges’ worth lies in their capability to cross the river!

I find the idea of the existence of root-bridges, origin-bridges, beginning-bridges, beautiful; bridges that emerge from nature itself, the same nature from which rivers, rocks, and fish are made.

## ABSTRACT

“What is left to research?” If we asked this question about the basic psychology of learning of the twenty-first century, the answer would be: The relational content of associative learning is what is left to explore in depth. During the twentieth century, it was assumed that associative learning, one of the most generalized forms of behavior acquisition and knowledge of nature, entails a form of relationship of environmental stimuli in which the relationship “lacks meaning,” that is, the individual cognitively connects events but the connection does not mean anything (this is called contentless link). Interestingly enough, outstanding researchers from this field have studied the “content of associative learning” for several decades in terms of the events that are related but not of the relationship itself. To pose the problem metaphorically: It is as if every bridge that has ever been built in the world was exactly the same and had been designed in its simplest form. However, important dissenting voices have started to be heard in the field of human associative learning, which emphasize its propositional nature; that is, humans always associate events by connecting them in a particular way; for instance, “A causes B.” We argue, drawing on recent results of research on causal cognition in animals, that this propositional nature of associative learning is probably not exclusive to humans. To support our hypothesis, we creatively turn to physical bridges as metaphors of cognitive bridges: The places that need to be connected in the world (metaphors of the cognitively related events) are linked by bridges with very different designs and sizes (metaphors of relational content).



Figure 2. Gablenz, Germany. Rakotzbrücke.

As the legend goes, the Rakotzbrücke, located in Kromlauer Park in Gablenz, East Germany, was built during the 1860s by the devil himself. It is well-known that the devil was a great builder—and demolisher—of bridges throughout Europe from the twelfth to the nineteenth century, when—apparently—he changed the nature of his business and turned to new interconnection digital technologies, which raised his wealth and profits exponentially.

*Keywords:* cognition, associative learning, relational content, metaphors, bridges

### IS THERE ANY BRIDGE THAT DOES NOT HAVE CONTENT?

“What is left to research?” If we asked this question to the basic psychology of learning of the twenty-first century, the answer would be: The relational content of associative learning is what is left to explore in depth. During the twentieth century, it was assumed that associative learning, one of the most generalized forms of behavior and knowledge acquisition in nature (see Cándido Ortiz, 2000), entails a form of relation with environmental stimuli in which the relationship lacks content, that is, the individual cognitively connects the events, but that connection does not mean anything. The association acquired through these ways of learning is seen as an excitatory or

inhibitory “bond” between the representations of the events, which do not contain the bond’s nature in themselves (Shettleworth, 2010).

The most classic form of associative learning is classic conditioning (Rozo, Baquero Venegas, & Pérez-Acosta, 2004). In this type of learning, an individual learns to respond to a stimulus (CS or conditioned stimulus) by having been exposed, a sufficient and appropriate number of times, to another stimulus (US or unconditioned stimulus) which originally produces such a response. A natural example of this is the learning of fear. People who are afraid of dogs have learned to react with fear when the door of a given house opens to the street (since a dog might come out through there). Such learning can derive from an experience where the dog was linked, for example, with an aversive stimulation. Coming back to the issue of learned association, from the traditional point of view, one could say that the relationship between the CS (the sound or seeing a door being opened) simply “excites” the US memory (the dog) but does not mean anything in itself.

Interestingly enough, prominent researchers in this field have explored the “associative learning content” for decades in terms of the events that are related to each other but not in terms of the relationship itself. Without a doubt, from a biological adaptation point of view, it is important for an individual to represent the events that are important for his or her survival (in this case, unconditioned stimulus and, subsequently, conditioned stimulus). The question regarding the content that the individual (animal or human) represents in the conditioning situation is certainly relevant and has been the object of empirical research for the past few decades (see Shettleworth, 2010). However, this research has focused mainly on explaining what can be learned from conditioned stimulus and what can be learned from unconditioned stimulus, without exploring what can be learned from the relationship between conditioned and unconditioned stimuli.

To pose this problem metaphorically, it is as if every bridge that has ever been built in the world was exactly the same and had been designed in its simplest form. Let’s remember the beautiful city of Budapest (capital of Hungary), connecting the ancient Buda and Pest, separated by the Danube river. Imagine that these two architectural jewels (Buda and Pest) instead of being connected by different bridges with their own individual identity (Chain Bridge, Margaret Bridge, Liberty Bridge, Elisabeth Bridge, among others) were dramatically connected by a single nameless bridge, which is sometimes open (“excitatory”) and others closed (“inhibitory”). And not only that, but imagine that the cities with spectacular bridges such as Lisbon, New York, San Francisco, Mérida, or London had only one plain and simple bridge as well, the same as everywhere else in the world, which is open or not depending on the circumstances.



Figure 3. The Netherlands. Ecoduct over Highway A50.

Is a bridge a bridge no matter which material it was built from?  
 What would users of that bridge think?  
 Life-bridge, Subsistence-bridge.

An argument in favor of this traditional view, which comes from David Hume's (1748/1999) empiricist philosophy itself, is that speaking about contentless links (Shanks, 2007; Carter, 2012) or about systematically transparent relations (Fodor, 2003) entails a soundly parsimonious way of dealing with learned association theoretically. Unless there is consolidated evidence in their favor, it is best to avoid additional theoretical inferences. Ever since medieval times, William of Ockham presented his razor: "The simplest explanation is usually the correct one."<sup>1</sup>

However, in the past few years some voices have come forward with arguments and evidence that would prevent the unavoidable wound of Ockham's razor. In what follows, we will discuss the contributions that, again metaphorically, would do justice to the freedom and beauty of the bridges shown in Figures 1 to 6, with their respective comments. It seems that cognitive bridges also have identity and beauty.

1 [https://en.wikipedia.org/wiki/Occam%27s\\_razor](https://en.wikipedia.org/wiki/Occam%27s_razor)

## EXPLORATIONS OF THE ASSOCIATIVE LEARNING RELATIONAL CONTENT (HUMAN AND ANIMAL)

The cognitive version of Ockham's razor is the canon set forth by the English psychologist Conwy Lloyd Morgan regarding the mental processes that have been attributed to animals: "In no case may we interpret an action as the outcome of the exercise of a higher mental faculty, if it can be interpreted as the exercise of one which stands lower in the psychological scale" (Morgan, 1903, p. 53).

The razor and the canon have efficiently made sure to preserve the traditional view of nature regarding association in associative learning, as a contentless link, in spite of attributing representational content to associated events based on contemporary research (Harris, 2006; Shettleworth, 2010). However, the mainstream already shows a problem in its argumentation when speaking about associative learning content: The rule applies to event association but not to their representation. In this sense, it may be argued that the rule should be the same for all the instances involved: If it is not possible to talk about the representational content of the relationship, then it would not be possible to talk about the representational content of the stimuli either.

All in all, the theoretical concept that best captures the current approach to relational content in associative learning is that of "associative force" (Baayen et al., 2011; Cándido Ortiz, 2000; Harris, 2006; Hummel, 2010; Rescorla & Wagner, 1972; Rozo et al., 2004; Vogel et al., 2007).

This force is defined as the degree to which two events are associated by an individual; its nature is merely theoretical and quantitative; that is, it can take a positive (thanks to excitatory conditioning) or negative (mainly as a result of inhibitory conditioning) numerical value. Thus, association in associative learning is a matter of *quantity* but not of *quality*. The main theoretical developments in associative learning from the mid-twentieth century to date have been based on different formulations of the associative force, which garner more or less empirical support in experiments on conditioning and other complex processes, such as categorization (Hummel, 2010) and language (Baayen et al., 2011). In terms of the bridge metaphor, the associative force would be the degree of strength of said bridge, regardless of where this strength comes from: perhaps a pinewood bridge (soft) that turns into an oak bridge after the learning process. The emphasis here is in the quantitative and not in the qualitative change; it could also be argued that oak is qualitatively different from pinewood, but that is a problem of the metaphor and not of the theory and research in associative learning during the twentieth century.

However, this purely quantitative conception, "free" of content, that can be traced back to David Hume (18<sup>th</sup> century) has, of course, its philosophical



counterpart, paradoxically within the same British empiricist home. Two decades before Hume's birth, John Locke had published "An Essay Concerning Human Understanding" (Locke, 1689/1999), where he discussed the concept of "relation" as a type of complex idea: "Thirdly, the last sort of complex ideas is that we call Relation, which consists in the consideration and comparing of one idea with another. Of these several kinds, we shall treat in their order" (Locke, 1689/1999, p. 145).

It is remarkable that already in the 17<sup>th</sup> century there were writings about the Relation as a theoretically independent entity and with a specific qualitative content. However, this statement cannot necessarily be considered as an antecedent of the associationist conception of learning. In fact, it would be more compatible with a symbolic view of learning in general or with a propositional view of associative learning in particular (De Houwer, 2009). However, De Houwer synthesises several pieces of experimental empirical evidence about "relations as complex ideas" in the human learning field. The question remains, of course: Is it possible to generalize this to other species?

Perhaps the first piece of experimental empirical evidence of an "explicitly" relational content in animals was that of causal learning in rats (Blaisdell, Sawa, Leising, & Waldmann, 2006; published in the journal *Science*), interestingly achieved with instrumental conditioning variations, which is another sort of associative learning. Originally, this type of conditioning is a lesson of the relation between conduct and its consequences. It is said that there is conditioning insofar as the individual (animal or human) enacts the behavior that has a given consequence (for example, food or an electric shock), but one cannot infer from this that the individual makes a "causal inference" (that is, the formation of an explicit idea of causal relation) that connects his or her behavior with the consequence.

Blaisdell and his colleagues conducted an interesting study in which a group of rats learned a "common cause" first through classical conditioning, in which a light (L) preceded both a sound (T) and the presence of food (F). The other group learned a "casual chain" (T) (L) (F), but this chain was produced out of their control, that is, the rat's behavior. Next, both groups moved on to the "intervention phase," where the pressure of a lever (P) that was introduced for the first time produced the sound (T). The rats who were exposed to the casual chain first pressed the new lever significantly more times than the group of the common cause. This advanced the conclusion that the rats must infer whether or not there was a causal relationship between the lever's pressure and the presentation of food.

Even though Blaisdell and his collaborators (2006) concluded that rats made causal cognitive reasoning that went beyond the associative learning of the first phase, the concept of "cause" is also amenable to theoretical crit-

icism as a form of explicit relation in animal associative learning. Coincidentally, that same year, Víctor García-Hoz Rosales published a theoretical essay on the nature of learned relations in Pavlovian conditioning (García-Hoz Rosales, 2006; see also Benjumea and Zentall, 2006). According to García-Hoz, it must be inferred, before causality, that there is a relation between events, in general. In this sense, it is more plausible for Pavlovian conditioning to infer a signal relation (as Pavlov himself had already suggested: “A predicts a B”) than a causal relation (“A causes B”) between stimuli. The author warns that the concept of cause denotes something different from the mental operation of knowledge and refers to the property attributed to the events of physical nature of producing or changing another event from the physical world.

In short, García-Hoz Rosales’ (2006) approaches to “signal relation instead of causal relation” in Pavlovian conditioning and De Houwer’s (2009) “proposition formation” in human associative learning are, to our knowledge, the first two approaches that deal explicitly with relational qualitative content of associative learning (that go beyond the quantitative concept of associative force). The result of Blaisdell et al. (2006) was interpreted by themselves as cognitive inference beyond associative learning. However, it is possible to apply Ockham’s razor and Morgan’s canon to Blaisdell and his collaborators’ conclusion (see Shettleworth, 2010, to confirm this). Thus, cognition may be seen, from an evolutionary perspective, as behavior mechanisms.



Figure 4. Vaud, Switzerland. Peak Walk by Tissot.

In October 2014, the Peak Walk by Tissot was inaugurated in Switzerland, the first suspension bridge between two mountain peaks (View Point and Scex Rouge), over 3000 meters above sea level. It is 107 meters long, 80 centimeters wide, and has a 15% slope!

This bridge offers visitors not only a dizzying experience, but also a spectacular panoramic of the Alps and the Rhône valley. From up there, one can see 24 snow-capped, 4000-meter giants: Eiger, Mönch, Jungfrau, Matterhorn, Grand Combin, and the Mont Blanc, in addition to other natural wonders.

A few years ago, these experiences and panoramas were only accessible in books, those bridges of our imagination.

### CONCLUSION: PARTICULARITIES OF PHYSICAL AND COGNITIVE BRIDGES

Rescorla (2007) suggested that research must explain three things: (a) the conditions in which it is carried out, (b) its content, and (c) how it affects behavior. In the case of associative learning, theory and research on its content normally obscure the association per se to give way to cognitive representation of related stimuli. The association itself becomes a number (associative force): positive (in excitatory conditioning) or negative (in inhibitory conditioning).

However, dissenting voices of human associative learning have questioned that in associative learning semantically transparent automatic bonds (without content) are formed and argue that contents are formed by way of propositions (beliefs about the world, which may be true or false) through controlled reasoning processes (De Houwer, 2009). Whether this can be transferred to the animal learning field is a matter of empirical evidence. The findings of Blaisdell and collaborators (2006) seem to point in that direction.

Coming back to the valuable reflection of García-Hoz Rosales (2006), it must be stated that there is relational content that is qualitatively different in associative learning, and it is necessary to empirically explore which type of relations are acquired both for animals and for human beings. Theoretically, there are many different types of relations between two events, starting with the most generic type: “A is related to B”; other possible relations are: equivalence (“A equals B”), prediction (“A points to B”), cause (“A causes B”), belonging (“A belongs to B”), among others. If this is so, physical bridges and cognitive bridges would begin shearing their qualitative diversity, not only at the level of controlled symbolic cognitive processes in humans, but also in automatic associative processes in animals.

Just as it has occurred with other complex processes in animals and in humans, the experimental studies of the relational content of associative

learning will depend on finding the right paradigms, both for human beings and for other species, such as the case of conditional self-discrimination for the study of self-awareness in animals and in non-verbal humans (Hermosillo, Penagos Corzo & Pérez-Acosta, 2011; Pérez-Acosta, Benjumea Rodríguez, & Navarro Guzmán, 2001; Pérez-Acosta & Navarro Guzmán, 2004; Penagos-Corzo, Pérez-Acosta, & Hernández, 2015).

The relational content analysis is part of the pending agenda of associative learning research in the twenty-first century. It may be the “boson” that would complete its conceptual, theoretical, and empirical framework. It may even allow us to appreciate its variety and aesthetic dimension, such as the one we can enjoy in a group as varied as the living bridge of the War-Khasis (India, Figure 1); the *Rakotzbrücke* (Germany, Figure 2); the Ecoduct of Highway A50 (The Netherlands, Figure 3); the *Peak Walk by Tissot* (Switzerland, Figure 4); the Da Nang or Dragon Bridge (Vietnam, Figure 5); and the Infinity Bridge (England, Figure 6). At least in theory, the possible relations that can be learned between two events are also infinite.



Figure 5. Da Nang, Vietnam. Dragon Bridge.

“Birds fly, fishes swim, and the other animals run. Those who run may be stopped by a trap, those who swim may be stopped by a net, and those who fly may be stopped by an arrow... but then there is the Dragon. I cannot tell how he travels underwater nor how he travels through the earth; I cannot tell you how he mounts in the air and soars to heaven. The Dragon cannot be stopped.

Today I have seen Lao-Tse and I can say I have seen the Dragon.”

**Confucius**

We know very little, very little of the Dragon, and yet we cannot ignore it, nor stop it. There it is.

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## ABOUT THE AUTHORS

### **María Angélica Fonseca, PsyD.**

She is an editor, pedagogical reviewer, instructional designer, copywriter and proofreader. She has authored textbooks related to language, mathematics, literature, among other topics. [ps.mariaangelicafonseca@gmail.com](mailto:ps.mariaangelicafonseca@gmail.com)

### **Andrés M. Pérez-Acosta, Ph.D.**

Winner of the Colombian Psychology Award, 2010, Researcher of Excellence category. His research program is the basic and applied psychology of associative learning, within which he currently develops the Self-medication Behavior Observatory.



Figure 6. Infinity Bridge, Stockton-on-Tees, England.

“We will go, I, your eyes and I, while you rest,  
under the smooth empty eyelids,  
to hunt bridges, bridges like hares,  
through the fields of the time we are living.”  
Pedro Salinas, Puentes de amor.

And the more the hare jumps before us, the more clues we will have to  
discover the road soon.  
Between bridge and bridge, between jump and jump, we will draw infinities.

**14**

**chapte**



# In Search of a Creative Response to the Creativity Challenge in Colombian Schools

► Félix Antonio Gómez-Hernández · Pontifical Xavierian University

## ABSTRACT

This article offers a proposal to respond to the challenge of How to design and implement a program for the development of creativity in the Colombian schools that contributes to the unfolding of the intellectual, social and aesthetic capacities of the students? The proposal is based on the analysis and articulation of three aspects: the political device, the epistemological horizon and the pedagogical dimension. In the first, the emphasis is placed on the fact that government policies should be placed at the service of the development of the creative capacity of individuals, as a means to enrich human dimensions, so that people can freely determine a better way of life. In the second, the adoption of an epistemological framework based on consilience is considered, to understand the origin of creativity, its nature and the mechanisms necessary for its development. In order to achieve this purpose, it is necessary to break somewhat artificial barriers that separate the social and human sciences, the natural sciences and the formal sciences from each other. In the third and last aspect, the need to intervene in each and every component of the pedagogical device is examined, in order to bring what is projected to a successful conclusion.



This article offers a proposal to respond to the challenge of How to design and implement a program for the development of creativity in the Colombian schools that contributes to the unfolding of the intellectual, social and aesthetic capacities of the students?

Although the proposal is intended for the Colombian educational system, it could be extended to other educational systems in the world.

*Keywords:* consilience, cognitive science, educational model, information society, interdisciplinarity

It is not rare to find words that every now and then become fashionable, maybe because they become clichés or because they are words with a strong ideological load, or the disclosure of them by mass media. Consequently, Julio Cortázar, in a conference at La Villa Cultural Center in Madrid, in 1981, stated:

Hay palabras que a fuerza de ser repetidas, y muchas veces mal empleadas, terminan por agotarse, por perder poco a poco su vitalidad. En vez de brotar de las bocas o de la escritura como lo que fueron alguna vez, flechas de la comunicación, pájaros del pensamiento y de la sensibilidad, las vemos o las oímos caer como piedras opacas, empezamos a no recibir de lleno su mensaje, o a percibir solamente una faceta de su contenido, a sentir las como monedas gastadas, a perderlas cada vez más como signos vivos y a servirnos de ellas como pañuelos de bolsillo.<sup>1</sup>

One of those words that, today, is used with extreme ease in the most diverse areas is the word *creativity*, to such an extent that the Italian philosopher Giancarlo Livraghi asserts that “it is one of the most abused words in modern vocabulary” (2010, p. 210); and the historian of science J. M. Galech confirms that, together with the term innovation, “they are omnipresent in the times we live in, fetishes with almost supernatural powers” (2013, p. 46). The problem is that this situation generates misunderstandings and confusions, leading people to expect magical solutions from science and technology, and becoming a breeding ground for commercial exploitation, hindering rather than promoting an adequate understanding of the phenomenon.

In this regard, the Austrian psychologist and researcher Aljoscha C. Neubauer complains: “Creativity has become fashionable. ‘Creative thinking’ is invoked to deal with all kinds of situations. It is to be hoped that this wave of creativity, with its seminars, consultants and training programs, will fade away soon” (2003, p. 37).

1 Free translation: “There are words that, by force of being repeated, and often misused, end up being exhausted, by losing little by little their vitality. Instead of sprouting out of mouths or writing as they once were, arrows of communication, birds of thought and sensibility, we see or hear them falling like opaque stones, we begin not to receive their message fully, or to perceive only one facet of their content, to feel them as spent coins, to lose them more and more as living signs and to use them as pocket handkerchiefs.

In spite of the above, currently there seem to be, both in the scientific and in the educational spheres, two agreements on the subject of creativity: first, the urgency of its promotion and development in the context of the information society (Gardner, 2005; Klimenko, 2009) and, second, the need to continue studying it due to the enigmas about its origin, nature, and mechanisms that remain to be unraveled (Galech, 2013).

