

**ARTICLE**

# The Mindset of Innovation: Contributions of Cognitive and Social Psychology

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ABSTRACT

In order to consider anything as new, individuals have to accept it as possible. To consider it as innovative, a person has to see it as necessary. These two concepts, derived from Piaget's theory (1987), are key elements for the analysis of innovation mindset. Theoretical framework explains how "opening up for new possibilities" implies overcoming pseudo impossibilities, and how possibilities are built up alongside individual development. In short, an innovation has to be considered possible and necessary, feasible and viable. Thus, the cognitive processes involved in defining what is possible, and accepting what doesn't have to be the old way, are crucial mental structures subjacent to innovations' decision making. This study examines mindset through mental models, cognitive processes and executive functions, as well as Piaget and Gestalt theory's contributions. The empirical investigation involved a search for articles published on the theme between 2019 and 2021, concluding that they apply the innovation mindset definition, taking for granted the psychological mechanisms inlayed in it. The article also points up to the gap between management and psychology, indicating the urgent need of interdisciplinary studies, due to the mutual benefits for both sciences and also, better comprehension of the constructs.

## 1. Introduction

Traditionally considered as a topic of management studies, innovation gets, here, a new approach, through the lens of cognitive and social psychology. Besides understanding why and how people create startups, new artifacts, or studying how to enhance the key factors which

can lead to more successful businesses, the investigation of the mindset of innovation brings up classical scholars of cognitive psychology, as Piaget, and mental models, as in Johnson-Laird, to discuss this kind of mindset.

Although some of the articles, published on this subject, point it up to social psychology behaviors of an innovative person <sup>[1]</sup> or to the personality traits favorable

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to it <sup>[2]</sup>, they do not approach the psychological theories from which the concepts are originated.

The present study goes deeper and further, aiming to understand the cognitive facets of the mindset of innovation. With this purpose, Piaget's theory opens up the investigation. Recognizing possibilities, as well as overcoming pseudo impossibilities, are the core elements for innovative way of thinking.

From the theory of executive functions, stands out the concepts of mental flexibility, self-regulation and choice, which help understand the dynamic of mind favorable to innovation.

Mental models, studied, among others, by Johnson-Laird, follows the analysis, adding issues as inference, premises, which, related to innovation mindset, may lead, eventually, to cognitive biases.

Gestalt's theory, with the concepts of productive thinking, elucidates the fact that innovation, as a figure, has to be seen together with its ground, that is, the context in which it comes up. The dynamic of figure – ground has to remain flexible, changing with each new figure, or with the shifts in the context or environment in which innovation is inserted. As the scenarios are extremely volatile, this mental flexibility is crucial for as innovation mindset.

Those important theoretical contributions do not show up in the articles analyzed through mindset innovation's lens, as shown in the results.

## 2. Objective

The present article presents Gestalt's theory, mental models, and executive functions theory, as well as Piaget's contributions, discussing how they relate to the mindset of innovation, an important issue of innovation management. Through the analysis of articles published between 2019 and 2021, it aims to identify the presence – or absence - of these theoretical aspects in the studies.

## 3. Material and Methods

As a qualitative study, the present study initially describes the theoretical framework, regarding psychological aspects of innovative mindset. This step generated six key words, which were the basis of search in articles published on top Journals on Management Innovation and Psychological Research about the subject, between 2019 and 2021.

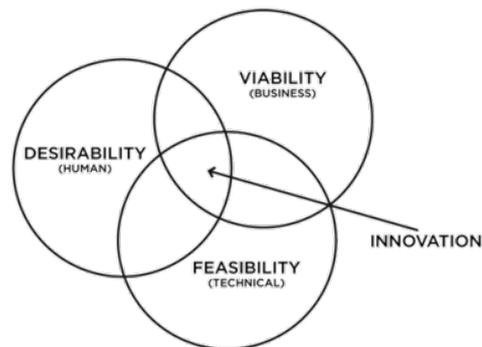
## 4. Theoretical Framework

In this section, first, theoretical aspects are presented, followed by the key words extracted from it, to embed the research of the articles about the mindset of innovation.

### 4.1 The Mindset of Innovation: Design Thinking

One of the most popular approaches towards innovation is design thinking. Tim Brown, from IDEO consulting company, defines it as “a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success” <sup>[3]</sup>.

