**The meaning of creativity through the ages: from inspiration to artificial intelligence**

**Introduction and Overview**

Given the relatively new pedagogic contexts of creative business education and creative industry business schools, this chapter aims to examine the complexity tied-up in the meaning of ‘creativity’ through the cultural and historical narratives that have both influenced, and been influenced by, the modern study of creativity – and more recently computational creativity and artificial intelligence (AI).

The chapter, built around an unpublished PhD chapter by the author, illustrates that despite the word ‘creativity’ appearing in English language dictionaries only from around the time of JP Guilford’s inaugural speech on creativity as chair of the American Psychological Association in 1950, its modern origins belie Western historic myths and culture such as genius, intelligence and imagination that have endured into present day ‘confluence theories’ of creativity by social psychologists such as Teresa Amabile – models explaining creativity as a function of intrinsic psychology and cognitive abilities.

It is argued that along this historical journey towards an ontology of creativity ‘in the mind’, the creativity of ‘the person’ in human and social systems (first outlined by AN Whitehead in the 1920s) has been overlooked, especially in the new field of AI. Along the lines of Still and D’Inverno’s paper at an International Conference of Computational Creativity (2016), the historical review in this chapter will show a split between ‘G creative’ (perhaps God like) and ‘N creative’ (perhaps nature like) narratives – and point to psychology’s ‘G creative’ dominance of the subject from 1950s onwards that informs the closed-system intelligence of AI programs and ‘thinking’ machines in the age of computing and machine learning.

A case is made here for the creative academy to aid the field of AI and machine learning, helping it move beyond ‘closed system’ creativity algorithms inspired by individualistic ‘thinking power’ theories. Though much AI in everyday modern technology remains akin to Margaret Boden’s closed-system ‘combinational’ computational creativity of the 1990s, a recent example in the chapter will examine the AI artwork algorithm by the Obvious Collective in 2018, against Mihaly Csikszentmihalyi’s sociocultural creativity model, highlighting its value in human-and-machine creative futures beyond complex problem solving and ‘in-the-mind alone’ analogous creativity.

**Creativity a modern concept?**

A rich history of concepts and ideas related to the act of creativity has brought many ideas – some more rational than others - to the table of contemporary creativity research, despite no formal definition or even entry into modern dictionaries existed until after World War II.

In a contemporary industrial context, the world of creative industries, creative labour and creative work examined by scholars such as labour economists Hesmondhalgh & Baker point out the nebulous ‘catch all’ term, saying “the terms ‘creativity’ and ‘creative’ have been abused and over-used” (2011 p2) in recent years. This is largely because, although there is some agreed definition of what creativity is in terms of the generation of ‘novel and appropriate’ ideas / products / concepts, academic literature on creativity lacks unified theory or explanations of its causes. Creativity, as a result, can be at best, according to Mark Runco, a “*syndrome* or *complex*, labels that capture the idea that creativity can be expressed in diverse ways (e.g. art vs. science), and sometimes involves different processes (e.g. cognitive or social)” (2007, xi) or a worse something so subjective, it is like defining humour.

Philosophising that creativity is *“not like height or acidity, but more like, say, humor or beauty, a quality that people—although they may concur in many of their actual judgments—are prone to disagree about”* (Klausen 2010 p348), Klausen, and others, see creativity as both consensual, real, measurable but at the same time *subjective*, and therefore best grouped in three directions (Klausen 2010 p350) – as *‘people’, ‘products’ and ‘processes’.* Each ‘P’, according to Klausen, places emphasis on a different location, depending on context. However, regardless of scientific approach or ‘direction’ and its philosophical approach, any modern creativity theory has to be judged against the weight of cultural history and engrained ideas about how creativity works and where creativity functions. Holland & Quinn (1987) define an anthropological system of cultural assumptions as a ‘cultural model’, one that Keith Sawyer explains in his preface to his book on *Explaining Creativity* (2012) exists and influences the various beliefs and assumptions underpinning the experts’ research in the field of creativity.