At first glance, it seems that the second point contradicts the first, so how to develop what has not yet been understood? However, the history of science and education has hundreds of examples of similar situations; even today, to mention only one of them, it is not completely known how the mental capacities are involved in learning work; nevertheless, this does not prevent the promotion of programs that optimize the acquisition and construction of knowledge inside and outside the school, while the functioning of those capacities are still being researched.

The present essay echoes the two expressed concerns, summarizing them in the question: *How to design and implement a program<sup>1</sup> for the development of creativity in the Colombian school that contributes to the deployment of the intellectual, social, and aesthetic capacities of learners?*

Based on the working hypothesis that, in order to achieve the purpose mentioned in the question, at least three fundamental aspects need to be taken into consideration: new ways of organizing the device of national education policies, addressing the issue from a new research paradigm, and identifying the elements of the educational model in which the intervention will take place.

In order to start answering the question –taking into account the aspects mentioned in the working hypothesis–, first, the position of creativity in the Colombian national educational context will be discussed; secondly, the reasons that lead to the need of designing and implementing the program will be exposed; thirdly, the conditions under which it would be feasible to structure and implement it will be presented; and, lastly, some final closing thoughts will be analyzed.

Before moving on, it should be emphasized that this essay is only a first step in the proposed task, since the development of such a program requires a long-term effort. Such effort is nourished from the conviction expressed by the researcher Saturnino de la Torre, who maintains that:

Si el siglo XIX fue el siglo de industrialización y el siglo XX el siglo de los avances científicos y de la sociedad del conocimiento, el siglo XXI está llamado a ser *el siglo de la creatividad*, no por conveniencia de unos cuantos, sino por exigencia de encontrar ideas y soluciones nuevas a los muchos problemas que se plantean en una sociedad

de cambios acelerados, adversidades y violencia social. (as cited in Klimenko, 2009, p. 192).<sup>2</sup>

## CREATIVITY IN THE NATIONAL EDUCATIONAL CONTEXT

Colombia has stand outfor its limited attention to the issue of creativity and for the even less interest it has expressed in examining the relationship it has with education and the development of individuals (as cited in Klimenko, 2009, p. 192).

Contrary to what happens in this country, in many of today's societies, innovative and efficient solutions are expected to address the problems faced by humanity; thus, the attention given to creativity is clearly explained. As Guilera (2011) points out when referring to the current global situation: "We have a lot of old problems that are not well resolved and a great deal of new problems stemming precisely from what we call progress, that is, the supposedly positive changes that we have introduced in our civilization" (p. 22); but this same author also points out later that "only a continuous and growing contribution of creativity will enable us to eliminate (or at least reduce) the problems of present-day civilization" (p. 24).

In addition to the hopes placed on creative thinking to solve the difficulties that the world is facing today, another motivation for its research and promotion lies in the economic value that the production of new knowledge brings, because under the current conditions of the information and knowledge society, this knowledge translates into ideas, products, processes, and systems that can generate wealth. It is for this reason that, according to Gardner: "Big companies that do not embrace innovation will inevitably be surpassed by those that do" (2005, p. 60). In countries such as Singapore, South Korea, and Finland, this concern for creativity has been translated into educational policies and actions aimed at their study, development, and improvement. This support of creative thinking is one of the reasons that explains the high results obtained by these nations on international educational tests and the great advances that they have reached in science, technology, and culture, in general, compared to other countries (García, Maldonado, Perry, Rodríguez, & Saavedra, 2014).

After that quick review of the conditions that motivate the growing concern for creativity, the question is why the same situation does not happen in Colombia. The answers to this question would require a more careful and

2 Free translation: If the nineteenth century was the century of industrialization and the twentieth century the century of scientific advances and the knowledge society, the twenty-first century is considered to be the century of creativity, not for the sake of a few, but for the need to find new ideas and solutions to the many problems that arise in a society of accelerated changes, adversities, and social violence." (Cited by Klimenko, 2009, 192).

extensive examination of what can be presented in this document; however, some of them may be mentioned.

In the first place, in this country there has not been a long tradition of study of the subject, from the theoretical and methodological framework offered by the cognitive sciences, whose theories and models are those that at present have contributed to the explanation of the origin, nature, and mechanisms that intervene in the creative act.<sup>2</sup> Secondly, there are still very few research groups dedicated to its inquiry and, finally, the educational policies emanating from the National Board of Education should be mentioned, which, although in recent years have taken greater account of the issue of creativity, still show a poor treatment of the subject and a technical-instrumental logic as the only guide to define the purposes and strategies for the development of creative thinking in the school.<sup>3</sup>

The current situation is clearly described in the words of the professor and researcher of the National University of Colombia, Luis Carlos Torres Soler (2011):

El estudio de la creatividad no ha tenido mucho interés en nuestro país, pues pocos son los investigadores o estudiosos en el tema. Quizás existe algún instituto para el desarrollo integral de las personas que trabaja en este campo, pero se desconocen sus alcances. También se habrá planteado la formación a docentes a través de seminarios, cursos o talleres para visualizar cómo desarrollar la creatividad, y se habrá proyectado para gerentes, pues la necesidad es muy amplia en las organizaciones, porque se sabe que la creatividad es necesaria, pero se desconoce qué es y qué representa.<sup>3</sup> (p. 19)

Once the situation in the country regarding this subject has been described, there are now some possible ways of solving the design and implementation of a model for the development of creative thinking. But first, although it may seem obvious and unnecessary, it is important to ask oneself about the purpose of such a project.

<sup>3</sup> Free translation: "The study of creativity has not had much interest in our country, because few are researchers or scholars on the subject. Perhaps there is some institute for the integral development of the people who work in this field, but their scope is unknown. Also, there is a plan to train teachers through seminars, courses, or workshops to visualize how to develop creativity, and it is projected for managers, as the need is very wide in organizations, because it is known that creativity is necessary, but what it is and what it represents is unknown.

## WHY HAVE A PROGRAM OF CREATIVITY DEVELOPMENT IN THE COLOMBIAN SCHOOL

Having commented on the objectives pursued in many societies with the promotion of creative thinking, and also with the knowledge that in some countries successful models have been implemented in the school environment, it seems that no greater justification is required to propose similar measures in Colombia. However, every pedagogical decision must take into account that educational actions are socially and culturally framed and, to such an extent, they cannot be foreshadowed by ignoring the conditions in which they will be carried out (Cole, Engeström, & Vásquez, 2001).

Because of the above, it is essential to ask about the ultimate purpose that a program for the development of creative thinking would have. First of all, it must be said that such a program should be at the service of the integral formation of people in the scientific-technological, social, and aesthetic spheres, areas conceived by Habermas (1999) as the spaces that make up reality and to which a particular type of knowledge and action belong, and not to the exclusive service of the interests of the market economy and the labor market. Although, as mentioned in the previous section, there has not been much interest in the issue on the part of governmental entities. The few instances in which the official documents of the National Board of Education refer to the issue unveil the unique and exclusive purpose that the creative capacity of the students is cultivated to put it at the service of production with total neglect of the other areas of the human life.

So, first of all, it should be pointed out that a program for the promotion of creativity in schools must serve the learner to nourish the development of his other capacities and to enable him to contribute to the solution of the social problems that afflict society, since creativity is an integral part of what some authors would call human nature:

Ser creativo es un acto tan natural del ser humano que es posible entender la creatividad de la misma manera como se da el lenguaje; no se ha encontrado cultura humana alguna, sin importar lo aislada que esté, que carezca de lenguaje, lo mismo puede afirmarse sobre la creatividad.<sup>4</sup> (Finke, Ward, & Smith, 1995, p. 7)

Thus, creativity should not become an instrument to the benefit of a productive machinery that generates self-exploitation and exhaustion in in-

4 Free translation: "Being creative is such a natural act of the human being that it is possible to understand creativity in the same way as language is given; no human culture has been found, no matter how isolated it may be, which lacks language, the same can be said about creativity." (Finke, Ward, & Smith, 1995, p. 7).

dividuals (Han, 2010). If creativity is to be cultivated in schools, it is because it must become a way of human emancipation,<sup>4</sup> because:

Desde el dominio del fuego hasta el descubrimiento de la penicilina o de la fisión del núcleo atómico, pasando por la invención de la rueda y la imprenta, todo nuestro desarrollo evolutivo ha sido posible gracias a una incesante sucesión de chispazos creativos de la mente humana (Kraft, 2005, p. 4).<sup>5</sup>

Once we have clarified the horizon to where efforts should be directed in order to design and implement a school program to foster creative thinking, it is necessary to examine the conditions needed to move forward.

### NEW DEMANDS FOR THE ACHIEVEMENT OF THE GOAL

As explained in the introduction, if we want to achieve the proposed goal, we need to consider at least three crucial aspects, as in our hypothesis, and work on them: (a) the conditions of the governmental policies about education, (b) the need for a new research framework that responds to the theoretical and methodological challenges imposed by such a task, and (c) the identification of the elements and relations to be affected. Below, the reader will find some initial reflections on those three elements, which must not be taken in isolation but rather as threads of one and the same warp:

#### Governmental Policies

If the development of the creative capacity cannot have another aim but the development of diverse human dimensions, so that people are able to freely determine a better way of life for the construction of more inclusive and equitable communities, then the governmental policies must embrace such call and redirect the meaning of educational norms and practices, since:

La creatividad es un bien social, una decisión y un reto del futuro. Por ello, formar en creatividad es apostar por un futuro de progreso, de justicia, de tolerancia y de convivencia. Creatividad es hacer algo

<sup>5</sup> Free translation: "From the mastery of fire to the discovery of penicillin or the fission of the atomic nucleus, through the invention of the wheel and the printing press, all our evolutionary development has been possible thanks to an incessant succession of creative sparks of the human mind." (Kraft, 2005, p. 4).

nuevo para bien de los demás.<sup>6</sup> (De la Torre, as cited in Klimenko, 2009, p. 192)

To that extent, the quest for a less technocratic society, not guided by the principles of instrumental rationale that objectifies individuals, can only be possible if creativity also leads towards the understanding of the social and aesthetic universe, in order to ensure that all voices are heard and have them participate in the making of the decisions affecting them. Although it may seem utopian, some steps have been taken in that direction; in recent years, in the field of education, new research is concerned about the control devices exerted on students; for instance, the works of Colombian researchers Jorge Eliécer Martínez-Posada (2010) or Tomás Sánchez Amaya (2010) which, from a viewpoint that aims at disclosing government devices of power behind public policies and school practices, are beginning to reveal the ways in which individuals are constrained and turned into part of the productive machinery. Despite the fact that these authors do not deal with the topic of creativity, they do open original paths in the exploration of educational laws and governance.

### **Towards a New Epistemological Paradigm**

Until recent decades, a topic as creativity was almost exclusively studied by psychology. With the coming into being of cognitive sciences and, particularly, with the progress in artificial intelligence, the creative act started to be scrutinized also in these disciplines (Boden, 1994; Boden, 1996).

Along the years other disciplines have joined, and, although the creative capacity is not their object of study, they have found meeting points with common concerns in their fields. Therefore, evolutionary biology (Wilson, 2012), archaeology (Mithen, 1998), and evolutionary neurophysiology (Calvin & Bickerton, 2001), just to mention some, also bumped into creativity. Not only did the evolution of human species need explanation, but also what had made humans such special beings in nature.

The former is an excellent example of those occasions when the object itself demands to be seen from a number of diverse viewpoints to reveal its mysteries, rather than when it is the intentions of researchers that which

<sup>6</sup> Free translation: "Creativity is a social good, a decision and a challenge for the future. Therefore, to form in creativity is to bet on a future of progress, justice, tolerance and coexistence. Creativity is to do something new for the good of others" (De la Torre cited by Klimenko, 2009, p. 192).



moves them to address an object of study from different disciplines. In cases like this, we are faced with a different epistemological event. When the already artificial boundaries between social and human sciences, on the one hand, and natural sciences, on the other, are crossed, we are in front of what the biologist and naturalist Edward Wilson has named *consilience* (Pinker, 2005).

Consilience considers that many of the existing phenomena require an approach that makes the disciplines cross their narrow limits, showing how, in many cases, the gap between physical phenomena and cultural or human phenomena is the result of the disciplines themselves rather than of the reality they intend to understand.

The first disciplines to reach a *consilient* approach were the cognitive sciences, because, as Steven Pinker explains:

Durante siglos, la brecha que separaba los sucesos físicos, por un lado, y el significado, el contenido, las ideas, las razones o los fines, por el otro, se veía como una frontera que distinguía dos modelos de explicación fundamentalmente distintos. Sin embargo, en la década de los cincuenta la «revolución cognitiva» unificó la psicología, la lingüística, la informática y la filosofía de la mente alrededor de una nueva y poderosa idea (la explicación de la mente).<sup>7</sup> (2005, p. 10)

According to all the above, an approach to the understanding of creativity that explains its origin, nature, and mechanism needs a consilient epistemological framework, on the grounds that, as a product, creativity can be addressed from sociocultural fields and knowledge; as a process, it can be addressed from cognitive psychology and artificial intelligence and, as a capacity, from neuroscience and evolutionary biology.

But in addition to the above, if the aim is, as discussed so far in this document, not only to understand creativity, but also to design and execute a school program for its development, it all requires the particular knowledge of pedagogy and education sciences.

Not only would a consilient approach help with such purpose, but also it would open the door to new ways of research in the fields of social and human sciences, which can no longer ignore phenomena like artificial life and intelligence.

<sup>7</sup> Free translation: For centuries, the gap between physical events, on the one hand, and meaning, content, ideas, reasons, or ends, on the other, was seen as a boundary between two fundamentally different models of explanation. However, in the 1950s the “cognitive revolution” unified psychology, linguistics, computer science, and the philosophy of mind around a powerful new idea (the mind’s explanation).” (2005, p. 10)

En este orden de ideas, la educación no puede estar ajena a las tendencias actuales en las ciencias como la física cuántica, la biología molecular, la neurofisiología, la biofísica, etc., que permiten no solo cuestionar lo conocido hasta ahora, sino también enfrentar la incertidumbre de lo desconocido y deshacerse de la arrogancia del saber (Klimenko, 2009, p. 194).<sup>8</sup> (Klimenko, 2009, p. 194)

### The Model To Be Intervened

In order to close this section, it is necessary to emphasize the fact that if education governmentality devices and a new epistemological framework are to take part in the project as a way to understand the phenomena involved, then it can be concluded that the way to intervene in the school will involve each and every component of the pedagogical device, and it will be necessary to work with each and every one of their members.

From all the above mentioned one can conclude why, what for, how, when, and where the school practices will be affected. From this point of view it is impossible to intervene in one factor without affecting the others. In terms of the categories coined by Carlos E. Vasco (1990), we would be considering the components or elements, the relations, and the activities or changes involved in every educational process, and at the same time, we would have to consider the relations between the diverse environments that shape the educational context (social, physical, and external micro-environments).

The discussion of the intervention of pedagogical factors and the educational school practices still requires diverse reflections to be had. Therefore, in this document no more proposals will be made around this topic. We will emphasize the fact that addressing the issue of creativity from the point of view of educational legislation would leave in limbo any concrete proposal, since “creativity does not occur by law. It is not enough to generate an initiative of law so that creativity happens in the classrooms and then in society” (J. Penagos as cited in Quiroz, 2005, p. 85). On the other hand, emphasizing the scientific aspects too much could certainly feed the existing knowledge about the creative capacity of mankind, but may never make an impact on the classroom. Finally, starting to intervene in pedagogical practices without a slightly clear legal framework and a model designed to tackle the demands of Colombian schools, education could end up, as other experiences have, in simple activism.

8 Free translation: “In this sense, education cannot be oblivious to current trends in the sciences such as quantum physics, molecular biology, neurophysiology, biophysics, etc., which allow not only to question what is known up until now, but also to confront the uncertainty of the unknown and to get rid of the arrogance of knowledge.” (Klimenko, 2009, p. 194)

Governmental policy, scientific knowledge, and education strategies must work together in order to achieve the goal of a program that develops the creativity of learners in favor of their growth as individuals and as active members of a society in permanent change and expansion.

## FINAL REFLECTIONS

The reflections and analysis presented in this document originated from the question: *How to design and implement a program for the development of creativity in the Colombian school that contributes to the deployment of the intellectual, social, and aesthetic capacities of the learners?* It is a question that arises from the keen interest in responding to an issue that has been overlooked by the national agenda of education, but that the social, cultural, and economic conditions that characterize the current society of information and knowledge make necessary to keep in mind.

This essay aims to become a first attempt in the right direction to bring into being the implementation of a program that promotes the development of the creative capacity in children and young people in Colombia and that also helps them grow as individuals, allowing them to “learn to live with the uncertainty” (Arizpe, 2001, p. 31) produced by the fact of living in a world in permanent change.

I have mentioned, as a working hypothesis, three aspects on which the proposal should be well founded (the political device, the epistemological horizon, and the pedagogical act). It may be necessary to add others; however, for now, these three aspects are the essential ones, and they do not function in isolation. Instead, they are the cornerstones of the proposal.

To finish, a few words for thought by the educator and researcher Olena Klímenko:

La educación aparece como protagonista de la transformación social, permitiendo fomentar la capacidad creativa de los estudiantes en todos los niveles educativos, elevando de esta manera la creatividad al nivel del valor social, convirtiéndola en un reto creativo para todos (2009, p. 192).<sup>9</sup> (2009, p. 192)

<sup>9</sup> Free translation: Education appears as the protagonist of social transformation, allowing the creative capacity of students to be promoted at all levels of education, thus raising creativity to the level of social value, making it a creative challenge for all (2009, p. 192).

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## ABOUT THE AUTHOR

### Félix Antonio Gómez-Hernández

Dean Faculty of Education Pontificia Universidad Javeriana. He holds a master's degree in Education and has specialized studies in Psycholinguistics. His research interests are related to cognitive sciences, complexity sciences, the development of intelligence and creativity and innovation.

[felixantonioigh@gmail.com](mailto:felixantonioigh@gmail.com)

## (END NOTES)

### 1 CONTENT NOTES

<sup>i</sup> A “Program” is an organized system of actions directed towards an end and framed within a set of philosophical, epistemological, and pedagogical principles that determine the nature of the procedures, the role of the participants, the design and selection of the instruments, and the assessment of all the elements mentioned. In this regard, a program for the development of creativity should ideally be initiated in the first years of schooling and extended to university education.

2 On the contributions of the various models that have attempted to explain creativity and its relation to education, see Chapter 2 of the book *Tendencias de estudio en cognición, creatividad y aprendizaje* (Parra, Marulanda, Gómez, & Espejo, 2005); and for a brief historical review of studies on creativity in Colombia, see Chapter 17, written by Colombian professor Carlos Alberto González Quitián, from the book *Desarrollo de la creatividad* (2005), published by the National University Pedro Ruiz Gallo, Perú.

3 In this regard see the essay titled “Los avatares de la creatividad en la escuela colombiana: Una gestión noopolítica.” This document analyzes the non-political device that is the basis of Colombian educational policies on creativity, particularly in the National Decennial Plan of Education PNDE 2006-2016. The foregoing analysis reveals how the purposes and addressing of the Plan are directed towards the formation of uncritical individuals, who can deliver their creative capacity for the benefit of the labor market and an economic system that exploits them (document in the process of publication).