As in Figure 1 below, each circle refers to one of these attributes of innovation: feasibility (technical), viability (business), desirability (human):



**Figure 1.** Design thinking. Source: IDEO

All the attributes are integrated and have to be seen as so. Deciding what is desirable and what is not is a subjective mental operation Gestalt's theory helps to explain. Business viability, by its turn, demands analyzing premises and making inferences, among other mental operations, which the theory of mental models supports well. Moreover, feasibility depends on a mindset open to possibilities, as well as to overcoming pseudo-necessities and pseudo-impossibilities. Thus, Piaget's study supports the analysis and opens up the theoretical framework of present study.

The mindset of innovation: Piaget's contributions

In one of his latest papers, Jean Piaget, great epistemologist and cognitive psychologist, presents a comprehensive study on how two linked sets of abilities develop:

- a. The ability to think about how things might be, or might have been, different from the way they are;
- b. The ability to notice limitations on possibilities, i.e. what is necessary or impossible” <sup>[4]</sup>.

Piaget based his work on a series of experiments with children, who performed differently, according to their chronological ages, corresponding to stages of cognitive development. In other words, subjects of the experiments responded to problem setting, recognizing – or not – possibilities and facing pseudo impossibilities, according to an order of phases <sup>[5]</sup>.

Possibilities can always be actualized, due to potential forces of matter, here understood as substance. That is to say, any substance can assume many and different shapes, explaining why creative solutions bring about new possibilities of matter, for example.

Understanding the essence of something is crucial to analyze innovations, because of the transformation of the object, be it a new shape, color or packing, which will be called incremental innovations, or a radical, breakthrough change at its core substance / matter.

By distinguishing possibilities from pseudo possibilities, and necessities from pseudo necessities,<sup>[5]</sup> open up new avenues for comprehension of innovative mindsets.

Say the authors: “For subjects of level 1, pre-operatory, [...] the central difficulty [is]: real is what it is, and it is necessary that it is this way, thus, excluding other possibilities”. In other words, pseudo necessities pop up, and the child can't imagine other solutions, due to the pseudo impossibility.

It is possible to classify these “subjective” impossibilities or pseudo impossibilities in two categories: a) the person believes, wrongly, that something is possible, and b) he (or she) believes it is impossible, because, supposedly, it corresponds to pseudo necessity<sup>①</sup>.

Piaget's cognitive theory defines necessity as a product of subject's inferential compositions, that is, also, non-observable. Observable and generalizable are more or less synonyms, according to a person's point of view, but what is general is not necessarily necessary; thus, its assimilation can lead to pseudo-necessities<sup>[5]</sup>.

Subjects of next level (of cognitive development) are able to reflect, asking if the thing has to be that way, or if there are other possibilities derived from the reflection. Curiosity is a natural consequence of this process and enhances creativity, as well.

In Piaget's theory, reality is a subjective construction. In order to attain more objectivity in adult's life, during his (or her) development, a child must overcome pseudo-necessities and pseudo-impossibilities, as a way to, mentally, form new possibles<sup>[6]</sup>.

According to this theory, an adult who overcomes those pseudo-impossibilities is more likely to maintain the flexibility of thought, be at his (or her) projects, or at coping with adversities, without stiffness they can cause.

In sum, creativity and mental flexibility is continuous actualization of possibles, through overcoming pseudo-necessities<sup>[5]</sup>.

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① In this case, the person believes that the substance, thing, person, or situation, needs to be that way (shape, color, matter, are examples of those “need to be” this way; the belief is that's how reality is).

Piaget's theoretical framework explains how “opening up for new possibilities” implies overcoming pseudo impossibilities, and how possibilities are built up alongside individual development. Moreover, this same framework contributes for better comprehension of the evolution of necessary, which is parallel to possible. In short, an innovation has to be considered possible and necessary, feasible and viable. Thus, the cognitive processes involved in defining what is possible, and accepting what doesn't have to be the old way, are crucial mental structures subjacent to innovations' decision making.

From Piaget's theory derives the key-word pseudo impossibilities to the article's search, explained in Methods section.

Piaget's theory is only one of the important contributions of Cognitive and Social Psychology to the study of the mindset pro-innovation. Following, the present paper discusses executive functions with the same purpose.

#### **4.2 The Mindset of Innovation: Executive Functions**

“Executive functions (EFs) enable mentally playing with ideas; taking the time to think before acting; meeting novel, unanticipated challenges; resisting temptations; and staying focused”<sup>[7]</sup>.

