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# Potential Originality and Effectiveness: The Dynamic Definition of Creativity

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Given the central role of creativity in the future post-information society, a call for a pragmatist approach to the study of creativity is advocated, that brings as a consequence the recognition of the dynamic nature of this phenomenon. At the foundation of the proposed new theoretical framework lies the definition of creativity itself, which is turned from static to dynamic through the introduction of the concept of potential originality and effectiveness. Starting from this central definition, and through the introduction of the auxiliary definitions for focus area, creativity goal, creative agent, creative potential of an agent, creative potential of an environment, creative process, product of a creative process, creativity potential of a process, representation of the product of a creative process, and estimator, we arrive at the definitions of creative achievement and creative inconclusiveness. Although both aspects are key in the creative process, creative inconclusiveness was not part of previous definitions, but it is argued that its role is fundamental for effective education in creativity. The new definitions are shown to have full backward compatibility with the extant corpus of scientific research in creativity, as well as forward effectiveness in suggesting novel investigation approaches to support the consideration of new theoretical hypotheses.

## PRAGMATIST REQUIREMENTS FOR THE DEFINITION OF CREATIVITY

It should be considered both natural and appropriate that the scientific study of creativity began in the realm of persons universally identified as geniuses, the most significant testimonials of this fascinating human capacity, along the lines of the historiometric approach introduced by Galton (1869). Although this line of research has continued to be fruitfully pursued (Albert, 1983; Eysenck, 1995; Simonton, 1984, 1988), since Guilford's presidential address (1950) attention has progressively shifted to the democratization of the phenomenon, comprising the study of qualities and abilities that

can sustain creativity in all individuals (Guilford, 1959; Runco, 2004; Torrance, 1988), their mental processes (Basadur, Runco, & Vega, 2000; Mednick, 1962; Sternberg, 1988), as well as the socio-cultural dimensions of creativity (Amabile, 1996; Csikszentmihalyi, 1988; Glăveanu, 2010; Sternberg & Lubart, 1995). Today, it can be argued that times are mature for a third wave to be launched, in which creativity will not only be accessible to everyone, but it will essentially be the prime skill and talent for all human beings. Such a strong statement can be justified by observing the present trends characterizing the information society (Corazza, Pedone, & Vanelli-Coralli, 2010), as well as the forecasts on its medium-long term evolution (Brynjolfsson & McAfee, 2014). In fact, in today's society, where technologies are transforming information into a mere commodity at the disposal of anyone who can access networked resources, the dignity and self-esteem of human beings cannot be related any longer to the mere possession of knowledge and know-how, but rather to the transformation of that knowledge for the generation of new ideas, concepts, and artefacts starting from the shared layer of extant information. But the future appears even more challenging (Brynjolfsson & McAfee, 2014), as the computational power of machines continues its apparently unrestrainable exponential growth, leading to forecast models of economy and society where the role

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of humans is definitely transformed and ever more intertwined with technology. In this new social ecosystem, evolved forms of artificially intelligent agents will be in active control in several ways, at least for ordinary and routine tasks. Accepting that this forecast will materialize, even only partially, there should be no doubt that the centrality of humans in the future will depend fundamentally on their adaptive performance related to non-routine tasks, requiring flexibility of mind, capacity to take decisions based on incomplete information, intuition, problem solving ability, artistic and aesthetic sense: in a word, on their creativity. In the lifespan of but a few generations, creativity will therefore pass from a sort of scientific singularity reserved to a few talented individuals to an essential ability for the entire human species.

It is then clear that all creativity researchers share a very important social responsibility, which includes two major goals: the in-depth understanding and description of the creativity phenomenon in all its multifaceted aspects, and the education of both younger and older generations in the subject of creative thinking and its practical application in all domains of knowledge. Given this sense of urgency and necessity for action, it is here advocated that the field of creativity research adopts a *pragmatist approach* to pursue these goals. From this point of view, it is of utmost importance to resolve any fragmentation (Hennessey & Watson, 2015) and coordinate research efforts, starting from the core element upon which any theoretical framework on creativity should be built: the definition of creativity itself. Given the aforementioned goals of in-depth understanding of the phenomenon and general education in creativity, it is possible to put down the first two *pragmatist requirements* (PR) for the definition of creativity: (PR1) the definition of creativity should encompass the overall phenomenon in all its experiential manifestations; (PR2) the definition of creativity should be useful in the pursuit of the goal of general education in creative thinking. As discussed in the following, work is still needed to satisfy these two requirements: notwithstanding the vast and high quality literature on this extensively debated issue, only a part of the phenomenon has been captured so far by the various definitions of creativity, and this in turn reduces their effectiveness in terms of general education.