4 On the concept of emancipation and its relation with education, it is important to remember the words of Guillermo Hoyos regarding this topic:

The educational process is not an affirmation without more of the tradition; it is not a mere transmission of culture, science, and technology. It always requires of what is new, of new questions, of new problems, new perspectives, etc. . . . In education the doors always have to be there so that a new face can appear at all times and the unexpected, the unsuspected, a new thought, an occurrence, or a different idea can access. (1990, p. 27; free translation)



# 15

chapite



# Innovation in the Field of Drugs: The Need to Rethink the Use, the User, and the Psychological Treatment

► [Claudio Rojas-Jara](#) · Universidad Católica del Maule, Chile

## ABSTRACT

Talking about drugs implicates, in a natural way, a number of ideas, judgements, and assumptions, some with fundamentals and others derived regularly from a lack of information or from incomplete knowledge. The unrestricted embracing of classic conceptions, lack of renewal in their meanings, and the scarce update of their explanations have generated a stagnancy that goes against the historical and evolutionary interpretation of the field of drugs. Therefore, in the 21st century the innovation in this field and the incorporation of elements that allow us to renew and “rethink” creatively the understanding and the approach to drugs from our psychological perspective is absolutely mandatory. Thus, the central objective of this chapter focusses on critically observing the traditional conceptualization of drugs, their use, and psychological treatment. These traditional regards define interventions that do not necessarily take into account the variable of the consultant, his/her opinion, fundamental human rights, and above all, psychology, and have generated a separation in the appreciation of the other as a fundamental pillar in the construction and deconstruction of not only the



Talking about drugs implicates, in a natural way, a number of ideas, judgements, and assumptions, some with fundamentals and others derived regularly from a lack of information or from incomplete knowledge.

problem (drug consumption), but also the solution (abstinence or harm reduction). The classic regards on drug addiction in psychology derive from the cognitive-behavioral notions or from the biomedical model. This has meant, in simpler terms, the vision of the person with drug use problems as sick or passive agents of their change processes, where therapeutic action and the definition of the objectives of treatment emerge from the expert. For that reason, the intention of the following text is directed towards interpretative innovation and practice on the phenomenon of drugs, restating the function of their uses, reorienting the psychological processes of the intervention, and acknowledging the substantial value of the consultant in the development and success of the treatment, as an agent, actor, precursor, and governor of the decision making process, objective constructions, therapy implication, and the evaluation of the results.

*Keywords:* drug addiction, function, models, person, intervention, consumption

### **CURRENT SCENARIO AND DRUG ADDICTION PSYCHOLOGY**

The comprehensive views regarding the consumption of drugs have been, for decades, determined by invariable classic notions that historically derive from the biomedical model. This has supposed not only epistemic considerations about this phenomenon, but also has rubricated the methodologies of treatment. The lack of revision, analysis, and update of these paradigms has sustained over time practices that have been established as hegemonies and consolidated without questioning. However, this reference does not intend to eliminate valid contributions that have derived from said source, but to recognize that in our era it is mandatory to renew the approaches, in coherence and tune, with new experiences and developments generated in the scope of drugs and their uses. As expected, various medical approaches, moral, juridical, cultural, existential, and biological theories, also psychological, anthropological, and pharmaceutical (Carroll, Rounsaville, & Keller, 1991; Fisher & Harrison, 2005; García, García, & Secades, 2011; González, 1987; Grigoravicius, 2006; Lettieri, Sayers, & Wallenstein, 1980; Rickwood et al., 2005; Muñoz, 2012; Rojas, 2015; Rojas, 2016) have refuged within themselves the explanations and, therefore, the action attempts about the people that present a problematic use of drugs, with a bigger preponderance of one over the other, as science and discussion tend to, or pretend to, move forward.

From psychology, there are a vast amount of explanations and treatment methods for drug consumption (Rojas, 2016). Nevertheless, due to a matter of extension, we will limit ourselves to those that are more consulted in the day to day praxis.

The cognitive behavioral intervention is regularly referred to as the method with the biggest amount of scientific evidence about its efficacy in the approach in terms of the problematic uses of drugs (González, 2009; Llorente del Pozo & Iraurgi, 2008; Magill & Ray, 2009; McHugh, Hearon, & Otto, 2010; Secades & Fernández, 2001), mostly because its results are evident and quantifiable in the short term, making it economically sustainable and desired by public policies, even though regular criticism arises, on one hand, arguing that there is no certainty that these achievements last over time and, on the other hand, the superficiality of the approach is often questioned (Sparrow, 2008). Under this perspective, the acquisition of the drug consumption behavior derives from a series of environmental variables in its emergence, stimuli, and particular conditioned response, as well as diverse contingencies, attributions, beliefs, and thoughts, both positive and negative, that would reinforce its habituation and/or extinction. These behavioral and cognitive keys would be the ones that sustain the therapeutic actions directed, for example, to the prevention and handling of relapses. This way, when the subject has managed to modify positively his/her consumption pattern and the problematic level is trying to be avoided, the intervention is accurately directed on the elements or situations of high risk that would enhance the chance of that happening (Larimer, Palmer, & Marlatt, 1999; Marlatt, Parks, & Witkiewitz, 2002; Witkiewitz & Marlatt, 2004).

The systemic view offers us a behavioral analysis of drug's use focused mostly on ecological-contextual elements and, more precisely, on how the use of drugs is understood within a proximal and interacting system, such as family caregivers and the group of peers (Becoña & Cortés, 2010). In this sense, an important value is given to the role of the relatives, friends, and/or meaningful figures as part of the solution to the "problem of consumption" in consideration of the role that is filled by elements like: communication, socialization, interrelation, norms, boundaries, and hierarchies in the family-social bosom, which implies that drug consumption in one or more of its members might answer a discomfort in the systemic function, to family symptom, to a transgenerational debt, to a mechanism to maintain a certain homeostasis, to the pseudo-individuation of some of its members, or the perpetuation of interaction guidelines and dysfunctional structures (Espinoza, Hernández, & Vöhringer, 2004; Fernández & Secades, 2002; Stanton, Todd, et al., 1990). Thus, the model gives an essential role in prevention, diagnosis, and intervention to the primary spaces of reference and socialization by observing the drug use behavior as a systemic framework, complex and wide that transcends the sole person that maintains it. In any case, there still are some important points to clarify in this approach when it is used in drug addiction, which according to some researchers (Girón, Martínez, & González

in Becoña & Cortés, 2008) involve determining: (a) what techniques from the systemic spectrum are the most effective, (b) by being combined with other methods (pharmacological or individual intervention only) the portion of the results that are due to the family intervention, and (c) what aspects of the dysfunction that configures the disorder are more influenced by the family approach.

From the psychoanalytical perspective, important and powerful comprehensive reflections also emerge about the motivations and defensive mechanisms, conscious and unconscious, that would sustain the approximation of people to the consumption of drugs as well as the renunciation (López, 2011). From the more classic positions, the notion of the use of drugs as a substitution of the primal pleasure (masturbation) and how a pretentiousness of subsistence to pain is sustained, that is to say, it is understood as a rejection to pain before the sole acquisition of satisfaction (Freud, 1897; López, 2007). According to Kalina (2000) drug consumption would respond to an oral-incorporative modality to face the anguishes and anxieties befitting of existence. It makes reference to the fact that facing reality requires effort and time, but doing it through drugs and their “bottled magical omnipotence” turns out much simpler and only implies minimal efforts. The psychological support to the base would be the existence of a symbolic replica of the child stages of oral satisfaction with primary objects, where the mother and her breast-nourishment were, originally, that magical omnipotent instrument capable of calming the anxieties coming from the outside world. To Héctor López (2007) the consumption of drugs answers to a strategy, defensive and active, from the subject or passion to avoid the pain, that is to say, it unchecks from the mere execution of the act as a sole search of hedonistic pleasure, allowing the pain avoidance to take that place. The subject in this case would use the drugs not as a way to feel pleasure libidinally, but as a defensive way to sidestep the displeasure. Therefore, the use of drugs would be described from psychoanalysis as a symptom conscious-emergent of a conflict suppressed-unconscious coined deep within the subject, or from the more modern view of Cristián López (2006) as “an attempt to solve the lacks of being and pleasure” (p. 75). To Becoña & Cortés (2010), however, the weak point of the psychoanalytical is not its acknowledged breadth in the comprehension of the phenomenon, but its intervention proposals given the lack of “controlled and randomized studies to being able to conclude that this type of treatments are effective in the approach of the addictive behaviors” (p. 163). This generally turns out in the fact that the explicative value of the use of drugs is attributed to the psychodynamics proposals, but the impact to their therapeutic interventions in the area is not recognized.

## ABOUT DRUGS: THE NECESSARY DECONSTRUCTION OF THE CONCEPT

The presence and the use of drugs in the history of humanity is a reference that does not seem to have an end (Braun, 1970; Escobedo, 2012; Schultes & Hoffmann, 2010). There is enough historical background to acknowledge that drugs and the human being have forged a path together from old times, creating a relationship that, in spite of statements like “a world free of drugs,” will never end. With this we do not want to offer a solely catastrophic statement nor do we want you to think that we are in front of the decaying of humankind and its moral foundation. Conversely, we want to establish that drugs, as an element, are and will be part of our infinite experience of being human, and hence, essential parts of their configuration and definition.

What today is understood and classified as “the problem of drugs” was not always like that. In fact, historically, it is from the medical discipline itself that originally, under the name of medical drugs, many of the substances that today are legally and socially chased as drugs for their “non-medical use” emerged. This idea –of drugs as the problem– determines a series of misconceptions that regrettably transcend the space in which they are forged and take over, dangerously, the treatment environment. The notion of drugs as something “qualifiable” emerges powerfully from this position and acquires form in concepts like *bad*, *disease*, *scourge*, or *terror*. This takes us to reclaim today the value of the definition of drug as an element, not the problem itself. The drug is not the problem; if there is one, it resides in the link of the person with it and the potential solution is to understand the function of drug use. This will determine a new view on treatment as it breaks the classic moral outline of “the punishment of drug” to move to: (a) the understanding of the drug and its use, (b) the demystification of its presence as a style and permanent state of life (basic fundament of its view as a chronic disease), and (c) a focus on the therapeutic initiatives towards the human experience of drug consumption. The problem then, from this proposal, is not suddenly extinguished with the mere withdraw of the drug, but the re-definition and the symbolic re-presentation that the drug has to the user. That is to say, as we achieve a deconstruction, in terms of Derrida (1994), of the concept of the drug, understanding it as a desirable creation and also unstable, we could orientate ourselves in recognizing what it is in terms of use, and mostly in its function, where it reaches a definitive value, subjectively representative and of elemental anchoring to the therapeutic. This new view would allow us to clean ourselves of the progressive medicalization, and in consequence, pharmacologicalization, of social problems (like drugs), largely imposed by the medical model (Conrad, 1992; Foucault, 1977; Muñoz, 2012), that despite the domain and monopoly that it holds, has not yet offered “the cure” to this

“disease” and has only reached, systematically, the extent of “symptomatic constellations” through the use of medicaments.

### ABOUT THE USER: PEOPLE WITH PROBLEMATIC USE OF DRUGS

The main victims of the traditional notions on drug abuse turn out to be those to whom the intervention should direct all its efforts. Denominations such as *ill*, *dependent*, *junkies*, or *addicted* are a small sample of how the person that reaches a problematic use can be, reductionistically, materialized by only one of the aspects of his/her existence: the use of drugs. But is that everything there is to that person? Is there something more than the mere “physiological compulsion” of consuming drugs in their definition and structure? In the current nosological line, the *Diagnostic and Statistical Manual* in its fifth version (DSM 5) does the exercise of excluding the use of the concept of *addiction* or *addicted* from its pages, referring to the uncertain nature of their definitions and the pejorative tone that they imply. In their place, a more neutral concept like “substances related disorder” is used as an allusion to the diverse forms and severities that it might reach (American Psychiatric Association, 2014).

If we stay with the biomedical view as the one and only source of light into the phenomenon we are discussing and agree on the label of *sick* for those who have a problem with the use of drugs, we can elaborate a series of reflections that reveal the fact that in spite of fitting in a scope (like the medical), this does not necessarily translate into the enjoyment of all its benefits. This is due to the fact that there are some inaccuracies regarding the notion of the problematic use as a disease. First, the label of *ill* deforms the image and identity of those who require support and it transforms them into a passive agent (patient), that is, not only obliged to agree with this definition of him/herself, but also to deliver the possibility of recovery into the hands of the expert, where he or she only has to follow, step-by-step, the unquestionable indications and objectives that are “professionally” imposed. This brings the insolent questioning of the decision if the needs, desires, and opinions of the “patient” have any place here, since the insurrection to the medical order can be easily called resistance, demotivation, low adherence, or lack of consciousness of the disease, being left out of the field of attention and from the responsibility of the expert. This way, the recovery and success of the treatment is merited to the doctor, but the failure belongs to the patient. Interesting, isn't it? Second, if we were to accept the problematic use of drugs as a chronic disease, as it is proposed in the biomedical models, said status should provide it with a level and regularity of attention similar to the that given to other chronic diseases, for example, diabetes and arterial hypertension. However, the subject that has a problem with drugs does not necessarily

enjoy the same social and professional perception that a person with high blood sugar levels or an overweight person does. A patient that consumes drugs problematically is not observed the same way other ill people are. Singular features are attributed to these; the perception we have of them changes like if this condition (drug use) would render them, automatically, out of what is understood regularly and socially as a disease, falling into an interesting contradiction. Third, if chronic diseases, like the ones already mentioned, imply that the governments has to be responsible for the delivery of sanitary services and comprehensive benefits to these people during their whole life, why does this not usually happen in the treatment processes with people that consume drugs problematically? Why do the treatments tend to finish when the patient says “yes” and reaches abstinence? Is it then a chronic disease or it will only be to understand it and not to treat it? Then, the open space for this discussion and reflection is left here.

Problematic drug users are, in the first and immovable place, people.. He/she is not sick nor a sickness. Is a person in a particular situation, the problematic use, that is also a temporary condition as it does not guide his/her whole life nor does it transform the drug in his/her only permanent object. This statement allows us to look, from a psychological perspective, at a person with recognizable rights who need respect, with a priority role in their recovery, with the ability to restate his/her self-management and control, with the legitimate power to define his/her objectives, to accept or turn down styles and therapeutic strategies, and, above all, to make his/her voice heard. The one who holds the highest level of knowledge about the situation he/she is going through must appear as the true expert. This might seem like a hit to the therapeutic vanity of the intervention agent, whatever the discipline, but who knows more about the problem and potentially the solution (even when if it is not correct, is the drug user. The role that professionals play in this renewed scenery is the one of facilitators of the process that these people might start, or might not, to recover their autonomy and their potential to reorganize naturally. Thus, the success or failure of a process should not be measured arbitrarily by the professional, in terms of abstinence or harm reduction, but by the meaning that these objectives have to the person when they are perceived as a decision made by themselves, voluntarily and freely.

### **ABOUT THE TREATMENT: RESCUE OF THE FUNCTION AND THE RENUNCIATION VALUE**

Generally, the discussion about the treatment of drug abuse is developed in the line of the *how*, *with whom*, *to what extent*, and *when* the person has to abandon undeniably the use of drugs. However, in this precise section we will only refer to the two pillars considered fundamental at the time of

developing any tentative psychological therapeutic intervention. About the definition of *what type of change* is expected (or imposed) in the treatment, we will punctually refer in the next section.

### **THE FUNCTION OF DRUG USE AS THE CENTRAL AXIS OF ANY THERAPEUTIC ACTION**

In a recent work, we have stated the need to understand the function that drug use fulfills to the subject and the need to work on this and not exclusively on the use when a treatment is developed (Rojas, 2015). In this text, we make perfectly clear that the main challenge of this correct identification of the functions that drugs deliver to users is the definition of what we call *therapeutic substitutes*. We speak of “substitutes” to allude to the search for the subjective meanings of the drug use and the replacement (or substitution) of its function, in such a way that its use does not lose the original sense favoring in the person a modification of his/her pattern (from abstinence to regulation or reduction). The “therapeutic” alludes to the development of a solution to the person that does not solely imply to equip the function of the drugs, but also that the substitution reached delivers a state of wellbeing.

### **THE RENUNCIATION VALUE AS THE CENTRAL AXIS OF THE BEHAVIOR DRUG USE MODIFICATION**

The people that decide to modify their drug-use behavior, partially or completely, do not establish the abandonment and unrestricted oblivion of the same (Rojas, 2015). There is a whole series of elements, rites, behaviors, meanings, and the own pleasure associated to its practice that the subject does not lose when ceasing or modifying his/her relationship with drugs. They stay undamaged in the person forming part of his/her repertoire of memories, smells, sensations, colors, and images that must step aside, motivationally impose, if it is sought to preserve the behavioral change. This is because during the modification of consumption of drug behaviors, an amnesia to pleasure is not developed, nor to its function, but a renunciation to these in demand and direction of higher goals (Rojas, 2015). Being psychologically aware of the value of renunciation favors an empathic understanding of the people being treated; it reduces frustration and generates the strengthening of a positive therapeutic alliance, in the measure that we recognize that the process in which they manage to get a “non-problematic” pattern might result temporarily extensive and not exempt of relapses.



## FINAL CONSIDERATIONS: NEW USES, NEW USERS, NEW TREATMENTS

To finish, we would like to deliver some statements of what we consider – or maybe just long– to be the directions that the topic of drugs and their therapeutic actions will take in the future.

About the nosological conceptions, the next 20 or 40 years will probably not bring with them radically discrepant changes from the ones we can observe about drugs nowadays. The guidelines will maintain unchangeable the views focused on more and more specific criteria, but with little acknowledgement and understanding of problematic drug use as a situation that is developed in the field of human experience. In the same current direction, the new versions of the DSM that is elaborated by the American Psychiatric Association will continue to progressively incorporate in their pages other addictive non-chemical disorders (it already did it with the addiction to gambling), e.g., the addiction to shopping, videogames, bigorexia, the internet, food, and sex, that due to economic and cultural tinges or conflicts with scientific evidence, have not been added to the current revisions of the international catalogues of disorders.

About treatments and their future orientations, we would like to make some previous references. Even with the emergence of the biopsychosocial model (Engel, 1977), whose pretension is to amplify the view on health phenomena and to acknowledge the multi-causality of these, and that maintains as the method with the highest reference to the approach to the drug consumption problems, the specific weight of the *biological*, the *psychological*, and the *sociological* is clearly not impartial. The medical model prevalence is still dominant relegating the *psychological* and the *social* to widen the understanding view, and from the treatment, to give accompaniment and support to the *biological*. Who usually has the last words in appointments, counseling, meetings, seminars, and multidisciplinary congresses to evaluate drug related topics? This biomedical predominance has also been reflected in a protocolization and predetermination of the objectives for the treatment where abstinence is an entry requisite and the maintaining of that abstinence the final goal of programs of high demand, much before the person enters treatment, leaving the ideal criterion of “joint construction of objectives” as a ghost of good intentions. Besides, this bias delivers a message that is, at least, contradictory: “So we can help you and treat your problem, please try to come without it.” In this sense, just as it is observed today and it is projected to the future, the proposals focused on harm reduction and risk management are the ones that are systematically taking form and strength. This does not represent a absolutist denial of abstinence as a goal of treatment nor of the biomedical model in itself, but a broadening of the offer and its objectives, in recognition of essential human rights and elements so

true and important like: (a) not every person that has problems with the use of drugs and requests therapeutic support intends to leave them completely; (b) there is a huge diversity of drug users, and so there is a need for individualized treatments; and (c) there are multiple meanings and adaptive values reached by the use of drugs (Marlatt, 1996; Marlatt & Tatarsky, 2010; Tatarsky, 2003; Tatarsky & Kellogg, 2010). With this background, it is worth engaging in some minimal questioning. Do problematic drug users, by not voluntarily or coercively “accepting” abstinence as the sole and exclusive goal, stop being subjects of attention? Are not they, in any way, deserving of a treatment that adjusts to their needs? Therefore, the harm reduction and its principles do not appear as a countermeasure, an enemy, or an opposition, but as a valid complement point to the already existent proposals of diagnosis and treatment.

About the approaches in psychology, we allow ourselves to respectfully disagree with the scientific evidence. First, for its risks of answering “scientifically” to the economic and market models standardizing the offer of treatments (opposing the conception of infinite human diversity) and, second, because of the inherent danger of losing the original approaches of the discipline: The approaches are the ones that should be at the service of the people, and not the latter in favor of the approaches (Rojas, 2016). This does not imply leaving the person free to the judgement of any view, but the psychological options should be sufficiently informed and renewed so as to identify the contribution of each one of our approaches, and to establish, jointly with the person that consults, the style, form, strategies, and tools that are more adequate to his/her experience with the problematic use of drugs. The invitation to psychologist colleagues is to question our therapeutic comfort zones from any approach they might be, and to wonder if we offer an intervention method because it is the one we manage and know with greater expertise, because it adjusts better to our *psyche* as therapists, or because these really answer to the needs and requirements of the one asking for help. This invitation also includes an urgent call to become a professional human and scientist. That is to say, “human” because we have to understand this phenomenon, as it has been pointed out, as part of the experience of the being, and “scientist” due to the necessary dedication to the search for information and the duty to update and innovate daily in a dynamic phenomenon as flexible and diverse as drugs.