Cognitive flexibility implies creatively thinking “outside the box,” seeing anything from different perspectives, and quickly and flexibly adapting to changed circumstances. Besides, a response inhibition helps in self-control—resisting temptations (the first idea which comes to mind is not always the best one), and resisting acting impulsively. In problem solving, interference control means keeping selective attention and cognitive inhibition.

Important to say EFs are trainable and can be improved with practice, including diverse methods tried thus far<sup>[7]</sup>. All of them depend upon overcoming pseudo impossibilities and pseudo necessities, as well.

From executive functions' theory, the expression mental flexibility pop-up and was included in the article's search, explained at Methods.

#### **4.3 The Mindset of Innovation: Self-regulation and Choice as Executive Functions**

Self-regulation is another one of the self's major executive functions. It refers to its active, intentional aspects<sup>[8]</sup> and “may be thought of as that part of the self, which is ultimately responsible for the actions of the individual”.

The other major executive function of the self is choice. “Not only may a self-initiate behavior or control it, but

a self also is responsible for deliberating and making choices from among the universe of possible options”<sup>[8]</sup>. For the authors, choice and self-regulation are intertwined, and they often work in concert to achieve novelty and diversity in human behavior.

Executive function is also called the “agent” or “agentic aspect.” The first aspect of self was a knower and a known, the second a believer or member, but this third aspect is a doer. By means of its executive function, the self exerts control over its environment (including the social environment of other people), makes decisions and choices, and regulates itself<sup>[8]</sup>. Concepts like self-efficacy and agency<sup>[9]</sup>, locus of control<sup>[10]</sup>, and others, could enhance deeper comprehension of this particular executive function.

“Self-regulation refers to the self altering its own responses or inner states. Typically, this takes the form of overriding one response or behavior and replacing it with a less common but more desired response”<sup>[8]</sup>.

Technically speaking, a self does not regulate itself directly, but it may control behaviors, feelings, and thoughts that it comprises. In this sense, self-regulation refers to the regulation of processes by the self.

Authors also state: “When self-regulation works well, it enables people to alter their behavior so as to conform to rules, plans, promises, ideals, and other standards. When it fails, any one of a broad range of human problems and misfortunes can arise”<sup>[8]</sup>.

Important to notice that being agent also depends on overcoming pseudo impossibilities in this sense.

The authors discuss self-regulation in the context of (supposedly) irresistible impulses: “In everyday life, people seem to have a ready explanation for failures at self-control: ‘I couldn’t resist’. [It means] that certain impulses are irresistible, and so they overwhelm the powers of the self. This view depicts self-control as a struggle between the strength of the impulse and the strength of the self, and whether the person resists temptation depends on the strength of the impulse. Somehow, apparently, neither nature nor nurture has provided people with strong enough power to resist many of the temptations they encounter, or so they say”.

The statement confirms the importance of the development of executive functions for innovation mindset, because, as mentioned above, the first idea, which comes to mind, is not always the best one; thus, resisting acting impulsively can be detrimental to new ideas<sup>[8]</sup>.

Self-regulation was the expression selected for the search, as explained at Methods section.

#### **4.4 The Mindset of Innovation: Mental Models**

That is the nature of many problems about the mind: we are so familiar with the outcome of its operations, which are for the most part highly successful, that we fail to see the mystery<sup>[11]</sup>.

Human beings form mental models, which enable them to understand discourse, and both the real and the imaginary issues. The problem with those models relies on internal consistency versus reality.

Mental logic, that is, logic laws, are different from physical laws, because mental entities are representation of something and, from the object to its mental representation, different laws and potential biases operate in the inner world of a subject.

The many different logics of different subjects can be explained by the resolution of possibility / necessity binomial. Both axiomatic reasoning (true x false), and inference processes show the cognitive stage of an individual and the resolution he (she) achieved.

From the definition of inference, it is possible to understand the problem of internal consistency versus reality, and apply this understanding to innovation mindset.

According to Johnson-Laird<sup>[11]</sup>, inference is “a process of thought that leads from one set of propositions to another”. Typically, it proceeds from several premises to a single conclusion, though sometimes it may be an immediate step from a single premise to a conclusion. In this process, mistakes correspond to invalid conclusions, even if they are based on valid premises. The author explains: any argument is guaranteed by the inexistence of a counter-argument, that is, the inference is valid if there are no premises, which deny the conclusion. According to the author, seeking confirmation is different from not disconfirmation Johnson-Laird<sup>[11]</sup>. That's why, whenever dealing with this mental process, one should look for a counter-example. That explains why spontaneous inferences, as heuristics, can be fallacious.