As well known, multiple definitions have been given for creativity (Mayer, 1999; Parkhurst, 1999; Rhodes, 1961) and the ensuing debate has been so fierce to have led Sternberg to recognize that “few psychological constructs have proved more elusive to define” (Sternberg, 1988, p. 126). However, a standard definition of creativity does exist (Runco & Jaeger, 2012, p. 92), and can be expressed as in the following.

D1) Standard definition of creativity: “*Creativity requires both originality and effectiveness*”.

According to this standard definition, *originality* and *effectiveness* are the two criteria that distinguish creative activity and creative products in particular, and therefore

these criteria should be assessed to operationalize the definition in experiential terms. Notably, Runco and Jaeger (2012) traced back the appearance of this standard definition to the work of Stein (1953). As Runco (2015) pointed out, this definition is in line with a parsimonious approach to the theory of creativity—the effort to reduce the description to the essential elements of the conducive mechanism, classifying other components as either influences, results, or consequences of the creative activity. Although largely accepted, this definition has been criticized in three ways. First, by stating that the definition should contain explicit reference to relationships that are inherent in the process, and in particular in the judgment of the outcomes. This is in particular requested by those researchers addressing creativity from the socio-cultural point of view, who stress the importance of the audience and the relationship between creator, creation, and audience itself (Amabile, 1996; Csikszentmihalyi, 1988; Glăveanu, 2010). As a matter of fact, the original definition of creativity by Stein (1953, p. 311) did include this explicit reference: “The creative work is a novel work that is accepted as tenable or useful or satisfying by a group in some point in time.” However, it can be argued that in all instances of application of the standard definition, it is implicitly understood that neither originality nor effectiveness can be measured in absolute and exact terms, as they will always depend upon the judgment process, which will, in turn, depend on time epoch and on who the judges are (including the creator himself or herself). Accepting this argument, the difference is therefore only between explicit versus implicit mentioning of the conditions under which the two criteria are applied, but the core substance can be held to be the same. The second kind of criticism goes in the direction of enlarging the set of requirements. In particular, following also the procedure adopted by the US patent office, Simonton (2012) advocated the inclusion of *nonobviousness* or *surprise*, in addition to *novelty* and *utility*, a line of thought in agreement with Bruner (1962) and Boden (2004). It is, however, evident that novelty and surprise are not disjointed dimensions, because if an item is expected, both surprise and conceptual novelty are denied. On the other hand, it can be argued that originality is more than novelty, because originality also contains a sense of uniqueness. If one accepts that the semantic implications of originality contain both novelty and nonobviousness, which in some cases can be the cause of surprise, then the standard definition of creativity still holds.

A further extension to four criteria was recently proposed by Kharkhurin (2014), including *novelty*, *utility*, *aesthetics*, and *authenticity*. Notably, according to Kharkhurin (2014), the latter two criteria appear to be more suitable for appreciating creative efforts in the Eastern culture, and the former two are the principal paradigms for the Western culture. Again, although these finer distinctions can be useful for cross-cultural analysis purposes, a reduction appears to be

possible: Originality can be argued to contain both novelty and authenticity; as a matter of fact, authenticity is a major element to judge a novel piece of work as original. In fact, a nonauthentic product contains necessarily elements that do not belong to the producer, elements that existed before, somewhere else, in some other form: hence the work is not original. On the other hand, the effectiveness of a work of art is certainly related to satisfying particular requirements for aesthetics. Therefore, by defining in a comprehensive way the criteria of originality and effectiveness, the standard definition of creativity can be argued to remain valid also in the sense advocated by Kharkhurin (2014). Clearly, this does not negate the value of the alternative proposals with an enlarged set of criteria, which can certainly be useful in research to place the accent on specific elements of the phenomenon.