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## ABOUT THE AUTHOR

### Claudio Rojas-Jara. MD

As psychologist he has developed functions as director of treatment centers, coordinator of programs in penitentiary centers, and currently advises professional teams y centers (public and private) that intervene with people with problematic drug use. [crojasj@ucm.cl](mailto:crojasj@ucm.cl)

# 16

chapite

## The Experience of Wonder in Magic from a Neurocognitive Perspective

► Jeniffer Ortega Marín · Universidad Nacional de Colombia

A normally functioning brain has some limitations that might not be readily obvious. It constrains our ability to do several tasks at once, it generates false memories, it makes incorrect inferences, and, in special circumstances, it makes us see things that dramatically depart from reality. This is because if we see reality as a puzzle, the problem is that the brain can't handle its many pieces. Instead, it selects part of the information and makes assumptions about the rest (Robinson, 2005). Generally, we discard 95 percent of what happens around us (Macknik & Martinez-Conde, 2012).

As a result of limitations in perception, attention, memory, and reasoning, our mental puzzle of reality is incomplete and inaccurate. This creates difficult and sometimes embarrassing situations in everyday life that we have all experienced. It is interesting to ask whether there are positive aspects of having an imperfect brain. If we regard the experience of wonder as something positive, then the answer is yes. Magicians perform seemingly impossible events by exploiting the limitations of the brain, and thus give us the gift of wonder.

In the first part of this chapter, I address some limitations related to visual attention that are exploited by magicians and describe some findings about how the brain reacts to magic. However, magic is not all about cognitive limitations.



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In the second part of the chapter, I argue that creativity pushes the art of magic forward, preserving its potential to generate wonder.

### THE EXPERIENCE OF WONDER IN MAGIC

Pickpockets, card sharps, and magicians have in common that they take advantage of our cognitive limitations to achieve their purposes. Pickpockets control their victims' attention to steal their belongings. Card sharps play with the mind of the unsuspecting observer in order to make him bet money (even several times) in a card game that is not at all what it seems. Magicians use some techniques employed by pickpockets and card sharps. However, their purpose is completely different. They want to astonish us through the illusion of the impossible, and to do this they need to influence our basic and higher cognitive processes. Put in other words, magicians are mind hackers. For instance, they know that we cannot do several tasks simultaneously with the highest level of efficiency. Consequently, they use divide-and-conquer attentional tactics in many of their tricks (Macknik & Martinez-Conde, 2012).

Kurtz (1989) points out that “the human eye can really only focus on one movement at a time” (p. 6). To hide a secret maneuver, the magician uses the coordination of actions which consists in performing two maneuvers at the same time. An attractive maneuver is used to cover a deceptive and less attractive one. According to Kurtz, an essential condition for this to work is that both actions begin and end at exactly the same time. The spectator will pay attention to the most attractive movement and will not perceive the secret action that occurred simultaneously. This failure to perceive the secret action can be accounted for by the limitations of the visual system beginning with the eyes.

The human eye contains cells called cones and rods that convert light into electrical signals. Cones are sensitive to high spatial frequency and are responsible for color vision, while rods are sensitive to light and allow vision in low light conditions. Cones are abundant in a small region of the eye called the fovea and are scarce in the periphery of the retina. The consequence of this distribution is that we have acute vision in a small portion of the visual field, approximately the size of the thumbnail at the distance of an arm. Therefore, in order to see an object sharply we have to move our eyes in such a way that the light of that object enters directly into the fovea (Holmqvist et al., 2011). In the coordination of actions, the viewer will move his eyes towards the attractive maneuver to be able to observe it with clarity. If another subtler action occurs at the same time and at some distance, it will be virtually invisible due to the poverty of peripheral vision.

Nevertheless, a number of studies using magic tricks suggest that we can perceive unexpected salient events even when our fixation point is located



in other stimuli (Kuhn & Tatler, 2005; Kuhn, Tatler, Findlay, & Cole, 2008; Kuhn & Findlay, 2009). In the study by Kuhn et al., (2008) participants observed a magic trick presented on video that consisted of the disappearance of a cigarette and a lighter. To accomplish this effect, the magician dropped these objects on his lap. To prevent spectators from detecting this method he used misdirection. This word is widely used by magicians around the world to refer to the act of directing people's attention toward the effect and away from the method (Lamont & Wiseman, 1999). Misdirection should not be confused with distracting attention with irrelevant stimuli (Lamont, Hender-son, & Smith, 2010). The magician who uses an abrupt stimulus such as an explosion while placing a rabbit on the hat would be employing distraction and not misdirection. The problem with distraction is that spectators might suspect that the magician used the explosion to prevent them from noticing a secret maneuver.

Misdirection can be achieved in several ways. For example, in the magic trick used by Kuhn et al. (2008) the cigarette is dropped from the left hand at the same time that the magician is observing his right hand and snaps the fingers to show that it has made the lighter disappear. This is a form of physical misdirection in which the spectator's spatial attention is controlled through movement and gaze (Lamont & Wiseman, 1999). As expected, some participants did not detect the dropping cigarette. Eye movement analysis revealed that at the time of the dropping they made fixations around the hand that held the lighter or in the face of the magician. The rest of the participants detected the dropping cigarette and all, except for one exception, made fixations similar to those made by the participants who did not detect the method. These results suggest that for the trick to be effective, it would not be enough to control where people look. It is necessary to manipulate their covert attention.

Some magicians would say that, depending on the circumstances, it is not enough to influence basic cognitive functions such as visual attention. It is also important to control the suspicion of the spectators. It is difficult to experience wonder if there are suspicions in the mind about how and when the method occurred. According to Burger (2003/2013) the public must have the feeling that everything was done fairly so that the final moment of magic has a real impact. To create that illusion of "fairness" the magician has a repertoire of psychological misdirection techniques that allow him to reduce and deflect suspicion. In this regard, Fitzkee (1945/2009) states that the true ability of the magician is the capacity to influence the mind of the spectator and not his manual skills. For Fitzkee, the real secret of magic is misdirection and not secret devices or sleight-of-hand techniques. In the next section we will see that this idea has an important implication for beginner magicians

who are content to learn the tricks they see on the Internet and know little or nothing about misdirection.

The beginner magician could invite suspicion to the mind of the spectator in various ways. Suppose he is shuffling a deck of cards and says the following: “As you can see, I am truly shuffling the cards.” Certainly, spectators can see that he is shuffling the deck. What need is there for the magician to emphasize the action with the word “truly”? His statement could raise suspicion in the spectator, who will doubt that he is doing what he said, and consequently he will pay more attention to his hands. Even if the magician possesses a manual dexterity that allows him to conceal the prestidigitation technique flawlessly, his words will have created a threat to the experience of wonder.

Non-verbal language can also become a threat. For example, when the magician shows an egg, the spectator does more than just see it. He will recognize the object and will have a series of expectations based on his previous experience (e.g., he knows that if the egg falls to the floor, it will break). If the magician manipulates the egg in an unusual way, the viewer might suspect that something is not right (Fitzkee, 1945/2009).

A defiant attitude is another element that could reduce the experience of wonder. Some magicians challenge the public to discover how the tricks are done as if magic was about solving puzzles. This attitude fosters a competitive relationship with spectators, who will be encouraged to “catch the magician.” If they do not succeed, they will experience frustration rather than wonder. Ortiz (1994/2013) warns that the relationship with the public should be cooperative and non-competitive. Spectators should want the magician to give them the gift of wonder. However, wonder is not the only reaction people may have when they see a magic trick.

Lavand (1998/2013) points out that some spectators enjoy the illusion while others experience tension while trying to discover the secret. The reactions of the public can be varied, from apathy to irritation and wonder. Burger (1983/2013) holds the assumption that magic is not entertaining by itself. People may even perceive it as distractions that interfere with activities of greater personal interest. He said that often people find it irritating to interact with individuals who know things they ignore. He wanted to discover how to arouse people’s interest in his card tricks. He got people to interact with him and each other through magic tricks, which for Burger was the real magic. Fitzkee (1943/2009) also thought that magic tricks were not entertaining by themselves, and for this reason he prescribed the use of music, dance, and humor in the show. Ortiz (1994/2013) refers to this approach as the “Fitzkee Fallacy” and argues that the main source of entertainment must be the magic

itself. His stance is so radical that he suggests to those who do not share it that they give up magic.

Regardless of whether or not magic tricks are entertaining by themselves, it is reasonable to assume that the reaction of people does not depend solely on tricks but also on their cognitive and personality traits. On the other hand, how does the brain react to magic?

Unlike other everyday experiences, magic tricks are characterized by violating the causal relationships that has been established throughout life through learning and experience. Suppose a magician shows an egg to the public and then tries to break it in several ways, but fails. Spectators will quickly assume that this is not a real egg and would not be impressed. However, when the seemingly frustrated magician asks a spectator to try, the egg breaks. A causal relationship has been violated since if the egg was real, it had to be broken when the magician dropped it to the floor.

Parris, Kuhn, Mizon, Benattayallah, and Hodgson (2009) investigated the neuronal correlates of violation of causality using functional magnetic resonance (fMRI). Participants were 25 right-handed volunteers between the ages of 18 and 34. They watched video clips of magic tricks (magic condition), video clips that represented an unusual action with one of the objects used in the tricks (surprise condition), and video clips of actions similar to magic tricks that did not represent a violation of causal relationships (condition of causal control). It was found that the dorsolateral prefrontal cortex (DLPC) and the anterior cingulate cortex (ACC) showed a significantly greater activation in the magic condition than in the conditions of causal control and surprise. These activations were greater in the left hemisphere. Researchers suggest that the DLPC plays an important role in the processing of causality violations while the ACC is related to the detection of conflict between expected and observed causal relationships. The comparison between the magic condition and the causal control condition produced a clear hemispheric lateralization which, according to the researchers, suggests that the activations are related to inference processes. However, it is impossible to draw conclusions about the nature of the processes reflected in the activations because this study did not require participants to report their thoughts after watching the magic tricks.

In another study with fMRI, researchers investigated the neural correlates of expectation violations. Participants were 25 right-handed adults between the ages of 21 and 35. They viewed 24 video clips of magic tricks and 24 control video clips in which the expected relationship between action and response is maintained. In contrast to the study by Parris et al. (2009), global brain activity was analyzed instead of using regions of interest. In addition, the brain activity of the magician who performed the tricks was analyzed. At

the moment of the violation of expectations in the magic condition, researchers observed activations similar to those reported by Parris et al. (2009) in the DLPC and parts of the cingulate gyrus bilaterally. The brain activity of the magician was different since the activation was significantly greater in the parietal lobe, specifically in the supramarginal gyrus bilaterally, in the right upper parietal lobe, and in the right postcentral gyrus. In agreement with what Parris et al. (2009) found, these results suggest that the DLPC plays an important role in the processing of violations of expectations. Moreover, it is possible that the magicians process the information of a magic trick differently and not as a violation of expectations, although in this study only the brain activity of one magician was recorded, and therefore the results are inconclusive (Danek, Öllinger, Fraps, Grothe, & Flanagan, 2015).

Because the experience of wonder seems to be an essential aspect of magic, Rensink and Kuhn (2015) propose that scientific research should go deeper into this topic. According to Leddington (2016), spectators feel wonder when they try to find a solution to a magic trick and fail. However, it might not be true that spectators watch a magic trick and try to solve it at the same time. They may not even try to solve it at all. Ortiz (2010) explains that magicians need to prevent spectators from approaching magic intellectually, and they can do this through a careful design of magic tricks. If a magic trick is designed or performed poorly, it gives away clues that will encourage reasoning. An explanation for the experience of wonder is necessary for cases in which reasoning is not involved.

As pointed out before, people may react differently when they see a magic trick. Therefore, Rensink and Kuhn (2015) argue that the study of individual differences will allow a better understanding of the experiential states produced by magic. Another suggested topic is the influence of different types of tricks on the experience of wonder. It would also be interesting to investigate the response of patients with brain damage, considering that the activity of the DLPC is related to the processing of violations of causal relations. In sum, the experience of wonder through magic is the result of applying methods to influence basic cognitive processes (e.g., attention, perception, and memory) and higher cognitive skills (e.g., thought) in order to violate causal relationships, or in other words, create the illusion of the impossible. According to Wonder and Minch (1996), these methods can be of different nature. Manipulative methods refer to ways of handling objects (e.g., a particular way of shuffling the deck). Mechanical methods consist of using special objects (e.g., a gimmicked deck). However, psychological methods (e.g., misdirection) are essential tools because the mind is where magic happens. The importance of psychology has been acknowledged by several magicians. For instance, Wonder and Minch (1996) state that psychology is the “main and primary

method. It is the key pillar on which magic rests” (p. 317). Tamariz (1973/2013) affirms that without psychology it is practically impossible to be a good magician because magic is fundamentally about exploiting failures in attention, perception, and memory. Tamariz also refers to another primordial aspect for the magical talent that will be discussed below: creativity.

## MAGIC AND CREATIVITY IN THE AGE OF THE INTERNET

After having published an article about the Magic Olympics in *Harper's* magazine, the magician Alex Stone received a letter from the Society of American Magicians. The president of the ethical committee asked for his resignation from the society because he had revealed secrets of magic in a magazine for laypeople. If he did not resign, then he would be expelled. Several members of the magician community reacted viscerally to the publication of the article (Stone, 2013).

The case of Val Valentino, better known as the Masked Magician, is a very illustrative example of the hysteria that can be generated by the exposure of the secrets of magic. Valentino became famous when starring in the television show *Breaking the Magician's Code: Magic's Biggest Secrets Finally Revealed*. Several magicians filed lawsuits, published protests in newspapers and magazines, and even urged viewers to stop tuning in to the program and to boycott corporate sponsors. Valentino received death threats and was forever banned from the Magic Castle, which is the clubhouse of the Academy of Magical Arts (Stone, 2013).

But not all magicians share the same view about exposing the secrets of magic. Fitzkee (1945/2009) considers that the explanation of a trick is not really equivalent to a revelation since the secrets of magic are those through which the magician manages to influence the mind of the viewer. From this point of view, a person may know the mechanical or manipulative aspects of a trick, but he can't do it in a deceitful way since he does not know how to influence the minds of those who observe him. Even if he has some knowledge about the psychological secrets, he would not know how the magician intends to use them.

Nowadays anyone can find videos on the Internet that offer detailed instructions to perform magic tricks. This may be stimulating for the learner, but has some disadvantages. The videos give the feeling that to perform a magic trick it is enough to learn the manipulative or mechanical methods. However, psychological methods are fundamental. In his *Card College*, Giobbi (1996) tells a great anecdote that illustrates the importance of psychology: The magician John Ramsay explains to a man how to vanish a coin. “A few days later, the young man proudly seeks out Ramsay to show him his

progress. As the eager student reaches into his pocket to bring out the coin, Ramsay interrupts him, saying, ‘Completely wrong!’” (p. 437).

The young man didn’t know or had forgotten that an essential aspect of the trick is to establish strong eye contact from the beginning and to maintain it throughout the performance. Giobbi (1996) warns that it is useless to look at something and suppose that the spectators will do the same if they have not been previously conditioned to follow the magician’s gaze. This process of joint attention is necessary for a lot of magic tricks. However, many beginner magicians who publish their tutorials on the Internet do not mention it or fail to refer to psychological methods, either because they do not know them, they assume that people already know about it, or they think it is not important to talk about it.

Another disadvantage is that learning through videos does not allow for feedback. The apprentice uses the mirror to identify his manipulative mistakes and then presents his tricks to a group of spectators so that they are the ones who feed him back. The problem is that laypeople will not be able to feed back the magician with respect to the prestidigitation techniques over which he has no knowledge. The approach of the layperson is similar to that of an individual who observes the presentation of a gymnast, but who—having no knowledge of gymnastics—will be unable to detect subtle errors. In contrast, a more expert gymnast can provide more effective feedback to improve performance.

On the other hand, the execution of tricks in videos often contains errors that learners might unconsciously imitate. For example, it is common for some beginners to inform spectators about what they are doing instead of using language that entertains or serves as a misdirection technique. Throughout the trick they say things like, “I’m going to shuffle the cards. Now I’m going deal the cards this way, etc.” This type of information is not only boring, but can also be counterproductive because it attracts the attention of the spectators towards what the magician does at every moment.

Another typical error is the constant execution of visually appealing but unnecessary actions. In some videos you can see the beginner magician making flourishes that do not contribute meaningfully to the effect. Riobóo (2002) believes that flourishes can be attractive, but they do not have an intrinsic value in magic unless they are used to hide a secret action. Flourishes may even reduce the experience of wonder because spectators will think that the magician is simply very skillful with his hands. In this case, the illusion of fairness of which Burger spoke about would be lost. Even though the magician may perform complicated actions, it is important to give the impression of simplicity (Kurtz, 1989).

Videos can be useful, although they should be complemented with other learning tools. There is a varied repertoire of material produced by professional magicians and amateurs of great prestige who not only share the manipulative and mechanical methods of their tricks but also the psychological ones that allow to exploit cognitive failures. Taking into account the widespread dissemination of the secrets of magic through free and commercial materials available on the Internet, it is reasonable that some people wonder whether the art of magic could disappear.

Fortunately, magic is not static but evolves rapidly (Stone, 2013). The element responsible for this evolution is creativity. Creativity allows magicians to invent techniques and design new tricks (Tamariz, 1973/2013). Although there are magicians who are essentially artists and not inventors, it requires a certain degree of invention to make small variations to the tricks and adapt them to the skill and personality of the magician (Fitzkee, 1945/2009). The world of magic competition is especially prone to creativity because innovation is necessary to surprise a magician, and this ensures the progress of magic.

There is a legendary story about a magician who boasted that no one could deceive him three times with the same trick. It was the famous Houdini. For years no one had overcome the challenge. But one night, a magician named Dai Vernon managed to deceive him more than three times with a trick called “the ambitious card” (Stone, 2013). This story suggests that even highly talented magicians may experience wonder when they become viewers of a novel creation.

But how does the creation of a new trick or method occur? Is it a spontaneous act or a deliberate process?

Dietrich (2004) proposes that creativity can be the result of two different types of processing. Deliberate processing involves directing the brain’s ability to solve a particular problem in a methodical way. Therefore, it tends to be structured and rational, but it has the disadvantage of being limited by preconceived mental paradigms. This type of processing requires focused attention and effort. In contrast, during spontaneous processing attention is unfocused and unconventional thoughts may enter into consciousness. In this way, loosely connected associations emerge. This processing is experienced as a state in which creative ideas are produced automatically and effortlessly.

To create a magic effect, Wonder and Minch (1996) use a tool called the mind movie. The mind movie follows a deliberate processing style because the magician conceives an effect, analyzes it from every possible angle, and improves it. An essential aspect of this process is to conceive the trick without imposing constraints to the imagination related to the method. For instance,

the magician may have a blurred idea of a new effect consisting of guessing a card that a spectator thought of, but at this stage he will not care about how to do it. He will do imaginary trails to transform that blurred idea into a clear and structured magical effect. Considerations about the know-how will come only after the magician has achieved an ideal version of the trick.

A group of researchers examined various aspects of the professional activity of Finnish magicians through semi-structured interviews and found that many participants invested great effort in creating new magic tricks motivated by factors of internal and/or external origin. Participants reported feeling motivated internally by curiosity and the desire to learn something new and by external factors such as money, an upcoming important presentation, and the public's desire for novelty, among others. Moreover, they pointed out that new ideas could emerge in different ways, even outside the context of magic (Rissanen, Pitkänen, Juvonen, Kuhn, & Hakkarainen, 2014). In this way, the ability of the magician to influence the mind and his creativity are essential ingredients in magic.