Interesting to say that in most apps, the auto-correct function can lead to mistakes: the individual is trying to express something, when the app completes the word, phrase or sentence automatically, according to the artificial intelligence database. The human-machine relationship is influenced, according to Johnson-Laird<sup>[11]</sup>, by the following: if the inference rule is active in one's mind, it will be automatically applied, regardless of the proposition's content. The same phenomenon can happen when the individual is reasoning or making decisions, pointing out to resisting temptations, one of the executive functions, previously mentioned.

In short, “reasoning depends on imagining the possibilities compatible with the premises, and drawing conclusions from these mental models”<sup>[12]</sup>.

Moreover, according to the mental-model theory of deductive reasoning, “reasoners use the meanings of assertions together with general knowledge to construct mental models of the possibilities compatible with the premises. Each model represents what is true in a possibility. A conclusion is held to be valid if it holds in all the models of the premises”<sup>[12]</sup>.

Important to detach this last conclusion as related to Piaget's theory of possibilities, although it points up to the biases, which may come up when reasoning about what is possible, based on false premises, leading to pseudo-impossibilities, for instance.

Within the subject of mental models, Besnard, Greathead & Baxter (2004)<sup>[13]</sup> highlighted a psychological phenomenon affecting the accuracy of mental models. “It occurs when two consecutive events happen as expected by an operator. Typically, such a situation reinforces the confidence in one's mental model. However, consecutive events can happen as a random co-occurrence, for reasons that actually differ from the ones believed by the operator. Nonetheless, because of the consistency between the environmental data and the operator's expectations, one event can be taken to be the cause of the other. When this false belief happens, the mental model is erroneously assumed to be valid”. They discuss this phenomenon and its potential disastrous consequences, concluding, “Humans tend to consider that their vision of the world is correct whenever events happen in accordance with their expectations” (p. 2)<sup>[13]</sup>. Besides, “humans tend to treat the available evidence as exhaustively reflecting the world, erroneously believing that they have understood the problem at hand”. Obviously, this mindset is not favorable to innovation.

Inference was selected as a key word for the empirical research, explained at Methods.

#### 4.5 The Mindset of Innovation: Gestalt's Contribution

As a theory of perception, Gestalt's principles are important tools for those who are interested in innovation, because perception is not a faithful copy of reality, and, thus, realizing what is new, as well as distinguishing it from habitual objects, is always challenging.

Gestalt, school of psychology founded in the 20th century, provided the foundation for the modern study of perception. Gestalt theory emphasizes that the whole of anything is greater than its parts. That is, the attributes of the whole are not deducible from analysis of the parts in

isolation.

The word *Gestalt*, in modern German language, means the way a thing has been “placed,” or “put together.” There is no exact equivalent in English. “Form” and “shape” are the usual translations. In psychology, the word is often interpreted as “pattern” or “configuration”<sup>[14]</sup>.

Differentiating sensation, captured by human senses and explained by physiology, from perception, a psychological phenomenon, Gestalt founders<sup>[15-17]</sup> introduced one of the most important paradigms in psychological science, that is, what is real for an individual is not necessarily identical to what is captured by his (or her) senses.

For those pioneer scholars, reality is codified by complex mental processes, which occur between stimuli, captured through sense organs, and the perception of them.

Originality, one of the main attributes of creative ideas and, thus, to innovation, is not easy to identify, because it frequently defies logical reasoning. So, the challenges of any evaluation process includes dealing with the influence of stereotypes, prejudices, previous experiences, cognitive biases, and other cognitive mechanisms.

Gestalt theory tries to understand the laws of our ability to acquire and maintain meaningful perceptions in an apparently chaotic world. Its central principle is that the mind forms a global whole with self-organizing tendencies. Moreover, Gestalt's law of past experience implies that under some circumstances visual stimuli are categorized according to past experience and says that If two objects tend to be observed within close proximity, or small temporal intervals, the objects are more likely to be perceived together, as in Figure 2, below.

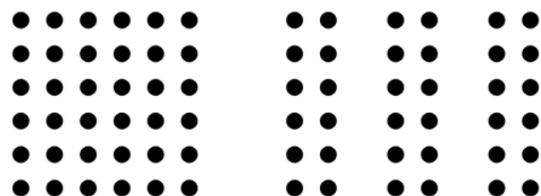


Figure 2. Gestalt's law of proximity (author).