The third, and perhaps strongest, kind of criticism to the standard definition of creativity goes in the opposite direction, trying to reduce the number of criteria to only one: *intentional novelty* (Weisberg, 1993, 2015). The major difference is clearly the elimination of the effectiveness (or value) criterion in the definition of creativity. As noted, when the first criticism to the standard definition was discussed, value judgment does change over time and culture, and specifically over the culture of those who make the judgment. According to Weisberg (2015) then, the application of the standard definition may seem to become erratic and to impede a scientific approach, especially if the judgment on the creativity or noncreativity of a product is transferred as is to the person who generated it (a nonobvious inference, however). Elimination of value judgment was therefore justified by Weisberg (2015) as a way to try to avoid introducing forms of subjectivity in assessing a product, a time-dependent practice which could lead a person to change his or her status from noncreative to creative (or vice versa) after death, and also to try to avoid possible misunderstandings due to linguistic interpretation of terms. Certainly, subjectivity and time-dependence of judgment are experiential realities that must be addressed by a definition of creativity (either explicitly or implicitly): however, this cannot lead to the elimination of the effectiveness criterion, for this would cause the following negative consequences: (a) given an objective assessment of intentional novelty, the definition would be ineffective in discriminating between different levels of creativity: this would for example equate radically innovative artists with those who are content to intentionally produce works that are novel but that follow slavishly the dictates of a style (overinclusive definition); (b) all novel artistic, scientific, or technological productions would be undiscernibly creative, and possible differences on the impact they had/have/will have on society would pertain to a separate phase of value judgment, which would be detached but clearly extremely important to assess the practical consequences of the phenomenon (immediate return of value judgment); (c) most importantly, without

value judgment it becomes impossible for the creator to advance and conclude his/her creative activity, because creating involves fundamentally a search for original products which are felt to be appropriate to one's goal (lack of meta-cognitive guidance in the creative process). Real-time assessment of effectiveness is an essential driver of the creative process.

In summary, the standard definition still appears to be the most balanced in terms of establishing the requirements for the achievement of creativity, and we shall take it as our state-of-the-art reference. However, even though the exclusion of value or effectiveness from the definition of creativity does not provide a satisfactory solution, the arguments proposed by Weisberg (2015), as well as those advocating explicit reference to time and culture, are strong and should find an adequate reflection in a new definition of creativity. This generates a third, and very important, pragmatist requirement for the definition of creativity: PR3) the definition of creativity should scientifically account for the time-dependent and context-dependent subjectivity of judgment. Note that the inclusion of the adverb *scientifically* in PR3 implies that the operationalization of the definition must allow to build a valid framework for scientific research. This third requirement on the definition leads to the discussion of creativity as a dynamic phenomenon.

## CREATIVITY AS A DYNAMIC PHENOMENON

All definitions of creativity discussed previously, as well as others encountered in the literature (see references in Parkhurst, 1999; Rhodes, 1961; Runco & Jaeger, 2012) share a common goal: establishing the criteria that are required to realize and recognize positive instances of creativity. In this sense, they can be considered to be definitions of *static creative achievement*. Evidently, creative achievement is important to creativity, and it might be argued to be the most distinctive element in creativity, but it does not describe the phenomenon completely: It actually represents a smaller (albeit very significant) fraction of it. The larger part of the creative process is carried out without any evidence nor guarantee for success, but trying to generate and maximize a potential for future creative achievement. In order to clarify this fundamental concept, consider two diverse examples, one from the technological domain and one from the arts.

Thomas Alva Edison is considered to be one of the greatest inventors of all times. As Wills (2007) noted, one of Edison's inventive strategies was to build and test large numbers of alternative solutions to any problem. This flourishing of possible outcomes to be tried out should be considered to be both natural and necessary when one faces a difficult or ill-defined problem, without any a priori knowledge of the existence of a valid solution. Clearly, the vast majority of these alternatives will not satisfy the criteria of

originality and/or effectiveness, and as such they could be classified as failures and discarded. Such failures, which should be preferably identified as *inconclusive outcomes*, should not stop the process on account of frustration, as expressed in Edison's (Wills, 2007, p. 383) own words,

I never allow myself to become discouraged under any circumstances. I recall that after we had conducted thousands of experiments on a certain project without solving the problem, one of my associates (...) expressed discouragement and disgust over our having failed 'to find out anything'. I cheerily assured him that we had learned something. For we had learned for a certainty that the thing couldn't be done that way, and that we would have to try some other way. We sometimes learn a lot from our failures if we have put into the effort the best thought and work we are capable of.

Coming now to an exemplary evidence from the world of the arts, let's consider a quote from one of Van Gogh's letters to his brother Theo, as reported by Brower (1999, p. 686):

I also worked on a large [figure] and have scraped it off twice, which you perhaps would have thought too rash if you had seen the effect; but it was not impatience, it was because I feel I can do better by grinding and trying, and I absolutely want to succeed in doing better, however much time, however much trouble it may cost.