Certainly, there is a lot more to learn about the experience of wonder, and magic is a suitable tool for this purpose. Interestingly, scientists in brain and cognition laboratories have turned to magic to explore questions about the mind, and members of the magic community are contributing to this endeavor by sharing their secrets with them.

In this chapter, I have explained that the experience of wonder in the context of magic stems from cognitive limitations. These limitations are not readily obvious for spectators. Therefore, we could hypothesize that the experience of wonder in magic is rooted in imperfect metacognition, that is, an imperfect knowledge of our cognitive processes. How would magic be experienced by an individual who could see his mind's capabilities and gaps transparently? Perhaps it is hard to imagine such an individual. Leon Greco, a fictional character from the short story "Understand" by Ted Chiang (2002), experienced an increase in his cognitive abilities due to the hormone K therapy. He could easily do more than one task simultaneously, his reading speed and comprehension improved, he could learn anything effortlessly, and his executive functions were superb. Eventually, he developed a powerful ability to know his own thinking, reaching a new level of self-awareness. He could see how his mind was functioning, and by using a new kind of language he could describe and modify its operations. In other words, he was now the programmer of his mind and not just the user. For ordinary humans like us, it seems that we know what goes on in our minds. Magic and science tells us otherwise. I would like to end with a question to reflect upon: Would a person like Leon Greco feel amazed if a magician showed him a trick based on psychological techniques?



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## ABOUT THE AUTHOR

### Jeniffer Ortega Marín, Ph.D.

She is investigating metacognitive errors using magic tricks. She is dedicated to working with patients who have disorders of cognition caused by brain damage or pathology. [jenifferortega@gmail.com](mailto:jenifferortega@gmail.com)



# 17

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# A Novel Psychoeducational Strategy for the Prevention and Control of Emotional Risks in People with Epilepsy

► Gladys Alejandra Rojas Sánchez, Lucia del Carmen Alba Pérez, Laureano Rodríguez Corvea, Javier García Sacarías, Ana Hortensia López Pérez, and Mario Pérez Rodríguez · University of Medical Sciences of Sancti Spiritus, University of Medical Sciences Serafin Ruiz de Zarate of Villa Clara, “Camilo Cienfuegos” General Hospital of Sancti Spiritus.

## ABSTRACT

A study of technological development was carried out, based on the theoretical and methodological foundations of Health Psychology in the salubrious field, with the objective of favoring the regulation and emotional control of people with epilepsy and their insertion in family and social life, as well as to modify their own and their family's coping with the disease, with an impact on the prevention and control of emotional risks. The explanatory theoretical model was formed and the psycho educational strategy was elaborated that made it successful. We worked with two groups of 30 cases each, assigned probabilistically; those that were evaluated to diagnose the presence of positive and negative emotions. The group designated as experimental benefited from the designed strategy, which contains stages with combined psycho educational actions for people with epilepsy and their relatives, while the control group was waiting to receive it



The explanatory theoretical model was formed and the psycho educational strategy was elaborated that made it successful.

later. The actions of the strategy were directed to the diagnosis of the emotional states mentioned, the acceptance of the disease, the reinforcement and regulation of emotions, and personal and social growth. Quantitative, open, and qualitative analysis techniques were used, with which modifications were obtained that support the results of the intervention in the enhancement of positive emotions, emotional regulation, and personal and social growth, as well as coping with the disease and crises by people with epilepsy and their families.

*Keywords:* positive and negative emotional states, epilepsy, epileptic seizures, emotional control and regulation, psychological intervention

For centuries, epilepsy has attracted the attention of specialists and researchers, from the times when animistic and religious ideas dominated the interpretation of diseases, until it was understood as an illness of the brain and its conceptualization was expanded with the development of sophisticated complementary studies and effective clinical treatments. However, there was a strong stigma surrounding the condition, which today remains hidden in other forms of expression, and perhaps because of the dramatic nature of some types of crises and the harmful effects they bring about to the patient and family, interest has focused more on crisis management than on the general well-being of patients (Fabelo, 2010; Figueroa & Campbell, 2004; Sánchez, 1991).

Reflecting on this reality and so that patients diagnosed with epilepsy can enjoy emotional well-being, have a useful life, and be given full access to happiness, it was conceived to develop a novel, creative strategy that—with positive influence in all areas of his personal and social life—could guide them and lead them along this path.

Epilepsy has been defined by the WHO as “a chronic condition of diverse etiology characterized by recurrent crises due to excessive discharge of brain neurons (epileptic seizure), with various clinical and paraclinical manifestations” (Sánchez, 1991). Their manifestations are so complex and different that classifications have been elaborated, over which there is still debate, and modifications are suggested to perfect the diagnoses that allow efficacious and timely attention. It is recommended to refer to *epilepsies* and not to *epilepsy*, in addition to taking into account that clinical exploration is paramount (Garófalo & Gómez, 2009).

Epilepsy is a neurological disorder that affects 50 million people worldwide, with varying prevalence rates: they seem to range between 3.3 and 7.1 x 1000 inhabitants (Pozo & Pozo, 2007), but may be higher in developing countries (Figueroa, 2004; García-Ramos et al., 2010; Organización Panamericana de la Salud [OPS], 2011; OPS/Organización Mundial de la Salud, 2013).

In Cuba it is estimated to occur in 6.2 x 1000 inhabitants, a rate similar to that of developed countries (Fabelo, 2008).

It is described that children with a diagnosis of epilepsy are usually irritable, impulsive, contradictory, and have a lower cognitive performance than the others who share their age group; this is accompanied by strong family overprotection and an inability of teachers and society to provide the attention that might allow the full development of their capacities and an adequate social insertion. Thus, they reach adulthood with characteristics that limit their personal growth, such as low self-esteem, underestimation of their possibilities, dependence, and various affective symptoms, such as anxiety, sadness, depression, fears, and insecurity. Fabelo (2008), Thapar, Kerr, and Harold (2009) confirmed a high frequency of depression in these people.

In a study in adults with epilepsy, the presence of affective inadequacy was identified that it is characterized by emotional immaturity, poor impulse control, instability, feelings of disability, and frustration of affective needs. This seems to explain the higher incidence of pathological anxiety in them when compared with healthy people (Rojas, 2008). Accordingly, authors such as Hixson and Kirsch (2009) point out that the factor that determines with greater precision the life quality of patients with epilepsy is their emotional health.

In general, in the care of people with epilepsy the clinical emphasis has prevailed, without considering the psychosocial aspects, particularly those related to the patient's personality and affective-emotional life.

In Cuba, in people with epilepsy, especially in those who have not achieved an adequate control of the crises, there is poor information about the disease, an infinite number of fears, uncertainty, and resignation with what they have had to live. Therefore, it follows that, similarly to other settings, psychosocial research has been placed below the medical-clinical approach (López-Terradas, 2003).

Researchers recognize the influence of stress on the onset and evolution of epilepsy, the patient's vulnerability to losing psychic balance, and using non-constructive coping with the problems of daily life, all reinforced by the stigma surrounding the illness and the attitudes that the family assumes (Fabelo, 2008; Rood, Schultz, Rausch, & Modi, 2014).

The limitation and overprotection, as educational methods that prevail in families towards the patient, do not allow for the development of potentialities and capacities, and thus these constitute the basis of inadequate coping with the disease, which generates the same in patients (Hermann & Jacoby, 2009; Rojas, 2013).

For all of the above reasons, it was necessary to implement interventions that would contribute to placing epilepsy at the same level of attention as

other chronic diseases, starting from a salubrious position within the framework of Health Psychology, with an emphasis on the education of patients and family members who allow them to assume healthy behaviors and a better incorporation into social life.

The use of educational programs for people with epilepsy is described in the literature, though these are applied with limited results (May & Pfafflin, 2005). Cognitive behavioral therapies, relaxation for crisis management (Maguire, Marson, & Ramaratnam, 2011), and salutogenic models (Fabelo, 2008) are also used. However, there is a lack of a method that combines the educational-preventive and the psychological, which in addition to providing information about the disease, considers the experiences and affectivity of these people, enhances self-esteem, and self-development.

Taking into account the limitations of medical and psychological care in people diagnosed with epilepsy, efforts have been made to develop strategies and programs that can act not only on the control of crises, but also on the aspects related to the emotional, family, and social life of these patients, so as to increase their well-being and quality of life.

In 2013, research was concluded that aimed to develop a psycho educational strategy designed from the potentiation of positive emotions, the regulation of emotions in people with epilepsy, and the adequacy of their coping and that of their families with the disease. Positive and negative emotions, anxiety and frustration states, as well as their own coping styles and those of family members with the disease were identified. This was applied and proved to be efficacious.

The methodological design employed was mixed according to the nature of the studied variables; it was considered a developmental study for the proposal and implementation of a new technology for healthcare. It passed through two phases: the first descriptive, for the characterization of the subjects and their families, regarding educational needs in relation to the disease and from the psychological perspective; the second phase was experimental, with three stages: design of the strategy, implementation, and evaluation of results.

Of the individuals with epilepsy who were observed in the neurology service of the General Hospital of Sancti Spiritus from 2007 to 2009, an intentional sample was taken according to the inclusion criteria of 60 patients, who were randomly assigned to two groups: G1 Experimental (Study) and G2 Control.

For the inclusion of patients, a confirmed diagnosis of epilepsy, treatment at the neurology service of the hospital, absence of psychopharmacological treatment, ages between 20 and 50 years, and normal intellectual capacity were considered. Patients with another chronic disease were excluded.



For the initial assessment of the subjects from both groups the tools used were: an interview, the Non-Perceptive Test of Herman Rorschach (Bohm, 1970), the Incomplete Phrases Test of Rotter (Alonso, Cairo, & Rojas, 2006), the IDARE (González, 2007), a composition with the title “How I Am and How I Would Like To Be,” a narrative method in which the patients are instructed to write a brief composition where they describe how they consider themselves to be and how they would like to be—in terms of personal qualities, attitudes, values, and capabilities—(González, 2007), and the Self-assessment of emotional states, a technique developed by Likert in 1932 with five stations that range from *bad (0)* to *very good (5)* (Hernández, Fernández, & Baptista, 2006)

Patients from the study group were asked to: (a) deliver an Emotional Autobiography, a narrative method in which patients are asked to describe in written form facts of positive and negative significance during their lives; (b) establish the approximate age in which they occurred; and (c) talk about the emotional reactions they had before them (Alonso, 2006).

The psychological dependent variables studied were: anxiety, emotions, emotional regulation, frustration, coping styles, coping epilepsy, family coping of crisis, and personal and social growth. The anti-epileptic treatment prescribed was considered as a control variable (anti-epileptic drugs).

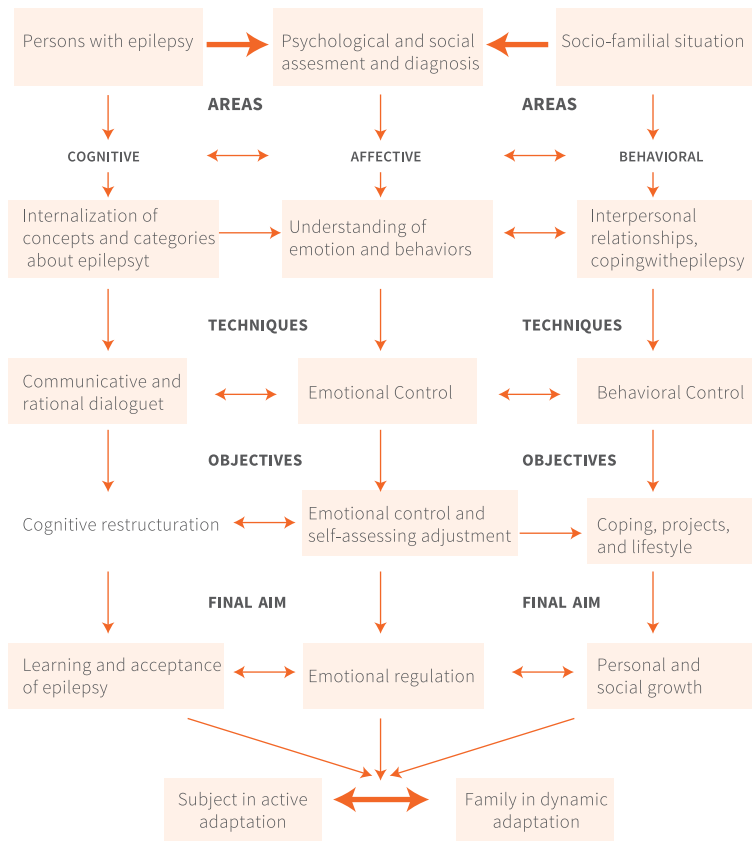
## DESCRIPTION OF THE THEORETICAL MODEL

Once established the main characteristics of patients and the affections suffered in the different areas of the psyche, as well as the influence and interaction of family and social determinants, the structural criteria of the model were adjusted (See Fig.1).

## STRATEGY DESIGN

For the design of the strategy the following was taken into account: the research experience accumulated by the main author, for more than 25 years, and the bibliography reviewed that gave rise to the model elaborated. The criteria individually expressed by specialists in neurology and psychology who have provided clinical care to people with epilepsy for years, collegiate discussions in two nominal groups performed with these specialists, and the elements contributed by the psychological characterization of their processes, states, and qualities. For the structure of the strategy, De Armas, Laurences, and Perdomo (2003), and Sanabria's (2008) recommendations were followed.

The strategy was comprised of three stages: it was made up of the combination of educative activities and psychological influence; group work (three groups of 10 patients) was taken into account, so that the themes developed—in an expositive, brief, and simple way—would allow to carry out



**Figure 1.** Theoretical-methodological model for the application of the psycho educational strategy to people with epilepsy and their family.

the group dynamics in which the participants were involved. There were 12 sessions (the first two for assessment and 10 practical) for patients and their accompanying family member, with a duration of approximately one hour every two weeks. The stages were as follows:

1. Psychological assessment and detection of care needs of people with epilepsy and their family.
1. Knowledge and acceptance of the disease.
1. Reinforcement, control and, regulation of emotions.

The content covered by sessions is described below.

Session	Contents
1	Start of group work. Dedicated to adapt the knowledge about epilepsy and favor the incorporation of habits of self-protection.
2	Dedicated to externalize experiences associated with epilepsy and to learn to express their condition free of stigma.
3	Dedicated to understanding the relationship between emotional factors, behavior, and health.
4 & 5	Dedicated to the expression of emotions and problems that affect the people of the group.
6	Dedicated to self-knowledge and the adequacy of self-assessment.
7	Dedicated to the expression of motivations and aspirations.
8	Dedicated to the family and their relationship with the patient.
9	Dedicated to the expression and strengthening of the interests of patients.
10	Dedicated to the analysis of patients' life projects.

**Table 1.** Description of Sessions of Psycho educational Strategy for People with Epilepsy.

All sessions included objectives, activities, techniques and closure.

The Topics Addressed by Psychologists Are:

- Epilepsy as a chronic condition.
- Stress, emotional states, and health.
- What is a problem?
- Self-assessment and its relationship with people's health.
- Motivation and health.
- Family functionality. Communication as a vital resource.
- Life projects, formulation, planning, and execution.

The Group Dynamics are Discussed as Follows:

- Sharing concepts, criteria, assessments, and experiences on epilepsy and crises. Family attitudes.
- "Let's talk about epilepsy." How does this diagnosis affect us, the family, and others?
- Experiences of stressful situations, emotions, and their relationship with epilepsy and crises. Coping styles used.
- Sharing aspects of emotional autobiographies.
- Self-assessment and self-knowledge.
- Why do we feel motivated? What are our aspirations and goals?

- What does this person mean to us and what can we do to make them happy? (Family members refer to their relative with epilepsy.)
- Expression of interests and their materialization in the activity of patients.
- Initiated life projects, experiences, and perspectives were presented and an analysis was made of the role of the family in the execution of these projects.

The techniques used during the sessions included: communicative informative dialogue, expression of emotions, correcting overrated symptoms, cognitive and support techniques, positive social comparison, problem solving, clarification of emotional states, list of personal qualities, group discussion, educational orientation, and expression of interests. At the end of each session, a closure is made, reinforcing what has been learned by the participants themselves and culminating in Luthe's collective relaxation practice (British Autogenic Society, 2013).

The efficacy checking was performed by evaluating the results. For this, most of the techniques applied in the initial characterization were used; comparisons were made between the groups before and after, and of each group within itself in a longitudinal way, in relation to the variables of interest.

## RESULTS OF THE IMPLEMENTATION OF THE STRATEGY

The analysis of the results is presented according to the stages that were defined for the execution of the psycho educational strategy.

### STEP I

In the two groups, similarly, it was observed that the subjects were more affected by personal, family and marriage dissatisfactions. Nevertheless, the family, despite using overprotective and limiting educational styles with them, behaved as an important resource of social and affective support. In general, the experiences of conflicts and frustrations during adult life prevailed. These situations make them vulnerable to various stresses and alterations, with harmful emotional consequences (Lanteaume, Bartolomei, & Bastien-Toniazzo, 2009).

Most people in both groups had a general coping style centered on emotions; the predominant coping with the disease was fear; the coping of families to crises was characterized by being frightened and nervous about half of them.

Through psychological techniques, it was possible to obtain indices of imbalance and a lack of emotional control in more than 70% of the cases, a presence of negative affectivity expressed mainly in anxiety, both in the form of trait and state, difficulties in achieving social contact, and the existence

of conflicts, especially in the area of affectivity, which generates presence of negative emotions. Evaluations of positive emotional content were related to motivations, values, and attitudes. In all these aspects, the two groups had a similar behavior.

The Central Nucleus of Social Representations (CNSR) pointed out the non-existence of differences between the groups, since the central nucleus was considering the possession of positive personal qualities and the fundamental peripheral, possessing negative qualities. It was observed that the subjects of both groups consider themselves to be good people, which they relate, above all, to serving the family and others, although they describe possessing negative qualities like irritability, “bad temper,” and clumsiness. There was a lack of correspondence between what they thought they were and what they would like to be.

The comparison of the experimental and control groups in the above mentioned aspects of the characterization, through Mann Whitney statistics, allowed to establish their homogeneity before carrying out the intervention.

## STEP II

After the intervention to the study group, the subjects of both groups were assessed (29 in each one by a sample fall), and the results were compared with the initial assessment.

It was noted that the perception of epilepsy underwent changes after the intervention. Acceptance of the disease was widely doubled in the study group and fear-driven coping was eliminated; in controls, acceptance and denial rose discreetly and four of them eradicated fear as coping. To demonstrate the significance of the changes, it was decided to group negation, rejection, and fear as inadequate confrontations, and to consider acceptance as the appropriate mechanism. Mc Nemar test showed significant differences ( $p < .05$ ) in the study group, which did not occur in the control. This speaks in favor of the efficacy of the intervention in modifying the criteria and perception about epilepsy.

As for the families' coping with crises, the coping of families to the crises with the proper control in the study group was increased to 65.5%, while in the control one remained the same. In former group, there were an increased percentage of families who were scared and nervous before crises and those who sought help to face them. Wilcoxon test, in the study group, showed significant differences between coping before and after the intervention ( $p = .001$ ).

This was a result of the aspects emphasized in sessions one and two of the strategy (see Table 1), although they are elements that necessarily integrate into other sessions.

### STEP III

At this stage we worked with the autobiographies of the participating subjects (see Table 1, 4<sup>th</sup> and 5<sup>th</sup> sessions). In them, affective disturbances were expressed in family relations—especially in the past—as well as needs for recognition and insecurity to face life. The frustrations appeared in the third part, in reference to the stages of childhood and adolescence, but with predominance in the present.

The comparison of the frequency of crises showed that in the study group, as in the control group, having a monthly crisis in 43.3 and 50% of participants, respectively, was initially prevalent. In the pre-test, the Mann Whitney test demonstrated the homogeneity of the groups; however, in the post-test, the differences between them were significant ( $p < .05$ ). The Wilcoxon statistics showed significant differences in both groups, in the SG ( $p < .001$ ) and in the CG ( $p = .018$ ). The frequency of crises is the neurobiological factor most susceptible to be modified by the diverse therapeutic influences; and its control is considered a fundamental factor for the achievement of the sense of well-being (Fabelo, 2010; Harden & Goldstein, 2002). It is possible to assume that the modifications experienced in the control group may be due to the natural evolution of the disease under the effects of medical treatment and by the positive events that occurred to the subjects that manage to improve their emotional state.