Another important contribution of Gestalt theory is the distinction between reproductive and productive thinking. The first one considers solving a problem with previous experiences and with what is already known, while a productive one involves solving a problem with insight. Reproductive thinking is the most common way of thinking. For example, when a person is given several segments of information, he/she deliberately examines the relationships among its parts, analyzes their purpose, concept, and totality, he/she reaches the "aha!" moment,

using what is already known. Understanding, in this case, happens intentionally by reproductive thinking. Productive thinking implies quick insightful unplanned response to situations and environmental interaction.

Although reproductive thinking is the most common way of reasoning, it is far from being the best one for decision-making about innovative ideas, for obvious reasons.

To detect and perceive new as, indeed, new, implies a process involving figure and background, that is, the innovative “object” tends to be opposed to the previously existing, or known, one, or compared with earlier mental images catalogued by the brain.

Figure – ground segregation is also a concept, which explains how defined and salient figures are perceived against undefined grounds, once those “objects” can only be noted when separated from their grounds. Figure, in this case, alludes to what is perceived by the individual (or the individuals, in general), while ground relates to the context in which the object is engraved. A didactic and very well known example is the Rubin vase (Figure 3), developed by the Danish psychologist Edgar Rubin, presenting to an observer two valid interpretations: a vase silhouette (chalice) or the profile of two human faces<sup>②</sup>.



**Figure 3.** Vase of Rubin<sup>[18]</sup>.

The Rubin vase shows the displacement of observer's focus point implies the perception of one – or other – figure, meaning the interference of subject's perspective or point-of-view, consequently overcoming a simple capture of stimulus by sense organs.

An example of how Gestalt's theory contributes to the comprehension of innovation management refers to the

process of design thinking, mentioned above. As a verb in German, Gestalten means get into a form. One of the phases of design thinking, prototyping, means giving format to ideas, which, then, can be tested in “real world”, proving to be viable, possible, or being discarded, for not fulfilling one of the criteria – feasible, viable, or desirable.

Figure-ground and productive thinking were the expressions which derived from Gestalt's theory for the research on innovation mindset.

## 5. Results

As previously mentioned, from theoretical framework presented, emerged the words and expressions: a) pseudo impossibilities; b) mental flexibility; c) Self-regulation; d) inference; e) figure-ground and f) productive thinking. Each of them was introduced in the search mechanism of the selected Journals, aiming to realize if they embedded some of the articles published on innovative mindset studies.

A previous research, through Google Scholar focused in the articles published on the subject within 2019 – 2021 period, in order to identify their presence or absence of those terms as part or as foundations of the reasoning.

Next step consisted in identifying the top Journals with most publications on theme, in the period.

With the expression “innovation mindset” in the title, Google Scholar showed six articles and with this expression in the content, four.

Next step, identifying if those publications share a common Journal, resulted none. Thus, the ten articles, plus the ten Journals, were searched with the key words and expressions previously detected. As a complement, the search included the names of Piaget and Gestalt, again with no results.

Results are shown in Table 1 below, followed by comments.

As shown in Table 1, the majority of the articles does not mention any of the psychological aspects pointed up by the theories previously approached, be Gestalt, Piaget or mental models. Nevertheless, some of them allude to other important issues not considered when theoretical framework was built.

One good example appears in Eason & Mazzei (2019)<sup>[21]</sup>, who include in their study the cognitive biases, a contemporary subject for Behavioral Economy, or Economic Psychology. Also, Harsono & Fitri (2020)<sup>[22]</sup> include the resilience as a subject in their study, enhancing, thus, the theoretical field.

By its turn, the article of McLaughlin & McLaughlin (2021)<sup>[23]</sup> refers to creativity when writing about innovative mindset. Finally, the term bureaucracy shows

② The phenomenon, studied by Rubin, and also by many other scholars of Gestalt's theory Gestalt (Wertheimer & Wertheimer, 1959; Koffka & Cabral, 1975; Kohler, 1980) was the optic illusion