These two quotations, from Edison and Van Gogh, who nobody would doubt to classify as outstanding heralds of creativity although in completely different domains, clearly indicate that creative products are rare gems embedded into multitude of self-assessed noncreative outcomes, dynamically generated in the course of an overall process. This generation and exploration of multiple alternatives is a very important effort that requires motivation, determination, and resistance to frustration. Will this effort always lead to creative outcomes? Not necessarily; this is the distinction between a successful and an inconclusive creative thinking process. But it can be argued that the process remains of a creative kind, even if inconclusive. The individual (or the group) engaged for a period of time in the search for original ideas, explored multiple alternatives, but the efforts were frustrated by the absence of a positive outcome: this is still creative activity! To deny the fact that this result-empty activity can still be classified as creative, would be tantamount to saying that a football team that did not score in a match did not actually play football. In creativity, as in many other areas of positive human activities, active engagement has a very important value in itself, even without achievement and/or recognition of success. Therefore, to focus the definition of creativity on static creative achievement may well represent the most significant part of the phenomenon, but fails to give a proper place to creative inconclusiveness, as well as to the abilities, traits, and contextual elements

that are instrumental in increasing the chances to see the light at the end of this crucial part of the process. The fundamental element that should be at the core of the definition of creativity is therefore the search for potential originality and effectiveness, much before any attribution of creative achievement (or inconclusiveness) has materialized. This is extremely important both to reflect the overall experiential evidence of the phenomenon (pragmatist requirement PR1) and to effectively educate new innovators in their approach to the process (pragmatist requirement PR2).

But considering pragmatist requirement PR3 yields another extremely important reason to introduce the concept of *potential* into the definition of creativity: To account for the fact that creative achievement (or inconclusiveness) is actually not static, due to the intrinsic subjectivity in assessing the originality and effectiveness of the outcomes of a creative process, reflected by time- and context-dependent conditions of judgment. Subjectivity of judgment is not only inevitable, but also an important degree of freedom which allows interpretation, imagination, discovery of value in a novel outcome by a specific observer, where perhaps others cannot see any. In essence: there is no unique and immanent truth to be established about the originality and effectiveness of the outcome of a creative process; rather, it is of fundamental importance to imagine all of its possible implications through a conceptual projection onto future, present, or past reality. Conceiving all possible effects of a creative product is an art of its own, which must be properly contemplated in a pragmatist approach to creativity. Consider Peirce's canonical statement of the *pragmatist maxim* (Peirce, 1992-1999, p.132): "Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of those effects is the whole of our conception of the object." Projecting this maxim into our discourse, the object represents one of the outcomes of the creative process, and the effects are to be expressed in terms of originality and effectiveness attributes. The practical bearings, in the most general sense, relate to the transformation of knowledge (personal or historical) as a consequence of the generation of the creative outcome. Assessment of this creative outcome is an exercise in giving meaning to a yet unknown object, by conceiving its potential effects on reality in terms of originality and effectiveness. Indeed, a novel outcome represents a force, an impulse in a dynamic relationship in Lewinian terms (Lewin, 1935) between the creator and the judge, whose ability in assessing the outcome depends on his or her ability to engage in a meta-creative exercise. No single expert can statically express an absolute measurement on originality and effectiveness, but only his or her best possible estimate at a certain time epoch, based on the projection of the novel outcome onto the expert's own knowledge domain to conceive all the potential practical bearings. Consider next the explanation of the maxim offered by William James (1975, page): "To attain perfect clearness in our thoughts of an object [...] we need only consider what conceivable effects of a practical kind the object