Regarding the variations that anxiety trait and state experienced, it was observed that in comparison with the pre-test, in the study group there was a decrease in high anxiety in both modalities and an increase of the mean and low anxiety post-test; in controls, the anxiety trait elevated discreetly, while high state anxiety decreased by 13%. In the comparison of the Wilcoxon test before and after the intervention, significant differences were observed in the study group, both in anxiety state ( $p = .02$ ) and in anxiety trait ( $p = .03$ ).

In reality, trait anxiety should have remained without differences; but these results could be motivated by the fact that the positive mood and the reduction of anxiety manifestations influenced the responses that the subjects gave in the test to the category “Generally”, so that the experience of “Now” modified the perception of the habitual, and also one could think of the education exerted on the lifestyle, as a modifier of the typology of anxiety. In the control group, the measures of anxiety experienced little variation, with no significant differences in any of its forms.

The application of the Rotter test with respect to conflict responses, in the study group, significantly reflected its decrease, corroborated by the Wilcoxon test ( $p < .05$ ) in the areas of self-concept, affectivity, motivations, school, and learning, as well as problems and failures. Thus, conflicting self-assessments decreased, which may have an impact on emotions, be-

haviors, and on a satisfactory recovery (Rojas, 2009); in addition to probably reducing the vulnerability to falling sick (Fabelo, Martínez, & Iglesias, 2011). It is also important to highlight significant differences among groups in the areas of self-concept, affectivity, motivations, childhood and home, as well as problems and failures.

Positive content responses increased their presence in self-concept, affectivity, motivations, sex, love and marriage, as well as problems and failures in the study group, with significant differences as compared to the Wilcoxon test. In the post-test, differences in the area of childhood and home were significant ( $p < .05$ ), unlike the motivations, school and learning, and problems and failures ( $p > .05$ ).

After the intervention, modifications were observed through the CNSR In the study group, where the central nucleus was to wish to “be as I am”; at the same time, in the control group, there continued being the incorporation of positive traits. On the other hand, in the latter, the desire to be healthy appears as peripheral nucleus; evocation depreciated in the study group.

In the study group, as to “how I wish to be,” the aspiration to “be as I am,” later became the central nucleus; that is to say, a correspondence between what is thought to be and what is wanted to be was achieved to a great extent. This internally organizes individuals, who acquire a balance that allows a better regulation of their emotions (González, 2008) and, although this was worked on during all sessions, the sixth was dedicated to self-knowledge and to reflecting on self-assessment and self-esteem (See Table 1).

As for the incorporation to the activities of personal and social growth, modifications were achieved that were verified by Mc Nemar’s test. This detected changes with statistical significance in the study group in relation to the upgrading ( $p = .031$ ) with a real link between the subjects in the study at different levels and in other activities of personal and social growth ( $p = .001$ ), in which the coping with motherhood, reading, assuming working responsibility, and participation in recreational activities and mass organizations were highlighted, but not in the control group.

Chi-square confirmed differences between the groups in terms home tasks, improvement and others of personal and social growth. This was considered to be the result of the actions developed in sessions seven, nine, and ten, mainly (see Table 1).

The self-assessment of emotional states recorded in each session on a Likert scale (from 1 to 5) indicated that the general tendency of study subjects was to be located in 3 (*regular*) until the sixth session of the strategy, in which they began to move up the curve of the mean values, approaching the value 5 (*very well*). It was considered, as the occurrence of a progressive,

ascending, and cautious change towards the improvement of the self-perceived emotional state.

Based on the results, it was considered that the prevention of emotional risk was achieved since in the patients who participated in the strategy the presence of positive emotions were elevated, coping with the disease was adjusted (in the majority of cases), healthy habits and self-protection were incorporated, and their incorporation into activities of personal and social growth was increased. In families, adequate coping with crises and the use of appropriate educational styles were achieved for the patient's independence and self-responsibility.

By reducing negative emotions, conflicting assessments of situations, and frustrations, and increasing the regulation of emotions, control was exercised over emotional risks, which made it possible to reduce the frequency of crises significantly.

The encouraging results offered by before-after comparisons in terms of emotional states, self-perception of their progressive improvement, and greater incorporation into family and social life make it possible to affirm that timely care was provided by intervening in people with epilepsy with the psycho-educational strategy.



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## ABOUT THE AUTHOR

### **Gladys Alejandra Rojas Sanchez, Ph.D.**

She is the author of several articles about epilepsy. Her research has been directed mostly to conserved capacities, to the prevention of emotional problems and to the cooperation of the family in the personal and social improvement of patients. [gladysr.ssp@infomed.sld.cu](mailto:gladysr.ssp@infomed.sld.cu)

# 18

chapite

# The Challenge of Moving Towards a Critical and Transformative Educational Psychology

► Gonzalo Salas, Katherine Morgado, and Claudia Cornejo  
· Universidad Católica del Maule

► Ivelisse Torres Fernández · New Mexico State University

Educational psychology must transform and apply in its daily practice a profound change to detach itself from the medical practices that continue to influence the discipline. In Chile and in the United States, methylphenidate (Ritalin®, Aradix®) is widely available for medicating boys and girls diagnosed with behavioral and impulse control disorders (American Psychiatric Association, 2013). Medical psychology and traditional psychiatry have used this label to diagnose an increasing number of students from *School Integration Programs*, which allows students with special needs to access educational services. These diagnoses have led to a series of stigmatizing and threatening practices to mental health. Salas (2015) refers to the *Nonsense Scholastic Syndrome* to argue that school environments cloud the judgment of the members of their communities, producing *coarse school doctrines*<sup>1</sup> that cause substantial discomfort and have a negative impact on students' and teachers' well-being. In

1 Among these coarse school routines is the belief that academic failure is the responsibility of the student as opposed to the system in general or that teachers are ready to promote the use of medication among students as a requisite for entering the classroom.



Educational psychology must transform and apply in its daily practice a profound change to detach itself from the medical practices that continue to influence the discipline.

this context, the purpose of this chapter is to reflect on some key aspects of educational psychology to foster new analysis that moves away from rigid ideas, stigmas, poorness in expression, and mere *contenidismos*<sup>2</sup> (Gutiérrez, & Prieto, 1999) and focus instead on a psychology that revitalizes the *ethos* and detaches the prevailing *pathos*<sup>3</sup> (Salas, Scholten, & Rey-Anacona, 2015). Only this will enable a true transformation of educational psychology, to revitalize the connections and generate new possibilities from transformational, ecological, and critical dynamics.

The institutionalization of education has emerged through history hand in hand with various social, political, and economic processes, industrial and scientific developments, as well as the growing appreciation for human rights that has become a relevant topic since the late 1940s (González, 1998), in addition to the assumed value of education that has flourished in modern times coupled with other progressive ideals that elevate the value of culture. In this sense, the new appreciation of education brought about by these progressive ideals allowed the enhancement of academic opportunities, which were reflected in changes that expanded the role of schools by providing access to boys and girls regardless of their social status and origin (Gimeno, 1998).

In the XIX century, national systems of education linked to the public school emerged in the United Kingdom, France, Germany, Italy, Spain, and other European countries. The new independent nations of Latin America, particularly Argentina and Uruguay, turned to Europe and the United States to develop their school models. Japan, having put aside its traditional isolation, attempted to adapt its educational institutions taking the experiences of the above-mentioned countries as a basis for their modern school system (Redondo, 2001)<sup>4</sup>.

However, modern schools, nowadays understood as the formal place where the members of a society are *educated*, have come to be seen as spaces resembling factories, hospitals, and jails. These spaces are considered the main driving forces behind the capitalist economic model, as well as socially constructed spaces where the main social structures of exclusion and inequality are reproduced and perpetuated (Torres Fernández, 2015). From this

2 *Contenidismos*: Excessive importance given to a content or subject, thus reducing the relevance of context, form, and complex analyses.

3 The *ethos* refers to a psychology that takes into consideration the integrity of the individual and respects his subjectivity in the educational system, whereas the *pathos* is its opposite correlative; it is related to the feeling of rejection and lack of integrity towards people, which usually gives way to abuse and violence within the school.

4 The same was true for Chile. The creation of the Pedagogical Institute at the University of Chile in 1889, under the government of José Manuel Balmaceda and with the help of Valentin Letelier, invited German teachers to teach science. During the 1920s and 1930s, Amanda Labarca played an important role in introducing the North American influence under the postulates of John Dewey and William James.

perspective, in the school experience, “confinement, adherence to limiting rules and hierarchies are constitutive matters” (Brailovsky, 2012, p. 15).

As can be seen from this brief historical overview, the field of education is not lacking complex and powerful scenarios that are at odds with humanist ideals (which stand and promote overall human and socio-cultural development). Moreover, they threaten the liberating premises attributed to formal educational, such as narrowing the gaps caused by the abysmal financial and social class inequalities around the world and, in particular, in Latin America (United Nations Children’s Fund, 2011). In this regard, the philosophy of education aims to promote and support the development of a society where every individual is able to exercise his or her rational thinking skills (Carr & Manzano, 1996), in detriment of affective education.

Considering what has been previously stated, it would be naïve not to recognize and assume that formal education is in crisis. Now, is it really the type of crisis presented and experienced by the so-called social movements? Or is it rather a generalized awareness of the status quo that operates and prevails in our educational institutions that lies at the foundation of our social structure? Schools do not perpetuate their status quo, stigmatization, or social exclusion, nor are they in crisis due to the well-known *hidden curriculum*, or better said, not only because of it. However, today we can see how schools succumb and agonize due to their formal curriculum, riddled with meaningless practices that prioritize the achievement of standardized goals and the above-mentioned *contenidismo* (Gutiérrez & Prieto, 1999) instead of developing competencies for life, such as social-emotional, value-based, and ethical aspects of education (Greenberg et al., 2003).

One aspect that should be acknowledged is that if there is anything ideological in the education of a given country, it is precisely its educational curriculum and the practices that stem from it. Thus, the inherent interests pursued through the curriculum should be transparent. There is no doubt that the predominant curricular focus of most western countries is based on a technological, functional, and *efficiency-based* model, oriented to a hyper-exigency and performance measurement (Zabalza, 1987). These aspects are congruent with the current economic model, which protects, above all and at any cost, its capitalist values.

One major consequence of the prevailing educational model is the individual and collective discomfort, both inside and outside the schools. Therefore, the *Nonsense Scholastic Syndrome* implies a lack of appreciation for common sense and clarity in the learning processes (Salas, 2015). Consequently, this syndrome has negative consequences on the emotional state and motivation of everyone involved in the school setting, and it weakens the educational process as a result of its loss of meaning.

In this context, it is not surprising that educational psychology has assumed a strong *pathos*-centered role, as a need to compensate for those situations or individuals that have threatened the normalizing and rigid criteria imposed by the curriculum. The incorporation of psychologists into educational spaces was tainted with the almost unrelenting desire to incorporate someone from the medical field into school that could “measure,” diagnose, “cure,” and, above all, safeguard the educational system from the normalizing objectives of those students labeled as problematic or pathological (Torres Fernández, 2015).

Even today, most educational psychologists play this *pathos*-centered role. Furthermore, even the guidelines of school integration programs have assigned psychologists working in school settings a clinical practice primarily focused on those students with special education needs (SEN), all of which had been previously diagnosed and in most cases medicated. Conversely, according to the school of Milan, in the 1970s<sup>5</sup> the teacher’s main role was to intervene in difficult cases, e.g., with children who had trouble adjusting, to make a proper diagnosis and suggest an appropriate course of action. This, along with pedagogic counseling, focused the problem on the child or on his/her family, without even questioning the school or its structure (Selvini et al., 1993). With this in mind, psychologists should be attentive to those teachers or school personnel in charge of monitoring children during recess that label students that act out as having “nervous breakdowns” or engaging in “attention-seeking behaviors” since most of the time these children are just expressing their view points or feelings.

Every psychologist involved in the educational system is aware that the demands of the system are, most of the time, very different from those that emerge from the role that psychologists have within the school. This disconnection is due to schools and the education system in general, being unaware of the roles and responsibilities of educational psychologists. As a result, they are entrusted with responsibilities related to solving problems within the system, expecting psychologists to solve these issues isolated from the system and assuming they have the skill set needed to solve these problems. Consequently, schools see the psychologist as a “*magician without magic*” (Selvini et al., 1993), damaging, weakening, and distorting the role of the educational psychologist within the school system. Moreover, this conception hinders the vast array of possibilities related to their professional activity, which goes far beyond the clinical aspect. Regarding the school environment,

5 Please refer to Chapter 2 of Selvini et al. (1993) for an overview of the summary by a group of psychologists on “the role of the psychologist in the school setting”, developed by the provincial administration of Milan in 1974.



from a transversal point of view, the promotion and management of this aspect in Chile was linked in its beginnings to teams of professionals in the psychosocial field that addressed the special education needs of the students. This led to direct and delayed responses to complex violent situations, and forced psychologists to apply containment and compensation measures in accordance with the standing disciplinary model. As a result, the educational system was damaged, particularly in its formative, preventive, and mediating aspects (Gallardo, 2010).

These contingencies have led to a paradigmatic crisis in the educational field: the old behavioral model, with its operational objectives inside the school setting that are unable to explain the educational process in a satisfactory way, but it is still standing for practical purposes. Both school and life “need to be seen through a new cultural frame . . . , this calls for profound transformations inside the school, conceived as an organization that learns and creates (not only transmits) knowledge” (Diez & Román, 2001, p. 13). We are not referring to every aspect of behaviorism, but to the poor use of it; if we look back to the Walden II experiment carried out by Skinner in 1948, one can see that there are important arguments for the generation of social change from a utopic frame of reference (Skinner, 1968).

On the other hand, to speak about a new paradigm within the school setting is to acknowledge the relevance of our thoughts and practices on the quality of the relationship between individuals: human beings that are alike but different at the same time (Sime, 2006). In this regard, the *Convivial Society*<sup>6</sup> is proposed as an alternative to the contemporary productivist society, which stated that productivity was associated with ownership and conviviality was related to being (Illich, 1985a). Nevertheless, in the social sciences, paradigms refuse to relinquish their place and seem to prevail in spite of their lack of effectiveness in practice (Maldonado, 2004).

The current postulates state that we are heading towards a *Pedagogy of Conviviality* (Aristegui et al., 2005), which entails a pedagogic and systematic reflection on education, focusing mainly on conviviality in the school setting, understanding the social and educational problems in its midst, as well as its effects and incidental factors, from a perspective aimed at transforming the educational institution with a focus on *ethos* rather than on *pathos*.

This is where the transforming role of the educational psychologist comes into place, such as generating mediating practices that are able to mobilize the system, dilute resistance, change wills and expectations, optimize

<sup>6</sup> The *Convivial Society* is the initiative of people that participate in the creation of social life where each individual is guaranteed the greatest and freest access to the tools of the community with the sole condition of not hindering the freedom of others (Illich, 1985b).

conviviality, and everything related to strengthening practices and places for individual and organizational growth and development. All of these aspects come together within the school setting.

This vision and transformative role of educational psychology calls for professionals as “agents of change” within the educational setting, promoting the assimilation of new experiences and learning opportunities, conceptions, subjective schemes, and theories, which will translate into motivation, practices, and mutual collaborations.

Therefore, one of the ways of facing the current challenges and demands of education is to foster an educational psychology that is both transformative and critical of spaces and which promotes, on the basis of action and reflection, a transition from the rigid teaching models to more pluralistic, inclusive, and (why not?) divergent models. In these new models, the school setting and its agents should be capable of recognizing, from a critical point of view, the social and structural determinants that operate at the basis of the system, acknowledging them and choosing not to perpetuate them in their inner dynamics and day to day practices as exclusion mechanisms that only reproduce human *ghettos*<sup>7</sup> within their communities. We must mention that, in this brief analysis, our aim is to provide a situational diagnosis; therefore, the resources educational psychology could use to modify negligent or suppressive practices within the school are not discussed. These should be the focus of further studies and publications.

Several studies confirm that the intervening factors inside formal education institutions are as varied as the possible realities. Their complex interaction is far from a magical recipe that can be automatically reproduced. Understanding these complexities means that there is no single solution to the problems but rather varied and dynamic alternatives, all of them subject to improvement (this applies to both individuals and organizations). Our day-to-day activities can be restated to create healthier and less pathological individuals and institutions. Within the educational setting, this would entail reducing the neurotic obsession for diagnosing and measuring students as a valid excuse for everything negative that goes on inside the schools.

The challenge we must face is to rethink (or *disoñar*<sup>8</sup>) the school setting (Calvo, 2008), redraft the curriculum, and reposition the educational psych-

7 By using the term *ghettos*, we intend to describe classrooms, schools, and/or educational communities that exclude and isolate certain members, hindering a true inclusion in terms of conviviality.

8 *Disoñar*: neologism created by the Association for Peasant Development (*Asociación para el Desarrollo Campesino* [ADC in Spanish]) in Pasto, Colombia, that is used to express that their work has been designed from the collective dialogue as an effort to materialize their dreams of a fair and solidary society (Calvo, 2008). It is a play on words to describe an intercultural educational model or academic proposal whose ethic and aesthetic conceives school as a living system.

ology that is practiced in schools. We need to reclaim its essence and sense, transforming itself at the same time to innovate the educational spaces, leaving behind its obsolete and busy practices and looking toward more ecological approaches. In this regard, rethinking school entails a profound analysis of how current educational practices still preserve the status quo and promoting hostile, segregating, and discriminatory practices (Torres Fernández, 2015). Even though one of the primary objectives of schools is the academic development of its students, the development of social-emotional learning skills, the promotion of healthy school environments, and equity are essential elements in the successful development of students. Therefore, redefining the curriculum and repositioning educational psychology require a critical analysis of their fundamental roles, so psychologists can become real agents of social change. Lastly, promoting public policies that favor the majority and reassessing educational horizons will allow for the development of a critical education that reflects the social, political, and economic needs of all students.

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## ABOUT THE AUTHORS

### **Gonzalo Salas, Ph.D.**

He is an academic in the area of educational psychology and author of several books. The year 2011 receives a prize from the Chilean School of Psychologists for its contribution to collecting the historical and professional memory of psychology in Chile. [gsalas@ucm.cl](mailto:gsalas@ucm.cl)

### **Katherine Morgado, MD.**

She is a teacher in the postgraduate area of education at the Central University of Chile, and develops methodological advice on research projects and educational intervention.

### **Claudia Cornejo, MD.**

In the professional field she has worked as psychologist in the different educational establishments of the Maule Region (Chile), being her main line of development the technology of academic talent.

### **Ivelisse Torres Fernández, Ph.D.**

In the professional field, she has worked as a school psychologist in both clinical and educational contexts. His lines of research include: social-emotional development, resilience, multiculturalism, social justice and mental health promotion in children and adolescents.

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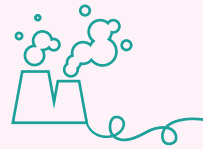
chapite

# Mexico's Approach to Disasters in the 21st Century: A Trans-Disciplinary and Multimethod Perspective from Environmental Psychology

► Octavio Salvador-Ginez and Patricia Ortega-Andeane  
· School of Psychology, Universidad Nacional Autónoma de México

## ABSTRACT

In the last decades, the impact which natural disasters triggered by global climate change have had on societies has outpaced institutional efforts to reduce the vulnerability of social groups exposed to threats with catastrophic potential. Research on how populations respond to climatological, geological, and technological threats, as well as the psychological effects on survivors of disasters, should be founded in an evaluation of the perception of risks and prior behaviors, both individual and collective, which are related to the adaptation to disasters. In the scientific work of environmental psychologists, it is a priority to examine the phenomenon of the risk-vulnerability-disaster triad in its psychological, social, cultural, political, and economic dimensions, because those variables are linked to the psychological and behavioral response to prevent and mitigate threats that an individual may adopt based on information received from their everyday surroundings. In this sense, we need to assess not only personality traits, cognition, and behavior; it is equally important to consider the social structure of the individual



Research on how populations respond to climatological, geological, and technological threats, as well as the psychological effects on survivors of disasters, should be founded in an evaluation of the perception of risks and prior behaviors, both individual and collective, which are related to the adaptation to disasters.

and conditions of vulnerability in the social and physical environment which magnify the impact of a disaster and the negative impact on the economy and development of communities.