Although Sawyer (2012) cites as many as ten separate assumptions or beliefs, some of them not entirely supported by scientific evidence - though many “partially true” (Sawyer 2012 pp 12-14), most creativity authors acknowledge a number of these. What could be called a series of discourses on the subject, representing different beliefs and power relations (Foucault 1972), or what has been termed the ‘rhetorics of creativity’ by sociologists of creativity (Banaji et al 2006), can be summarised as involving a number beliefs in differing ‘locations’, by different theorists and schools of thought, for example: Weisberg on ‘eminent’ creativity located in talent (1993); Sawyer on creativity as an emergent property via collaboration (1999); Amabile on creativity as a form of intrinsic motivational psychology (1983), Csikszentmihalyi on creativity located in affective ‘flow’ states of mind (1996), Simonton on creativity as a form of ‘intelligence’ (2009) and perhaps at the fringes of this chapter, the cognitive research of creativity in neurological locations in the brain (Sawyer 2011).

These theories and theorists ‘locate’ creativity in different ways and places, and their explanations of creativity have emerged via a long history of interest in the term, the phenomena and what it can add to various fields, for example the psychologists’ search for problem-solving talent Post-War (EP Torrence 1959), the educational and sociological proponents of creativity (Banaji et al 2006, Gauntlett 2011) and those with a post Schumpeterian political economy of a new ‘creative class’ of workers (Florida 2004). This varied and interdisciplinary field has created varying assumptions; and it has led to businesses reinforcing long-established ‘tools’ of creativity (such as brain storming and Google’s ‘skunk works’) and the creative industries (a sector defined by DCMS, 2001, to include advertising, publishing, design, film, music and the arts) failing to debunk ‘myths’ around creativity. In the 21st Century, creativity is still seen through a number of historically-derived ways, such as the work of ‘genius’, creativity as the ‘art’ of inspired individuals, creativity as the outcome of ‘play’ and collaboration or even creativity as form of mental illness (Freud 1924) – talent being a “silver lining” to madness in the creativity ‘beliefs list’ by Sawyer (2012 p13).

**A history of creativity theory**

Throughout various historical discussions on creativity, the concept, the values attributed to it and the various usages we give to the term, are widely said to be relatively modern (Weiner 2000, Sawyer 2012, Galveaunu and Kaufman 2019). According to Sawyer (2012), no historical period would understand today’s concept of creativity. It is a term that has evolved over a short period of time, and to put some context to this, he provides there is no reference to the word ‘creativity’ in the English language before the 19th Century (Sawyer 2012 p19). The first modern usage of ‘creativity’ emerges as late as 1875, well into the Victorian Age. Cited by Galveaunu and Kaufman (2019) as appearing in the text of *A History of Dramatic English Literature* by Adolfus William Ward, this was said to be first used in language to define some talent or force across all disciplines – although Sawyer points out (2012 p20) that in the French and Italian speaking world, no reference to the word in this sense would emerge until some 50 years hence. Even a formal usage entry into English dictionaries did not happen until after World War II.

This modernity, however, is not meant to mean that ‘creativity’ has no ancient origins and history. Indeed, the study of its origins, according to Galveaunu and Kaufman 2019, is recommended to help shed light on, not just “our species’ past” but “its present and beyond” (Galveaunu and Kaufman 2019 p9) – especially considering the contemporary definitional debate about what creativity means today and the cultural value placed upon it in the fields of the arts, humanities, science and technology (Batey 2012). Scholars interest in the phenomenon, emphasises the need for socio-political, technological and economic context – and that is a historical one. In the preface to Weisberg’s eponymous volume on the subject (2006), he gives over the entire purpose of the book to “demonstrate how something as seemingly difficult to pin down as creativity can be *defined* and brought under scientific study” [emphasis added] (Weisberg 2006 p4).