**Table 1.** Articles on Innovation Mindset 2019 – 2021 (author)

AUTHORS / TITLE	JOURNAL	Pseudo impossibilities	Mental Flexibility	Self-regulation	inference	Figure-ground	Productive thinking	OTHERS
Engelsberger, A., Halvorsen, B., Cavanagh, J., & Bartram, T. (2021) <sup>[25]</sup> . Human resources management and open innovation: the role of open innovation mindset	<i>Asia Pacific Journal of Human Resources</i>	NO	NO	NO	NO	NO	NO	
Eason, C. C., & Mazzei, M. J. (2019) <sup>[21]</sup> . Teaching and Doing Strategy as an Intentional Strategic Innovation Mindset	<i>Journal of Strategic Innovation and Sustainability</i>	NO	Curious flexibility	NO	NO	NO	NO	Cognitive biases
Harsono, A. A., & Fitri, S. (2020) <sup>[22]</sup> . Innovation mindset: SMES vs startups	<i>International Journal of Business and Economy</i>	NO	NO	NO	NO	NO	NO	Resilience
Fitri, S., & Pertiwi, (2019) <sup>[26]</sup> . A. Innovation mindset model at the early stage startup with Berkeley innovation index approached	<i>Technology Management</i>	NO	NO	NO	NO	NO	NO	
Muhamad, M. S. (2019) <sup>[24]</sup> . Open management and role in developing the innovation mindset of managers.	<i>AL-MANSOUR JOURNAL</i>	NO	NO	NO	NO	NO	NO	ARAB bureaucracy
McLaughlin, L. A., & McLaughlin, J. (2021) <sup>[23]</sup> . Framing the Innovation Mindset.	<i>Issues in Informing Science and Information Technology</i>	NO	YES	NO	NO	NO	YES	Creativity
ARTICLES WITH THE EXPRESSION INNOVATION MINDSET IN THE CONTEXT								
Sahasranamam, S. (2020, May) <sup>[27]</sup> . How coronavirus sparked a wave of innovation in India	<i>World Economic Forum.</i>	NO	NO	NO	NO	NO	NO	
Nunes, A. C. B., & Canavilhas, J. (2020) <sup>[28]</sup> . Journalism innovation and its influences in the future of news: a European perspective around Google DNI Fund initiatives	<i>Journalistic Metamorphosis</i>	NO	NO	NO	NO	NO	NO	
Muftahu, M., & Jamil, H. (2021) <sup>[29]</sup> . Sustainable knowledge flow and innovation in higher education: the implementation of change management in universities	<i>International Journal of Innovation and Sustainable Development</i>	NO	NO	NO	NO	NO	NO	
Urze, P., Rosas, J., Tenera, A., & Camarinha-Matos, L. M. (2019) <sup>[30]</sup> , September). Open Innovation Practitioners Mindset on Risk	<i>Working Conference on Virtual Enterprises</i>	NO	YES (*)	NO	NO	NO	YES (*)	

up in the article of Muhamad (2019) <sup>[24]</sup>. Although written in Arab, with no translation into English, the term appears in its abstract.

In sum, the articles, here analyzed, apply the innovation mindset definition to different situations, taking for granted the psychological mechanisms inlaid in it, although some of them mentioned theoretical issues not previously considered in the present framework.

## 6. Conclusions

As a theoretical study, it only touches the surface of the problem. It indicates the urgent need of interdisciplinary studies, due to the mutual benefits for both sciences – Management and Psychology - and for a better comprehension of the constructs.

The articles were most published in Management related Journal; none in Psychological ones. The search confirmed the trend to take for granted the innovation mindset definition itself and or the psychological processes to attain it, and focus on adoption of the innovation mindset, for example, or on the need of it in different innovative environments and situations.

Theoretically speaking, innovation mindset is, in short, a special kind of mindset, a peculiar way of thinking about problems, a particular look at uncertainties, besides the competence to deal with them, as say Salerno & de Vasconcelos Gomes (2018) <sup>[17]</sup>. It requires: a) overcoming pseudo impossibilities and pseudo necessities (thing is what it is? cannot change?); b) flexibility for segregating figure – ground (see figure and context in different contexts); c) resisting the first idea that comes to mind; d) avoid conclusions and inferences based on consecutive events; e) self-regulation.

The rooted habits, which fix the mind in known mental paths, create an inner environment not favorable to creativity and innovation. Dealing with this is a permanent challenge to those individuals who want to develop innovative projects. A free and creative spirit is the foundation of innovative behavior. Beyond new ventures and startups, creativity and innovation is the basis of an autonomous subject.

The present study presents several limitations, among which the quest of rational versus irrational choices, an important issue that has been studied by Behavioral Economy. As say Tomasello & Call (1997) <sup>[18]</sup>, “Most social sciences currently have a significant contingent of researchers whose research is based on a rational choice model. That is, they assume that people appraise their options and choose on the basis of what will further their self-interest in the long or short term”. Same authors conclude: “Rational analysis is a distinctively human

process. As far as research has shown, no other animals engage in rational analysis, which presupposes free will”. Future studies could investigate this important issue.

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