The study of natural disasters from the perspective of the social and behavioral sciences entails a theoretical, methodological, and technical challenge, given that the “raw material” of our research is the human mind, which is constantly transformed by individuals’ cognitions on the environment in which their lives unfold. In that context, it is important to emphasize that, unlike “hard” sciences like geology and engineering, where methods of studying disasters are more robust in technique, they undergo slight changes based on findings over time; for example, the impact of global climate change on the geotectonic system of a region “behaves” in a relatively stable fashion over a long period of time. However, because disasters have repercussions in social systems, the study of psychological response and adaptation to natural disasters from the perspective of research in environmental psychology requires constant development of methods and techniques for evaluating the experience, emotions, cognitions, and behaviors individuals assume in the face of natural threats, and our studies focus on developing strategies to mitigate and adapt to the adverse conditions under which people decide to live.

In the chapter we offer a brief overview of the work we have undertaken in recent years, in which we propose to approach natural disasters through a theoretical, methodological, and technical integration of several disciplines, including environmental psychology (which we define with the label of *trans-disciplinary*). This, on the premise that such an important phenomenon should be understood, explained, and communicated from the shared perspective of groups made up of scientists in varied areas of knowledge (including psychologists), to offer society practical proposals which enhance quality of life (even in situations of potential disaster) and help to mitigate and prevent risk of disasters. Finally, our proposal emphasizes the simultaneous, creative use of the qualitative and quantitative methods of the social sciences, therein overcoming epistemological and ideological barriers to concatenate the methodological resources of both perspectives in research as a means of attaining a fuller understanding of environmental problems.

### THE IMPORTANCE OF INVESTIGATING THE IMPACT OF DISASTERS IN PSYCHOLOGY

In recent decades, we have seen how population growth and economic growth, the use of fossil fuels, CO<sub>2</sub> emissions, production processes—for food, clothing, housing, and consumer goods to meet the lifestyle demands of the more than 7 billion people who inhabit the Earth—, and the deforestation caused by relentless urban sprawl and land use patterns are the driving forces



behind global environmental change. Due to dramatic changes in ecosystems, plant and animal species have been displaced from their habitats or succumbed to extinction, and humans have been affected by extreme natural phenomena with their destructive impact on environmental, urban, and social systems, and their even greater impact on emotions, cognitions, and behaviors, especially in persons who have survived a natural disaster.

When we hear talk of natural disasters somewhere on Earth, our thoughts turn to their social, economic, and political consequences; governments and mass media provide figures on victims, refugees, loss of human life, economic losses, and costs of recovery, urging society to marshal support to minimize the devastating effects.

The Fukushima Tsunami in the year 2011, the 2015 earthquake which devastated Nepal, and the earthquake which struck Haiti in 2010 allow us to observe the destructive power of nature, the vulnerability of individuals, and the impact such events have on societies (Alesch & Siembieda, 2012; Dynes, 1975, 1976), and above all how people are unprepared to cope with disasters of such magnitude (Tierney, Lindell, & Perry, 2001).

The social sciences, and psychology in particular, need to focus their research interest on disasters, to identify the psychological and social variables which can hinder and enhance a person's ability to respond before, during, and after a disaster, for example by identifying the actions individuals take in the moments after a disaster to reduce the impact of the phenomenon (Helsloot & Ruitenbergh, 2004); what actions people need to take when faced with the risk of disaster (Lindell & Perry, 1993, 2004, 2012); and in particular, what measures they should take before a disaster strikes to reduce its impact.

To understand how we react to unforeseeable phenomena, we need to consider how we interpret information from our environment based on the environmental and technological threats with which we live day to day. From Prospective Decision-Making Theory, people constantly make assessments of complex scenarios which involve the probability and frequency of an event, which is framed in prejudices and value judgments on the outcomes of such assessments (Tversky & Kahneman, 1991, 1992). In this context, the perception of risk is based on predicting individual responses to certain activities which are perceived as threats or not (Slovic, Fischhoff, & Lichtenstein, 1980).

The perception of risk seeks to systematize the assessment and evaluation of a threat (Breakwell, 2007), focusing on the probability of events and the magnitude of consequences (Kasperson, Golding, & Tuler, 1992; Renn, 1998a, 1998b; Slovic, 1987), as well as on people's preferences regarding a series of threats (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Pidgeon, 1991; Slovic, 1987), where individuals make judgments on risks and environmental acceptability which involves the perception of controllability,

foreseeability, safety, and adaptability to events (Lai & Tao, 2003; Lazo, Kinnell, & Fisher 2000; McDaniels, Axelrod, & Slovic, 1995, 1996; MacDaniels, Axelrod, Cavanagh, & Slovic, 1997; Willis, 2002).

Although some models which explain risk limit the possibility of understanding the phenomenon in all its dimensions, the perception of risk should be understood as a combination of objective and subjective elements in a situation in which human value is at stake (Sjöberg & Wester-Herber, 2008; Rosa, 2003), where the outcome is uncertain and the threat can be assessed in analytical (objective) (Campbell, 2006) and experiential (feelings and emotions) terms (Loon, 2002; Slovic, Finucane, Peters, & MacGregor, 2004). However, we need to bear in mind that assessment in terms of the likelihood of a risk materializing is based on personal and subjective assessment which creates concern regarding consequence less than on real probability; in other words, the interpretation of risk may be constructed socially (Kasperson, Kasperson, Pidgeon, & Slovic, 2003), given that people choose, discard, classify, and accept the risks they can cope with (Douglas & Wildavsky, 1983; Renn, 1998b; Sjöberg, 2000), and consequently their response to a threat will be centered on confidence, social inclusion, self-reliance, community cohesion, social autonomy, orientation in time, and cultural and personal factors (Douglas, 1992; Kasperson & Kasperson, 1996; Kasperson et al., 1988; Kasperson et al., 2003; Slovic, 1999; Siegrist & Cvetkovich, 2000; Salvador, 2013; Savadori et al., 2004).

Even though there is an overlap between the perception of risk and the features of the social, political, economic, and developmental setting of individuals and communities, we refer to the process of disaster when its impact and magnitude are such as to create disorder in the social system which exceeds individuals' capacity to respond. Unfortunately, it has produced false identification of risks and of the social system, due to a failure to distinguish between everyday risks, sources of vulnerability to danger, and major disasters (Blaikie, Cannon, Davis, & Wisner, 1994).

Research has found that persons who have been affected by a disaster react differently depending on their experience and social and historical context (Ding, 2007; Voorhees, 2008); after experiencing a disaster, individuals display psychological disorders like post-traumatic stress (Edwards, 1993, 1998; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Rodríguez, Navarro, & Santana, 2010), depression and anxiety (Gelbach, 2008), panic (Cohen, 2008; Davis, Tarcza, & Munson, 2009; Gaborit, 2006; Gerrity & Flynn, 1997), drug use, interpersonal conflicts (Saxena, Tiwari, & Tripathi, 2003), shock (Carlson & Rosser-Hogan, 1991; Loewenstein, 1996; van der Kokl, 1996), amnesia (Elliott & Briere, 1995), denial (Horowitz, 1993, 2003), shame, feelings

of helplessness, aggression (Gaborit, 2006), sleep disorders (Aranda, 1997), and stress (Barton, 2005).

In this context, a disaster, as an unforeseen and uncontrollable life-threatening event, produces adverse psychological consequences for the surviving victims (Jacobs & Kulkarni, 1999), generating collective stress and social crisis (Gómez, 1995), added to a state of helplessness due to lack of control over the environment which modulates the response to disaster (Suedfeld, 2012). Interaction with other people is affected as they are immersed in a process of competition and voracity for available resources; also, there is a cognitive impact which leads individuals to make mistakes in planning and performing tasks (e.g., protective behavior) and decision-making (Wickens, Keller, & Shaw, 2015). After a disaster, people attribute their situation to a disadvantaged state and the perception that they are more vulnerable than others, feelings which are reinforced by the inoperability and ineffectiveness of government institutions charged with protection from and management of risks (Salvador, 2013).

### THE PSYCHOLOGICAL RESPONSE TO DISASTER: AN EMERGING MODEL

In the last decades, research has focused on the population's response to threats, studying a broad series of climatological, geological, and technological events which have caused incalculable losses, both material and human, affecting a social system vulnerable to risk, especially in the least economically and socially advantaged sectors. In this context, it is important to study prior behaviors, both individual and collective, which are related to disasters, to the extent that they are linked to responses in risk prevention and evacuation in emergencies (Lindell & Perry, 1993). Psychological models of the individual's response to a natural phenomenon have been developed: the Protective Action Decision Model (Lindell & Perry, 1993; Lindell & Prater, 2002; Lindell, 2012; Lindell & Perry, 2012), the Disaster Preparation Model (Paton, Smith, & Johnston, 2005), the Theory of Motivation for Protection (Rogers, 1983), and the Personal Event Planning Model (Mulilis & Duval 1995, 1997), which analyze perception of risk, resources, personal responsibility, the information an individual perceives and which tends to be corroborated when exposed to a threat, the attributes of danger, assessment of coping, and motivation for protection.

The Protective Action Decision Model (Lindell, 2012; Lindell & Perry, 2012) has shown that assessments of the attributes of risk tend to facilitate: (a) identification of risks and by extension the adoption of protective measures, (b) the credibility of the authority transmitting the message, (c) the emergency message, (d) prior experience in similar situations, and (e) environmental signals (Perry & Greene, 1983; Lindell, 2012; Lindell & Perry, 2004),

and the search for and confirmation of information which influence the decision to adopt protective behaviors (Lindell & Prater, 2002). In this sense, to predict the response to the disaster, it is important to directly investigate the relationships, influence, and interactions of other social and psychological attributes, such as attachment to place, trust, perceived control, and behavioral intent regarding preparation for and response to disasters.

At present, we are developing a model of Psychological Response to Disasters (Salvador, in press), which includes an assessment of the effectiveness of processes of communicating risks implemented by experts and authorities responsible for risk management, social characteristics, the context and type of threat, perception of risk, and perceived social vulnerability. It is thought that when these variables are associated with a real threat, the response fulfills a de-adaptive function; in other words, individuals will prioritize behaviors of preparation, prevention, reduction, and evacuation in the face of a disaster.

However, aware of the influence of the cultural context in which the proposal is developed, we seek to draw attention to emotional, cognitive, social, cultural, and environmental factors which influence a person's ability to identify danger in a specific situation, which facilitates the adoption of appropriate protective behaviors, to minimize the impact of damage caused by a natural or technological phenomenon. For example, when the official response to a disaster is perceived as effective, it generates acceptance and confidence in the response to a disaster (García-Mira, Eulogio, Uzzell, Blanco, & Losada, 2005; García-Mira & Lema-Blanco, 2013; García-Mira, Stea, Eulogio, Coreno, & Elguea, 2013; García-Mira, Eulogio, Uzzell, Blanco, & Pol, 2013); thus, when a risk is communicated by a figure seen as trustworthy (for example, authorities or recognized members of the community), the perception of risk will give rise to a response to the disaster; on the contrary, when there is a lack of confidence, the response will be adaptive to the perceived threat. Likewise, collective emotional processes expressed through attachment to place, appropriation of space, and sense of community, influence the processes of perception of risk (De Dominicis, Fornara, Ganucci, Twigger-Ross, & Bonaiuto, 2015) and, consequently, the response to a disaster. On the other hand, there is evidence which suggests that persons prepare for an emergency and do not evacuate their homes when faced with a threat due to the emotional attachment they have formed with their geographic and social space because they have constructed symbolic and emotional representations based on interactions with their peers (Salvador, 2013).

It is essential to emphasize the role perceived control can play in individuals exposed to a threat which has the potential to become a disaster because, to the extent that people see themselves as self-reliant and in control

of certain effects of natural phenomena, they are more likely to adopt measures to prepare for and respond to a disaster. In other words, do people see themselves as capable of acting in response to a disaster, to safeguard their own and their families' lives? Perceived control as a predictor of behavior (Ajzen, 2002a, 2002b) allows us to explore under what conditions this variable is functional, in the sense that control can be effective when dealing with unforeseeable phenomena like earthquakes or may prove counterproductive in events like landslides, where individuals assume that they have control of the situation and decide not to take actions to prevent and reduce the threat, such as moving or reinforcing the structure of their homes, for example.

However, although theory assumes that preventive measures are determined by people's perceptions of risk and control, a mediating effect is produced by the perception of vulnerability; in other words, it is not enough to be aware that there is a possibility of being directly affected by a threat, but the person must also perceive that the loss is real because that will, in turn, determine the protective action. Therefore, once people are certain of the existence, probability, and severity of a threat, hypothetically, they should determine measures of preparation and protection to reduce risks, and such measures will truly minimize their negative consequences. Otherwise, if a person believes that the negative consequences are inevitable because protective measures are inadequate or there is insufficient time or resources to implement them, the person will not take action to safeguard himself (Gantt, 2008) and, on the contrary, will enter a state of loss of control, adaptation to the threat, and behaviors which increase the risk when exposed to or confronting the threat.

The influence of the psychological processes involved in response, especially in decision-making and processing information received on environmental attributes, permeates the individual's decision to act on a threat; for example, whether or not to take action to prepare for and prevent the risk (what processes in decision-making lead a person to stay and attempt to protect their home from the impact of a hurricane?). In this sense, processes related to decision making under uncertainty, which lead to a state of adaptation to danger; for example, it has been found that when an individual is faced with a situation of risk, the mind can use an "analytical" system or an "experimental" one based on heuristics (Slovic et al., 2004). Although Decision-Making Theory has shown how decision-making processes are based on irrational and rational processes (Kahneman, 2001, 2003), the literature on disasters focuses on the content and results of decisions made under dangerous or threatening circumstances, with scant exploration of decision-making processes under real risk factors which influence the choice between alternative responses; in this context, there is evidence that spatial

biases are related to attachment to place and therefore influence decisions on preventive actions (De Dominicis et al., 2015).

### **INTERVENTION BEFORE OR AFTER A DISASTER**

It is important to clarify that disaster response seeks to establish processes to search for actions to prepare for, prevent, and reduce risk, for which it is important to work with communities identified as vulnerable and susceptible to environmental risks before disasters occur; in this context, from our perspective the efforts of the environmental psychologist should focus on designing community interventions which facilitate understanding of risk and disaster in communities and offer training in actions to prepare for threats; prevention, reduction, and mitigation of risk; and, finally, disaster response.

This process involves designing participative strategies based on environmental threats and the social and cultural context, to implement local actions for communication of risks and environmental education, which allow members of the communities in which psychologists and other experts work to equip themselves with the technical, technological, and methodological tools they need to act before and during a disaster.

It is important to clarify that this process of disaster response must be distinguished from resilience, because the latter phenomenon may occur before and after a stressing event, disruption, or adversity and is more closely linked to mechanisms for adaptability to the disaster or disruptive event (Handmer & Dovers, 1996; Helsloot & Ruitenber, 2004; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008; Waller 2001). In this sense, efforts in the area of resilience are focused on adapting to environmental conditions which create a disaster and post-disaster recovery. On the contrary, preparation for a disaster includes a variety of measures implemented by families in homes and communities, through behaviors such as developing emergency plans, stockpiling supplies, forming response teams, and training residents for a potential disaster (Lindell, 2012; Mileti, 1993; Paton, 2000; Paton et al., 2005). Therefore, we believe that intervening before a disaster reduces the loss of human life and facilitates the process of post-disaster social and economic reconstruction.

### **THE ROLE OF THE PSYCHOLOGIST**

In studying complex natural phenomena, which are beyond our control and ability to predict, as in disasters, a trans-disciplinary approach is needed, combining the efforts of experts in different areas of knowledge, contributing the essential elements which help both scientists and citizens understand the phenomena of risks and disasters, to offer suitable tools to initiate effective processes for members of vulnerable communities to use in response

to a disaster. Therefore, the role the psychologist assumes in the study of risk and disaster should not be limited only to cognitive and emotional processes and decision-making, but on the contrary, should seek to advance understanding and comprehensive use of the knowledge generated, helping to translate what experts have constructed in their contributions and to transmit knowledge through the implementation of community intervention programs whose success is assured.

Although we know that in studying natural risks and disasters, geospace information based on geographic information systems (GIS) is indispensable: How many social scientists can interpret cartography? How many of us are familiar with international indices of vulnerability to disasters? And although it is not for us to acquire a command of all the techniques of the different scientific areas, it is important that we be able to comprehend and interpret the scientific language used, to ultimately communicate it to concerned laymen; it is at this point that we insist on a trans-disciplinary approach in studying risks and disasters.

In this context, research based on a multidisciplinary team is important, given that disaster is multifaceted and multi-causal, for which reason disciplines like geology, geography, architecture, engineering, sociology, anthropology, psychology, etc. can contribute to a comprehensive understanding of problems and provide theoretical and technical elements which help establish disaster's effects on economic, social, and psychological systems.

However, as we have remarked, the perception of risk is socially constructed when people see themselves as threatened; in this sense, psychologists need methodological tools which adapt to the social and cultural conditions of the individuals they work with, for which it is important to use multimethods in the gathering and interpretation of information drawn from people's experience, to understand disaster not only from a scientific perspective but also from the experience of persons who are vulnerable and susceptible to the harmful effects of the phenomenon.

## HOW TO INNOVATE IN THE STUDY OF RISK AND DISASTER

The challenge for environmental psychology in the face of the problems of the 21st century, and in particular in relation to natural disasters, is to understand how a given environmental problem, and in particular the risk of disaster, is socially constructed; for that reason, we propose to use innovative approaches which maximize our understanding of the phenomenon studied and in turn enrich strategies for gathering information using qualitative techniques—such as interviews, focus groups, and walkthrough—as well as use of site visits and participative reconnaissance for diagnostic purposes, which help stakeholders understand the environmental situations which

give rise to certain problems through collecting testimonies, photographic evidence, records of infrastructure and specific spatial characteristics, as well as records of imprints or remains which help to historically contextualize the impact of certain natural phenomena on the evolution of communities.

It is our view that, facing the challenges of the 21st century, there should be no limitations on our understanding of research problems; as psychologists, we should rely on creative processes to use the tools which other areas of science have developed, for example, computer systems, geolocation systems, participative planning methods focused on architectural design, social geography, and in particular social cartography for the planning of risk maps and evacuation routes which help individuals act more effectively in addressing risks.

As we have seen, to meet the challenges posed by multicausal phenomena like disasters, we promote the development of low-cost technologies needed to increase people's disaster response capacity and thereby strengthen communities in their efforts to mitigate environmental problems; notwithstanding, we insist that innovation depends on joint efforts with experts in other scientific disciplines and community involvement.

However, we need to understand that risk analysis and management need not necessarily come before and after a disaster; in the light of more recent global phenomena, we should consider that efforts of prevention, reduction, and mitigation of risks and disasters will be more effective in the long term, provided that risk management programs are implemented from the early school years, to prepare more fully aware and better-trained citizens to respond to environmental and technological threats and disasters, if we develop educational programs rooted in a culture of protection.

Although extreme natural phenomena will continue to occur, the greatest challenge for scientists, and for psychologists, in particular, is in the innovation and formulation of academic programs in the field of civil protection which offer citizens the means of preparing for disasters beyond mere adaptation; undoubtedly, it is a complex, long-term task which we must assume to help reduce rates of fatalities suffered in natural disasters.

## CONCLUSION

The proposed model allows us to expand our knowledge of the effectiveness of attributes related to preparation for risk and disaster response in a political, economic, social, and psychological context in which danger and natural, technological, and social threats are systemic. In this context, the role of the psychologist is fundamental in analyzing emotions, cognitive processes, and decision-making in the study of disasters, for which we should strive for broad-based preparation of psychologists, emphasizing the command of



qualitative and quantitative methods in social sciences and in multi- and trans-disciplinary work which allows us to creatively employ the technical, technological, and methodological tools of various areas of knowledge with the aim of strengthening individuals and communities.