Over the last six decades, a wide body of knowledge on the subject has emerged in wide variety of fields of research – fields such as: human psychology (EP Torrance 1959, 1974; Gruber 1981, Simonton 1976, 1989 ; Sternberg and Lubart 1991), social psychology (Teressa Amabile, 1983, 1996; Csikszentmihalyi 1988), the study of genius (Weisberg 1993), digital sociology (Gauntlett 2011), pedagogy and education (Sawyer 2006) and cultural anthropology (Niu and Sternberg 2002). According to a review by Sternberg and Lubart (1999), over the decades these many approaches, however, lack a ‘theory of creativity’, being merely practical approaches to enhance creativity of the mind, perhaps led in this direction by its mythical origins in Western thought. Researchers are said to have not provided a clear idea of what the characteristics of creativity exactly are. Given this lack of clear definition, the ‘confluence’ theories or explanations of creativity (ones that mix creativity of the mind, talent and motivation) are recommended for research by Sternberg and Lubart (1999) and Runco (2007), who cite contributions by Amabile (1983, 1988, 1999, 2016); Gruber and Davis (1988) and Csikszentmihalyi (1996) as well as their own ‘investment theory’ of creativity where creativity is explained in metaphorical market-like context, where creatives “buy low and sell high” in the world of ideas (Sternberg and Lubart 1991 p30).

**In the beginning…Creativity and Inspiration**

The word ‘creativity’ itself has deeply historic roots. Its etymology from the Indo-European root word *ker* or *kere*, meaning ‘*to grow*’, and arrives into the Latin *creatio* or *creatus* meaning the same. In classical usage, linguists point out that in spoken Latin, create would have implied to biologically grow, as opposed to the Latin *artis* to ‘make’ (Galveaunu and Kaufman 2019 p10). God created; people just made - a distinction that in the West endured for centuries, reinforced by the impact on thinking of the Old Testament and the Abrahamic story of God as creator and ‘his Creation’ which brought with it the idea that man was made in the image of God. The message was that man could be fruitful and multiply, but man’s participation in creativity, in every sense, was therefore limited, according to Weiner (2000 p 25), who cites 13th Christian theologian Saint Anselm (then Archbishop of Canterbury) as making analogy between the craftsman who first conceives a project in his mind and God’s pre-existing idea of Creation, before emphasising the analogy as “very incomplete” as the artisan follows existing models and “God who is the first and sole cause and creates through himself alone” (Weiner 2000 p44).

Over the centuries, in an enduring world where only God created, the nearest thing to a usage of the modern term ‘creative’ was, according to Sawyer (2011, 2012), the idea of *inspiration* – to draw on its Latin meaning, to breath into, akin the Creator breathing life into the world. Man is not superhuman, but sometimes he can be inspired, a belief that stayed within Western culture well into the Middle Ages, is said by Weiner (2000 p76) to have arrived from the classical Platonic Greek myths of the inspiration by muses or deities. In Shrine of Wisdom on Plato and the Four Inspirations, Greece, musical and poetic inspiration came from the muses (and water nymphs), whereas prophetic inspiration came from Apollo: different deities gave different creativity. This tradition is something that is consistent within a number of religions of the world – for example in Hinduism, the Goddess Saraswati has been invoked to inspire music for thousands of years (Kinsley 1988). In Hackforth’s translation of Plato’s Phaedrus (1972), a dialogue between his protagonist Socrates and Phaedrus, he explains that madness and Devine inspiration were described as going hand in hand, contrary to the understanding of Plato as a rationalist. According to Sawyer (2012 p 20), this form of creative ‘insight’ about nature, problem solving and the world itself through inspiration was a superhuman force, as only the work of the God could be truly novel: the gods took away thinking and reason before bestowing the gift of inspiration. As given by art historians Honour & Flemming (1999), art and not poetry, however, was only ever a poor imitation of the perfection of the world of ideas, explaining why ancient Greek artists did not try to imitate what they saw in reality, but always sought to depict the pure forms of underlying identity.