may involve—what sensations we are to expect from it, and what reactions we must prepare.” It is extremely important to note that the reference to “conceivable effects of a practical kind” does not imply in any way a restriction on the possible ways that the outcome can be interpreted. As Barrena (2013) pointed out, the approach defined by Peirce (1992-1999) and sustained by James (1975) is nothing less but a defence of imagination, which must be put into play in order to explore the possible consequences of the concept and the reasonable actions to which it may give rise. “[The approach] allows any flight of imagination, provided this imagination ultimately alights upon a possible practical effect (...); it makes conception reach far beyond the practical” (Peirce, 1931-58, v.5, p. 196). Subjectivity and imagination are therefore intrinsically part of the dynamic assessment of creative outcomes. Indeed, it can be argued that the higher the level of potential originality of an outcome, the wider the space for subjective imagination and interpretation of its possible effects on reality, and therefore the higher the chances for disagreements among experts (as well as novices) and for variable attribution of value in different time epochs. In some cases, the originality of a product is purposely directed towards abandoning or dismantling previous paradigms. A paradigmatic example would be the *Ulysses* by James Joyce (1922), where, as Jung (1953) noted, the traditional criteria for beauty and meaning, held as valid at the time of writing, were destroyed. Clearly, *Ulysses* caused scandal, outrage, and astonishment in the critics, provoking a segmentation in two fronts: those who discarded the book in disgust, and those who praised the paradigm shift it had brought about. This radical shaking of the field of pertinence can be considered to be the signature of those creative outcomes that lead to paradigm shifts. Finally, consider the effects that a creative product brings onto reality: knowledge is immediately transformed, and this changes the assessment of the product itself as well as that pertaining to all other present and future products of creativity in the same domain. It is impossible to statically assess a product which holds in itself a potentially very strong transformational power over the entire structure of knowledge.

The previous discussion should bring final persuasion about the fact that static creative achievement cannot suffice in the description of creativity, which is dynamic in a manifold manner: in selecting a focus, in the process generating the outcomes, in their assessment, in the transformation of knowledge through the outcomes themselves. The concept of *potential* should therefore be introduced in order to allow the necessary degrees of freedom and achieve a comprehensive description of this phenomenon.

## THE DYNAMIC DEFINITION OF CREATIVITY

In view of the previous discussion, because the definition of creativity must subsume both creative achievement and

creative inconclusiveness, and because it must give proper account of the dynamic essence of the phenomenon, in line with the pragmatist requirements PR1 (overall experiential representativeness), PR2 (educational efficacy), and PR3 (time and context dependent subjectivity), it is proposed that the following dynamic definition of creativity is adopted.

(D2) Dynamic definition of creativity: “*Creativity requires potential originality and effectiveness*”.

Note that the only difference between the dynamic definition of creativity and the standard definition of creativity is a single word: *potential*. This is positive as it minimizes the linguistic distance between this new definition and the most accepted standard, which should facilitate its adoption. At the same time, this single word has the power to allow for both achievement and inconclusiveness in the process, as well as time variance and knowledge-domain dependence into the assessment of the process outcomes. The concept of potential is also instrumental for educational purposes, because it clarifies to the younger and older generations the explorative nature of the process, the subjective nature of assessment, as well as the dynamic nature of the knowledge basis used for the assessment. Certainly, the introduction of the concept of potential has fundamental consequences for the investigation of creativity, and some of these will be addressed in the following. Before that, it is necessary to complete the set of new definitions (including focus area, creativity goal, creative agent, creative potential of an agent, creative potential of an environment, creative process, product of a creative process, creativity potential of a process, representation of a creative product, estimator), to arrive at precise definitions of creative achievement and creative inconclusiveness, both subsumed by the dynamic definition of creativity.

(D3) Definition of focus area: “*A focus area is a specific portion of a knowledge domain at a defined time*”.

(D4) Definition of creativity goal: “*A creativity goal is the intention to generate items, pertaining to a focus area, showing originality and effectiveness*”.

Evidently, focus areas for creative activity differ greatly depending on the knowledge domain of concern. Examples could be a problem to solve in science or technology, a specific product brief in design, a compositional style in music, and so on. The definition of the creative goal indicates that there is a wilful intention to generate new items pertaining to the focus, which clearly does not negate the possibility for serendipitous findings, related to items that have no relation to the specified focus. Goals can have different levels of ambition: It is a good educational practice to contemplate multiple levels of ambition—on the one hand, lower ambition facilitates success; on the other hand, a higher level of ambition is an effective stimulus to increase potential impact.

(D5) Definition of creative agent: “*An agent pursuing creativity goals pertaining to one or more focus areas*”.

(D6) Definition of creative potential of an agent: *“The quality and quantity of resources invested by an agent in the pursuit of creativity goals”*.

(D7) Definition of creative potential of an environment: *“The quality and quantity of resources offered to creative agents operating in the environment in the pursuit of their creativity goals”*.