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## ABOUT THE AUTHORS

### **Octavio Salvador-Ginez, MD.**

He has taught classes in psychology at private universities in Mexico. He has developed qualitative and quantitative studies about perception of environmental risk and social vulnerability in human settlements in Mexico City.  
[octavio.salvador.ginez@gmail.com](mailto:octavio.salvador.ginez@gmail.com)

### **Patricia Ortega-Andeane, Ph.D.**

She is the General Editor of the Latin American Journal of Behavioral Medicine. She has developed systematic research on aspects of the physical environment of hospitals and their impact on the generation of stress.



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# Deliberations Around Transsexuality in the Face of XXI Century Psychology

► Dayana Pereira

This chapter intends to offer the reader a purview that will allow him to contemplate the influence that the surroundings exercise over the subjective experience of comfort and discomfort in transsexual people. To do this we will treat in an precise manner how social pressure, family and work environments, as well as the influence of religion work as regulating mechanisms of conduct, ending in the peak of intolerance: the manifestations of transphobia that will help us to relate the different forms of violence to which transsexual men and women have been subjected.

Following this we will treat the subjective experience of transphobia. This section will cover all the factors that transsexual people relate to social rejection, such as transsexuality perceived as punishment and release from physical pain.

Finally, we will cover the path of identity construction, contemplating such process in the different stages of life: infancy, adolescence, and adulthood, as well as the importance that other peoples' opinions has in this construction process. This path ends with the expectations that one has about life projects and the sources of psychological wellbeing.

The difficulties that these people must face, the exclusion episodes, the aggression and abuse that they are subjected to, and the inexistence of information around the subject are the reasons that prompt this research, an investigation that



This chapter intends to offer the reader a purview that will allow him to contemplate the influence that the surroundings exercise over the subjective experience of comfort and discomfort in transsexual people.

aims to understand their reality, starting from the voices of the protagonists so we can create new ways to intervene that are adjusted to their necessities. In this sense it's proper to take into account the job that is implicit with being a psychology professional, work that must go beyond labels and diagnostics with the objective to get closer to the subjective experience of each person, trying to understand the context in which it develops, the defense mechanism it generates, its conflicts, expectations, and desires, in such a way that we can accompany them and answer their necessities, allowing them to reach their full development in the different endeavors of life.

The relationship between society and individual is developed and expressed through behavior, from living experience and from social interaction where the identity becomes a key organizing element in the relations that the subject has with himself and others, constituted at first having the sexual differences as base elements that separate the human being in opposite or “complementary” poles: male and female, elements that also establish differences in gender hierarchy: masculine and feminine (Cabral & García, 2005).

The psychological complexity of gender identity comes to the surface in the presence of transsexual men and women who feel, think, and have the conviction that their sex does not belong to them, that nature is wrong about them; given this, they desire to change their sexual identity (Cabral et al., 2005).

These identities pose important challenges to the way in which we usually conceive gender and sex, which is the reason why it is pertinent to rethink the bases that sustain a system that—far from trying to include and comprehend—excludes and stigmatizes the identities that do not have a place inside that sex-gender dichotomy.

Transsexuality is a term produced by North American medicine in the fifties, thought to categorize and label the vital trajectories of those people who were born with either the body of a man but live in feminine or that were born in the body of a woman but live in masculine.

Given this, in the U.S. and Europe the available information about transsexuality is constantly framed in medical, scientific speech of disease, of suffering, and—without a doubt—of treatment and care.

Transsexuality is typically manifested in an intense and persistent manifestation with the other sex, experiencing a feeling of inadequacy with the assigned sex, and for a permanent desire to dress, live, and be treated as a member of the other sex (Gómez & Esteva, 2006).

The Study Group for Gender Identity Disorders offers a wider definition for transsexuality, one that deserves to be rescued from its non-pathological character:

Transsexual men and women have the conviction of belonging to the sex opposite the one they were born into, with a dissatisfaction with their own primary and secondary sexual characters, and with a profound sense of rejection and a spoken desire to change surgically. From childhood their mental identity is different from their genital phenotype. They are women that feel “trapped” in the bodies of men, and men that feel “trapped” in the bodies of women; without any major psychiatric disorder that warps their perception of reality, they are people that need to be accepted socially and legally in their chosen gender (Arribas, 2008).

Body image, as well as the personal and social corpus, is fundamental in the construction of their own identity and in their determination of belonging to a group. The body is modeled and constructed according to the demands and rules of society, which is why transsexual people tend to feel eternally disappointed because they do not adapt to certain physical codes.

Common sense, as well as many scientific doctrines, all seem to agree that the differences between what is masculine and what is feminine belong to human nature, the binary order of sexes precedes any norm, social institution, or cultural significance (Fausto-Sterling as cited in García, 2009). As such, the hierarchical segmentation between masculine and feminine is implemented with rigidity, through the arbitrary naturalization of this dichotomic structure of gender that organizes the social world, surrounding things, and bodies (Bourdieu, as cited in García, 2009). Such division, based in the androcentric and naturalized principle, has a lot to do with the domination that women, transsexual, and other non-normative bodies and sexualities are subjected to. Nonetheless, this order of hierarchical segmentation that brings different manners or exclusion and violence has been strongly questioned by the feminist movements.

Butler (as cited in García, 2009) develops the concept of performativity in gender, and with that raises what is considered an internal essence of gender, manufactured through a set of actions and tenants on the sterilization of the body based on gender. One of the fundamental objectives of Butler is to question the essence of the “legitimate” gender identities, sustained in a causal relation between sex, gender, and desire, and a metaphysical conjunction of the three (Butler as cited in García, 2009). The mandatory coincidence between sex, gender, and sexual practices imposed by the heterosexual matrix organizes bodies and defines what the only legitimate and legible identities are, reducing the possibilities to be a coherent person to two finite options: woman, feminine with a vagina and heterosexual, and man, masculine with a penis and heterosexual. All other options—e.g., gay, lesbian, bisexual, transsexual, androgynous, and intersexual—appear as failures or logically impossible (García, 2009).

This rigidity in the subscription of roles that are considered socially adequate leads to the fact that people who do not comply with these models suffer social discrimination; they suffer significant discomfort, as well as confusion and doubts, about their identity.

Understanding discomfort as undeveloped potentialities and the capability of individuality in the subject leads us to a conception of health not as a lack of pathology, but as a presence of a state of well-being, in the sense of a sufficiently valid development for the subject's capacities. To be able to appreciate the degree of health, it is necessary to give attention not only to the symptoms but to the pathology, as well as to what we can call lifestyle and the way in which they satisfy their existential necessities, given that this is a better indicator of the basic tendencies of the subject, independently of whether they have created a conflictive situation (Lledó, 2009).

Mental health implies the development of lifestyles and characteristics that are personal and interpersonal as well as social- and work-oriented, which point to an integrated idea of bio-psychosocial well-being (Mebarak, De Castro, Salamanca, & Quintero, 2009).

Psychological well-being is a construction that expresses the positive feelings and constructive thinking characteristic to humans that gets them closer to themselves, which defines itself by its living subjective nature and closely relates to particular aspects of their physical, psychical, and social functioning. A person's well-being has reactive and transitory elements linked to the emotional sphere, as well as stable elements that are an expression of what is cognitive and evaluative; both aspects are tightly linked to each other and greatly influenced by personality as a system of complex interaction (Mebarak et al., 2009).

## 1. INFLUENCE OF THE SURROUNDINGS

This section discusses the means through which pressure is exercised over the subject and how these are used to regulate behavior. Society, religion, and family work together to augment in the subject a sense of physical and psychological inadequacy, delaying the encounter with themselves and countering the feeling of well-being that someone that reaches harmony with their surroundings does.

### 1.1 Social Pressure

Social surroundings push the families of transsexual people to regulate and normalize their behavior. Through criticism and mockery, a sense of shame and guilt is created with the objective of making them fit in with their specific gender stereotype.

## 1.2 Family

The relationship between the transsexual subject and their family plays a fundamental role in the construction process of an individual and in the way in which they perceive and relate with their surroundings.

Family rejection is lived as an offense to integrity, given that exclusion by the family makes them vulnerable to criticism from their surroundings, as well as being left unprotected and exposed to aggressions from strangers. In these people, the experience of abandonment and neglect is relived day to day in the rejection and incomprehension of a transphobic environment.

In this sense, Freud (1930) pointed out that alongside the loss of love from the other, on which we depend, we lose protection in the face of many dangers, being left exposed to the risk that this stronger stranger proves his superiority in a punishing way.

Transsexuality is lived by many families as a mourning process in which they have to accept that their expectations in regards to their children will not be fulfilled and that, at the same time, they have to face the demands and punishment that the social environment imposes as a result of the “failure to control” the behavior of one of its members. This generates guilt, shame, anger, and the feeling of powerlessness, just to mention some of the resulting emotions that in most cases lead to the exclusion of the transsexual person from the family group, a phenomenon which has a negative impact on the affective sphere of these individuals.

## 1.3 The Workplace

In a social and work related environment sexually typified, transsexual people face hard situations of acceptance and social exclusion, experiencing psychological discomfort in the face of a professional development that is cut short by a transphobic society.

In most cases, discrimination at work is experienced as a cause of the lack of agreement between body image and the legal identity of the person; such ambiguity alongside the pathology of transsexuality make inclusion and integration in the workplace harder for these people, resulting in them working in positions for which they are over-qualified and giving them a lower income.

## 1.4 Religion

The pressure exercised by religion creates in transsexual people a state of tension and conflict that stretches in time, augmenting their feelings of discomfort and inadequacy. Freud warned in his works about the greatest issue in cultural evolution, the sense of guilt, pointing out that “the price paid by the progress of culture lies in the loss of happiness by the growth of guilt” (Freud, 1930, p. 3060).

Some prejudices of religious purview have their origin in the judgment that the Judeo-Catholic tradition makes about any sexual behavior that does not lead to biological procreation. It is indubitable that the critical and thoughtless application of some religious precepts continues to have an effect on the attitude of many people (religious or not) and constitutes the most basic argument to attempt to justify transphobia (Barrios, 2011).

### 1.5 Manifestations of Transphobia

Phobias, by definition, are obsessive and irrational fears and aversions; transphobia is the fear and also the hate and repulsion towards transvestite, transgender, and transsexual people (Barrios, 2011). The conflicts that these people usually present are related to cruel manifestations of transphobia and the emotional response towards them, for which reason we have to identify these manifestations.

The physical and verbal aggressions that these people are subjected to generates in them a state of permanent psychic tension that causes them to perceive their environment as something hostile and threatening, finding themselves at the defensive expecting a new attack or in some cases adopting evasive behaviors that interfere in the completion of daily chores.

The aggressions and vexations that transvestite, transgender, and transsexual people are subjected to are not only a result of transphobia, but also gender inadequacy. In the case of a transsexual man, it can be seen how society pushes them to act like a man and all that implies. Putting his masculinity in the spotlight, the man is forced to prove it through aggressive behavior.

Transsexual women tend to be more judged and criticized. This is in part due to the association that has been established between transsexuality and prostitution, reason why the criticism, offenses and actions are directed to denigrate them not only for being transsexual but also for being women linked to this occupation.

These physical and discursive actions are tightly related to the historical becoming of patriarchy, a system that has used the imposition of its values to exercise control over the subordinate alternatives that the system has configured to assert itself (Segarra & Carabí, 2000). These humiliations and vexations can be read as a form of control, as attempts to discipline and bring order to the body (Martínez, 2011).

It is evident how society punishes, albeit in different ways, both men and women for not adapting to their assigned gender. It is even bigger evidence of greater intolerance of female transsexuals, as it seems that surrendering the female social category for that of the masculine is still considered a step upward on the social ladder; meanwhile, the passage from man to woman means the contrary (Bem as cited in Fernández, 2006).

## 2. THE SUBJECTIVE EXPERIENCE OF TRANSPHOBIA

The most destructive experiences of people's emotional sphere are, in general, rejection and guilt, both present in the common experience of the overwhelming majority of the transsexual population in transphobic societies. This dimension includes factors that favor environmental social rejection, violence, and exclusion.

### 2.1 Factors That Favor Social Rejection

Within the LGBTI community there are subgroups formed by lesbian, gay, bisexual, and transsexual people that try to reaffirm their identity by stating the differences between them. In this process there are a series of practices that exclude and discriminate others, which is why they do not accomplish the protection of respect and acceptance that they need from their environment. Sherif (as cited in Puertas, 2004) warns in her theory about conflict that happens when various groups compete for goals or incompatible resources. This produces a deterioration of the image of the outer group, and thus a negative stereotype about people of this community has been created.

One of the social functions of these stereotypes is to justify certain behaviors towards the members of these groups (Tajfel as cited in Puertas, 2004), and because of that, manifestations of intolerance and rejection are usually justified by the negative characteristics attributed to the stereotype. Another one of the functions is to illustrate the behavior of the LGBTI community through stereotypes that make the subject protect and defend their system of values and even stereotypes. The sharing of it makes it stronger, requiring more information and evidence to prove it wrong (Tajfel as cited in Puertas, 2004). This is why better sex education based on respect of what is different is necessary, one that questions gender stereotypes instead of legitimizing them.

### 2.2 The Perception of Transsexuality as Punishment

There still exists a series of negative connotations around transsexuality that stains the self-determination of these people as evil, making them feel inadequate, deviant, and monster-like. Many people perceive transsexuality as a fatality, as a condition that escapes from their control, which is why they tend to delegate the guilt to the individual's upbringing, god, or nature.

These people live with the load of that one who has a debt with humanity, with the guilt of not fitting in with the preordained order, with the stern conviction that they must repair in some manner their mistake, that one of being different.

One of the resources that culture uses to control the behavior in people is the sense of guilt. That share of aggression that is internalized and direct-

ed to the self accomplishes a very efficient sanctioning function because it manifests itself under the manner of need for punishment (Freud, 1930).

As such, the transsexual will be the crazy man or woman, the one to be reigned in, because they represent the chaos, the disease, but above all because they threaten the masculine and patriarchal might (Martínez, 2011).

### 2.3 Suicide as Escape From Psychical Pain

The suicide attempts that a great section of this population tries are evidence of how the violence and aggression to which they are subjected by their environments is internalized. It continues through the autolytic attempts that have as an objective to put an end to the state of tension and suffering caused by a series of traumatic experiences.

### IDENTITY CONSTRUCTION

Identity construction is a process that begins at childhood and goes on throughout one's entire life. In the case of transsexual people, the action of finding information and orientation constitutes the first step in empowering their identity, accomplishing with this the beginning of the changes necessary to adequate themselves to their corresponding gender.

In this sense the study on identity construction in transsexual people carried out by Altamirano, Arias, and Orellana (2012) shows how the search of these people ends with the discovery of transsexuality as a category; this creates in them a "realization," a process strongly bonded with the access to information. This concurs with what Echeverría proposed (as cited in Altamirano et al., 2012) when he stated that through language these people start configuring their representation of the world and with that they start constructing their identity.

In this way they find in the term transsexuality a significance through which they can define an identity with which they can be comfortable. This change that happens in language with labels that serve as categorization produces a transformation in their experiences and in the way in which they see themselves. This process of "realization" comes with a great sense of relief associated with the discovery of answers to multiple questions, the awareness of not being the only ones, and the fact that there are more people with similar experiences (Altamirano et al., 2012).

To conclude we must see that transsexuality carries a discomfort that does not only manifest itself because of the mismatch between mind and body but also because of the consequences that this has inside of societies like ours and the refusal to adapt to the rigid concept of gender that has as a base sexual differentiation. In this way everything that does not reproduce the heterosexist pattern of behavior is strongly punished by society, creat-



ing in the individual dissatisfaction, shame, and rejection towards themselves, making them internalize the anger, the hate, and the aggression that they have received from their environment, feeling inadequate and guilty for not answering to the social demands that their sex implies.

Family rejection, dropping out of school, discrimination, exploitation at work, and difficulties to establish relationships are due to transphobic discrimination, and these are some of the factors that diminish the quality of life of these people; this has been shown by previous investigations (Missé & Coll-Planas, 2010; Rocha & Pinto, 2012).

Nonetheless, an important finding of this investigation has to do with the associated discomfort related to the emotional and psychological wear that happens from searching continuously for an example with which they can identify. This, alongside the factors that we have talked about before, drastically restricts the personal and professional development of these people, increasingly reducing their possibilities to reach different ways of having a healthy life.

As we have explained in this chapter, the concept of mental health cannot be limited to the presence or absence of a disease; it must take into account the development of lifestyles and the personal characteristics that aim towards a unified vision of well-being. The fulfillment of the gender role—that gives sense and coherence to one's identity—implies filling a position for which there has been the proper training and for which the subject has to earn what is due. All this raises a feeling of being competent, capable, satisfied, autonomous, and free. The importance of values like loyalty, respect, and solidarity in relationships—as well as a sense of belonging and security that the support of others provides—are but some of the sources of comfort that transsexual people studied here express.

It is important we take into account the work that we have to do as health professionals, one that has to go beyond diagnostic labels and categories to be able to get closer to the subjective experience of each person, to comprehend the context in which this person develops, the defense mechanisms they develop, their conflicts, expectations, and desires, in a way in which we can accompany them in answering their necessities, allowing them to reach a proper development in the different aspects of life.

The transgenic and transsexual identities are not a call to unrest, licentiousness, and chaos; they are a call to reflect upon the rigid way in which the sex-gender system has been conceived, on how some religious tenants are applied without thought, and on the way in which we relate to those who have a gender expression or sexual orientation different than our own. They are a call to respect and to the acceptance of diversity.

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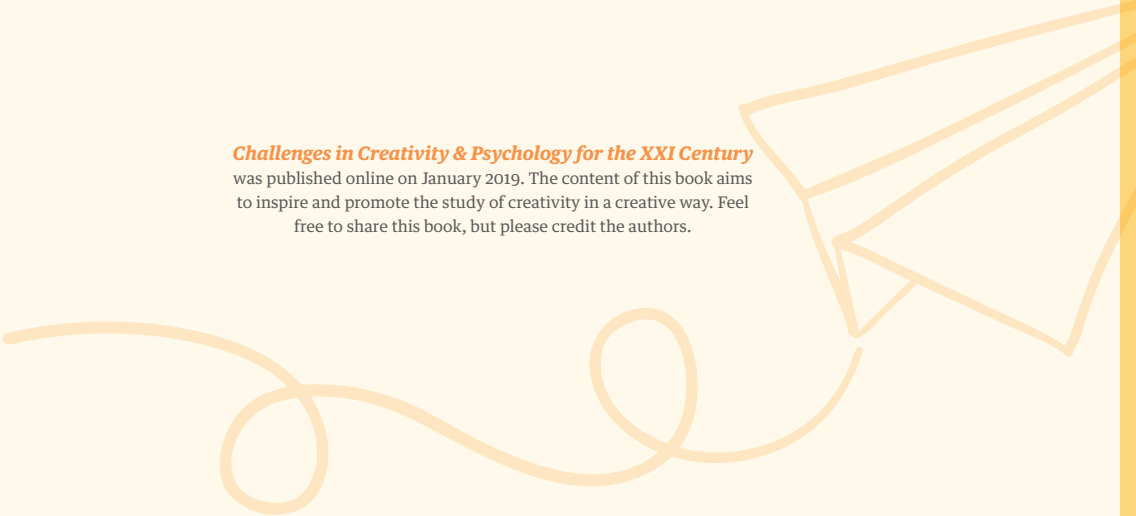
## ABOUT THE AUTHOR

### Dayana Pereira, PsyD.

She has developed her career in the defense of Human Rights, with special attention to topics related to Sexual and Reproductive Health. Psychological discomfort in transsexual people from the perspective of dynamic psychology, is one of her relevant research and interest topics.

[pereira.dayana.c@gmail.com](mailto:pereira.dayana.c@gmail.com)



An abstract graphic composed of several thick, orange lines. On the right side, there are several overlapping, angular shapes that resemble a stylized paper airplane or a series of connected triangles. From the bottom left, a single, continuous, wavy line loops and curves across the lower half of the page, ending near the center of the text block.

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