**The Origins of Creative Genius**

This history of genius, reflected linguistically, over centuries also provides evidence of the ancient, the something special about someone being *their* ‘genius’. Although not popular in modern idiomatic English, the phrasing of someone ‘having a genius for cookery’, or maths or anything else, relates better to other European languages, where the ‘genius’ is more clearly *separate* to the person, and therefore closer to its historical root as a spirit. One linguistic example in a modern European language, using the exact Latin word for genius, *genio*, exists in Spanish, where a bad temper might be referred to having *‘un mal genio’*, literally, having ‘a bad genius’. Simonton explaining in Spanish, one is not saying the person is an ‘evil genius’ but has a ‘disagreeable disposition’ (Simonton 1994 p13). *Geniality* existing in someone today, illustrates the genius spirit in them derived from an ancient cultural meaning in the term.

In the classical world, if being inspired was therefore the explanation of the act of human creativity, then the force behind someone who achieved extraordinary feats of creativity over time was his ‘genius’. Another superhuman historical factor in the history of creativity, no modern researcher of creativity entirely avoids raising of examples about ‘extraordinary people doing extraordinary things (Dean Simonton 1976, Sternberg 2000, Csikszentmihalyi 1988); and of the genius over the recent centuries, people who in their place and context so influential, Simonton asks us: imagine Spain without Cervantes, France without Napoleon, England without Shakespeare and America without Jefferson? (Simonton 2009 p2). A creativity scholar with an interest in genius (his 1976 study sample size of eminent creators reached into the thousands), he divides the study and meaning of genius into two parts: one contemporary, scientific and measured by psychometric methods, and a second, ‘humanistic’- and one measured by “a long history” (2009 p13), explaining roots of the humanistic definition of genius as therefore ‘story-based’. In the Roman period, genius is an idea of a personal deity, a “guardian angel”, according to Simonton (2009) very similar ancient Greek tradition of *daemon*, described as good and bad tutelary spirits in Liddell & Scott (1925). In Roman times people had deities; personal ones and ones that resided in locations (Struck 2019). The belief in this type of guiding genius carried over into Christianity (where it still exists today in Catholic school pedagogy), and endures thousands of years after the Roman idea of a spirit belonging to each person, Simonton (2009 p13) provides a vestige residing in contemporary art and culture via the 1946 film *It’s a Wonderful Life* where an angel ‘Clarence’ intervenes to show ‘George Bailey’ that life is worth living (portrayed by actor James Stewart).

**Creative Imagination**

It is only in the last century that the more individualistic notion of a person not *having* a genius but *being* one comes to the fore (Murray 1989), one that has a more Western interpretation and one that forms part of a cultural model. What elevates the idea of creativity as art, artistry and the modern concept of the creative, is in particular, the portrayal of a solitary individual. This specific belief, according to Keith Sawyer is one that is barely 200 years old, along with the concept of the artist having high social status. Explaining that, “before the Renaissance creativity was associated with the need to imitate established masters” (Sawyer 2012 p 20), history, artists in the Middle Ages needed to survive on patronage by nobility. The role of the artist being exclusively commissioned by royalty, the church or rich merchant (Clark 1997 p11).

Long before the establishment of capitalism in Europe (widely recounted in Marxist analysis as developing in the 17th Century by Braudel 1981-1984 and Holton 1978), Weiner’s (2000) examination of the history of creative works in an earlier 13th Century world, outlines one of technological developments and the growing individual value of art and artefacts were already becoming less craft and craftsmen based. Drawing on various technological and sociocultural changes Weiner (2000 p47) describes a changing cultural meaning of creativity, between the 13th and 15th Century, a period when Thomas Aquinas established a natural law theory against unjust rule, the Magna Carta sets out basic rights and freedoms of the individual and St Francis of Assisi inspired a new movement to elevate the individual as a “dignified creature of God” (Weiner 2000 p47). Surely the genesis of what, centuries later would become the Human Rights movement world, people are becoming liberated, and with that, the *creators* of their own destiny.