Note that the previous definitions are intended to apply without modification to single individuals or groups; for this reason, instead of introducing the person in the definitions, it is preferred to speak in a more generic fashion of an agent. The agent can therefore represent a single individual or a group of individuals. For an agent to be qualified as *creative*, it is necessary and sufficient that it actively pursues creative goals. Processes may differ, and creative achievement could follow or not. Generally, the larger the quality and the quantity of resources that are invested by the agent, the higher the potential for success, unfortunately without any guarantee. Resources should be intended in the most comprehensive form, including talents, abilities, traits, time, assets, etcetera. Clearly, the environment in which a creative agent is embedded and operates has crucial consequences on the creative activity. In primis, the interaction between agents, their possible exchange of resources, different levels of collaboration or competition, all have fundamental influence in determining the creative potential of the environment, and in turn of the agents. The same agent operating in environments with different creative potential may enjoy radically different creative potentials.

(D8) Definition of creative process: *“A process enacted by an agent in the pursuit of its creativity goals”*.

Obviously, the definition of creativity should not prescribe a specific process for creative thinking or creative expression. Any model for creative thinking can apply (e.g., Corazza & Agnoli, 2015; Mumford, Mobley, Uhlman, Reiter-Palmon, & Doares, 1991; Wallas, 1926;). Cognitive styles and strategies will largely differ across individuals, groups, societies, cultures.

(D9) Definition of product of a creative process: *“An outcome of the process with a potential for originality and effectiveness”*.

As a result of the intentional activity of the creative agent pursuing creative goals through a creative process, one or more products may be generated, characterized by a *potential* for recognition of originality and effectiveness. Attribution of creative achievement to a product will then depend on judgment.

(D10) Definition of creativity potential of a process: *“The potential for originality and effectiveness of the overall ensemble of generated products”*.

At a specific point in time, a creative process carried out by an agent in an overall time window (spanning over nested time scales, from minutes to years) may be observed in its entirety, and the potential of the process may be assessed. For a given average quality of the products, larger

quantities will typically translate into larger potential for the creative process, mediated by a representational interface.

(D11) Definition of representation of a creative product: *“The modality and substance of the presentation of a creative product to the outside world”*.

(D12) Definition of estimator: *“An agent observing the representations of the outcomes of a creative process and conceiving the ensuing potential effects in terms of originality and effectiveness”*.

It is important to distinguish, through a specific definition, the product from its representation. Given a specific outcome of a creative process, different kinds of representation are in general possible: verbal or visual descriptions, prototypes, actual realizations, and so on. More than a single representation can actually be used for the same product. The estimator will dynamically interact with the product through its representation(s), and the potential effects that he or she may conceive will serve to establish the instantaneously achieved levels of originality and effectiveness from the point of view of the estimator (according to the pragmatic maxim), and clearly may be significantly affected by the representation itself. *Estimator* may be a better definition than *judge* for the observing agent, both to underline the intrinsic subjectivity of the assessment and to highlight the creative role that is played in looking for value into a novel outcome. Note that the first estimator is always the creative agent itself, and the level of self-judgment is instrumental in determining the quantity and quality of the final outcomes. It is finally possible to arrive at the wanted definitions for achievement and inconclusiveness.

(D13a) Definition of Creative Achievement (long version): *“Creative achievement requires the attribution of sufficient originality and effectiveness to a represented outcome of a creative process by at least one estimator at a specific time”*.

(D13b) Definition of Creative Achievement (short version): *“Creative achievement requires both originality and effectiveness”*.

(D14a) Definition of Creative Inconclusiveness (long version): *“Creative inconclusiveness corresponds to insufficient attribution of originality and/or effectiveness to the represented outcomes of a creative process by any estimator at a specific time”*.

(D14b) Definition of Creative Inconclusiveness (short version): *“Creative inconclusiveness implies insufficient originality and/or effectiveness”*.

Note that the long definition of creative achievement is completely coherent with the definition of creativity by Stein (1953); the short version is essentially the standard definition of creativity by Runco and Jaeger (2012), both qualified as pertaining to creative achievement. The relevance of the definition of creative inconclusiveness should be underlined here, as it might be one of the more crucial consequences of the introduction of the dynamic definition of creativity. Indeed, most of the activity of the creative

agent produces inconclusiveness: Originality is sparse, effectiveness must be demonstrated and this can turn out to be very difficult. The agent must be able to hold on through the hard times when no recognition is given to its production. Finally, note that the long versions of both creative achievement and inconclusiveness involve explicitly the agent (person), the process, the outcome and its representation (product and press), the estimator (press), and time (dynamics). The short versions of both definitions leave all of these elements at an implicit level, and as such can be applied also to specific elements of the phenomenon, the products in particular.

### BACKWARD-FORWARD CONSEQUENCES OF THE DYNAMIC DEFINITION OF CREATIVITY

As convincing as the theoretical considerations leading to the dynamic definition of creativity might be, this new definition should only be adopted if it can be shown to yield a valid framework for scientific research. This includes a backward compatibility (BC) property and a forward effectiveness (FE) property, both of fundamental importance: (BC) the extant corpus of scientific work on creativity and its measurement must be properly accommodated in the new framework; (FE) the new framework must offer novel and useful avenues for scientific investigation.

A new definition of creativity would not be accepted if it had as a consequence that all previous research would have to be revisited: backward compatibility is essential for widespread adoption. Indeed, the theoretical framework built upon the dynamic definition of creativity allows for full backward compatibility: Given the fact that the long and short versions of the definition of creative achievement respectively coincide with the definition of creativity given by Stein (1953) and with the standard definition of creativity (Runco & Jaeger, 2012), all previous investigations are seamlessly accommodated into the proposed operational framework, simply by agreeing on the fact that what was being defined, operationalized, and measured was the positive concretization of creativity, i.e., creative achievement. All previous research efforts are retained as valid, only re-interpreted as work directed towards the characterization of the most visible part of the phenomenon: creative success.

On the other hand, for the new definition to be really attractive, it is not sufficient to state that it guarantees backward compatibility: Forward effectiveness is also needed. There must be advantages in terms of opening new paths for scientific exploration, or, as a minimum, new points of view on open topics. Here there are many possibilities, all necessitating future scientific research efforts.

FE.a) Investigation of the creativity potential of an agent.

The creativity potential of an agent has been here defined as the quality and quantity of resources invested by an agent in the pursuit of creativity goals. The main point is to set up

scientific investigation procedures that intercept the creative activity of individuals and groups also *before* any outcomes are actually produced, to estimate and finally improve the potential for creative achievement, while recognizing that there will also be creative inconclusiveness. This is critical for effective education in creativity. Elements that can be considered include: the number, quality, level of ambition of the areas that the agent is focusing on; the intrinsic or extrinsic motivation demonstrated by the agent in the pursuit of its creativity goals; the use of structured/nonstructured approaches to address creativity goals, also in relation to the level of the received level of education/training in creativity; the amount of time and attention devoted to the pursuit of each specific creativity goal. Here we give two exemplary hypothesis for possible investigation: (H1) Having multiple and diversified creativity goals improves the overall creative potential of an agent. (H2) Focus areas have different levels of ambition in relation to the agent's level of knowledge, leading to different potentials for creativity.

FE.b) Investigation of the creativity potential of a process, also in relation to the representation of its outcomes.

Elements that can be considered include: the number of outcomes generated in a specific amount of time; the number of outcomes that are represented to the outside world in a specific amount of time; the selected modalities of representation of the outcomes of the creative process and their impact. Exemplary hypotheses for investigation: (H3) The ratio of the number of outcomes intentionally represented to the outside world to the total number of generated outcomes is a function of the agent's level of self-esteem; (H4) For the same outcome of a creative process, different representation modalities produce different levels of potential originality and effectiveness, as a function of the selected estimators.

FE.c) Investigation of the estimator ability.

Given the observation that judgment of a creative outcome is a creative exercise in itself, there appears to be the opportunity to assess the ability in playing the estimator role. Elements that can be considered include: the number and diversification of the possible consequences that the estimator can conceive of a potentially creative item; the diversification of the possible consequences derived within a set of estimators; the diversification in the estimates of potential originality and effectiveness in the short, medium, and long term; the diversification in the estimates of potential originality and effectiveness as a function of cultural differences of the estimators; the correlation between the estimator ability and the assigned creativity scores; the dynamic effects of knowledge about other estimators' opinions on a specific estimator's assessment of a product; the environmental influences on the performance of an estimator. Exemplary hypotheses for investigation: (H5) Creativity assessment changes depending on the fact that estimators are given the task of judging static creative achievement or dynamic creative potential through the conception of all



possible consequences; H6) The higher the diversification of the possible consequences derived within a set of estimators, the higher the potential originality of the outcome; H7) Estimators operating in an environment with high creative potential tend to perform better at estimating creative potential. Note that hypothesis H5 is actually testing the effectiveness of the dynamic definition of creativity in opening up the role (and the mind) of the judge/estimator. Note further that what is suggested here is a double layer of assessment (judgment of the estimator's performance), or a meta-assessment task.

FE.d) Investigation of creative inconclusiveness.

Although it may appear paradoxical at first, in the study of creativity there may be specific value in observing the amount and quality of creative production that remains below the level of sufficient originality and or effectiveness, as well as the reaction of the agent within this phase of the process. Elements that can be considered include: the number of inconclusive outcomes, also in relation to the number of sufficiently creative outcomes, in the creative process; the number of estimators judging a product as inconclusive, also in relation to the environment and to the number of estimators judging a product as sufficiently creative, to provide a level of disruption in the field; the amount of time and resources spent while the process was inconclusive, to provide a level of commitment. Exemplary hypotheses that can be tested: H8) The ability to sustain longer periods of creative inconclusiveness leads to higher creativity potential; H9) The higher the level of disruption in the field, the larger the long term impact of a creative product.

FE.e) Relation between the dynamic definition of creativity and dynamical systems theory.

A scientific investigation is needed to clarify whether the adoption of the proposed dynamic definition of creativity leads necessarily to the use of the theoretical framework of dynamical systems (Beer, 2000; Schuldberg, 1999). An immediate negative response can be given in terms of the backward compatibility property discussed previously: The corpus of extant research referring to the standard definition of creativity and its variations can be accommodated in the new framework, simply by referring it to creative achievement and success. Also, all the previously proposed areas for investigation can be tackled within a cognitive psychology framework that does not use the terminology and concepts of dynamical systems. On the other hand, as discussed by Schuldberg (1999), there are many possibility for exploiting the concepts of nonlinear dynamical systems in the study of creativity, and it would be interesting to see how these concepts relate to the proposed dynamic definition of creativity. Exemplary hypothesis for investigation: H10) Extant concepts constitute saddle limit sets (Beer, 2000) in the state space representing knowledge: They are generally stable, but there exist directions leading to instability. The creative potential of an agent depends on the ability to insert perturbations in the knowledge state

space that reveal these directions of instability, leading to system evolutions asymptotically converging to new points of equilibrium.

Clearly, the previously list of areas of investigation for the theoretical framework built upon the dynamic definition of creativity is not exhaustive, and neither are the hypotheses that can be considered within that framework.

## CONCLUSIONS

The study of creativity must evolve along with the dramatic technology-induced transformations of society. In three waves, a transition is occurring from creativity as an elitist phenomenon, on to a democratic possibility for those willing to pursue it, and finally to a strict necessity for every human being. The last transformational step is a call for action for all researchers working in the creativity domain, who should adopt a pragmatist approach to resolve fragmentation, agree on fundamental definitions, and build a solid theoretical framework that can be used for both descriptive and prescriptive purposes. At the basis of this framework lies the definition of creativity itself, which is here proposed to be evolved from a static to a dynamic form. The main theoretical reason for introducing a new definition for creativity is to give full recognition to the fact that creativity is indeed a dynamic phenomenon. Cognitive and affective energy is required in the decision to engage in creative activity, and dynamic relationships with the environment bear fundamental influences on the process. The creative process itself is dynamic, producing typically multiple outcomes over time. The dynamic interplay between inconclusiveness and achievement must be subsumed by the definition of creativity: For a given creative production, creative inconclusiveness and creative achievement can alternate in time; and, at the same time, creative achievement and inconclusiveness can coexist across different cultural domains. Estimators of a creative process engage in a dynamic relationship with the creative agent and its production, by trying to conceive all of the ensuing consequences that can have a practical bearing on reality: an attribution of meaning in line with the pragmatist maxim. Discrepancies between estimators' assessments are a sign of potentially disruptive novelties, generating the necessary energy for transformation of a domain. The previous considerations justify the introduction of the dynamic definition of creativity, which establishes the requirement for potential originality and effectiveness. This definition gives a proper place to both creative achievement and creative inconclusiveness, and indicates that we should design educational programs for creativity and not only for creative achievement: this distinction indicates the necessity to devise methods to train resilience against the natural frustration associated to creative inconclusiveness. The adoption of this new definition yields both backward compatibility, ensuring that the extant

knowledge coming from scientific research on creativity is fully preserved, as well as forward effectiveness, in terms of possible evolutionary paths for investigation of creativity. These will be matter for future study.

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