In the last two centuries, this more individualistic idea of creativity developed into what DeFillippi et al (2007) calls creativity of the ‘Western Tradition’. A cannon of philosophy that starts with Plato, the development of the individual in the 13th Century, before the influence of modern psychology through Sigmund Freud and the philosophy through Karl Popper. However, within this tradition, the elevation of the fine arts to become synonymous with creativity is often attributed to the 18th Century writing of Immanuel Kant (Simonton 2009 and Banaji et al 2006). In his *Critique of Judgement*, creativity is described as the making of the ‘sublime’, of genius that can be revered and understood as set apart from the everyday – raising what in modern creativity research is frequently described as the divide between ‘Big C’ and ‘Small C’ creativity – the everyday from the extraordinary. This distinction, in Simonton’s view (2009), shows us, from a Western cultural perspective, creativity discourses are dominated by the extraordinary things made by extraordinary people. Creativity therefore “embodied in a particular kind of personality” (DeFillippi et al 2007 p511) – is a genius of things by genius people, and historically gave rise to the close association with domains of the fine arts, theatre, music, literature and architecture, during a period when the art world becomes less reliant on aristocratic patronage, emphasising the rise of the individual talent.

Science, however, had not yet become part of creativity in Kant’s Age of Enlightenment. Thought as a function of methodology, of replicable process, Simonton cites Kant himself as saying Newton’s *Principa* *Mathematica* was an “immortal work” but could have been produced by anyone with sufficient learning, “whereas only a *genius* like Homer could have written the Illiad and the Odyssey” [emphasis added] (Simonton 2009 p25). Although the mysterious ancient world of the inspired and the genius seem present in the Kantian view of creativity, in the Classical era painting and art was imitation, and only poetry could be *inspired* (Weisberg (1993), reminding us of Polycleitos and his prescribed proportions for drawing the human form, called *canon* or ‘measure’ (Pollitt, 1995) . In the Classical worldview, creativity in art was perceived in a way more akin to the 18th Century Kantian views on science, something than can be quantified, is rule-based and recreated only by method – not by the inspiration of genius.

In the late Enlightenment period, the idea of Kant’s sublime inspiration can be seen evolving towards providing a clear cultural notion of artists being special. Artists were seen to have an ability to create works without a specific ultimate consumer – worthy of creativity in its own right. By the time of the British Industrial Revolution, a new concept and belief about creativity was cystalising and evolving from the old – especially the idea individual talent as ‘imagination’ (Sawyer 2012 p21). Into the 18th Century the establishment of art institutions, galleries and a marketplace for artefacts nourished by the development of art history, art schools and apprenticeships formed the modern conception of an artist as a person set-apart from the rest, isolated, talented and inspired.

By the dawn of the 20th Century, these unchanged ideas about innate imagination and being set-apart, formed part of the new Freudian science of psychoanalysis. Creativity in this new field of examining the human mind was theorised, like many other facets of human character, as an **‘**unconscious’ act by Freud. Driven by the forces now often used as cliché of his ideas, the *ego* and *libido*, were theorized as an artist’s form of defence mechanism against neurosis. Playing out his fantasies in a socially acceptable way (in a similar way that play for children provides a form of meaning and control), the artist in Freud’s psychoanalysis makes unconscious daydreams a controllable reality. On his essay *Creative Writers and Daydreaming* (1908), Drobot (2018) provides that although the much quoted Freudian illness of ‘suppression’ was not theorised as being at work in artistry (but a more healthy form of ‘sublimation’), Freudian psychology is nevertheless said to have fuelled controversial ideas that endured into the 21st Century: ideas that artists (and by association all creative people) were “disturbed - similar to the mentally ill” (Sawyer 2012 p 22), by being sexually driven and even criminally minded. Psychoanalysis, is in Sawyer’s opinion, a factor aiding the enduring myth that a creative person is a tortured ‘lone genius’.

**Creativity as potential – the birth of a sociological view**

Alongside these new theories of the mind (some have called pseudoscience) about the ‘hidden’ workings of creative sublimation, the beginnings of a more scientific and philosophical modernity applied to creativity were emerging about a universal phenomenon – or even non phenomenon - not something subconscious, inspired or the property of the genius. One of Britain’s leading 19th Century’s philosophers, AN Whitehead, who while professor of philosophy at Harvard, made a bold intervention at separating out some of the inspiration myths of creativity in his philosophical and cosmological opus magnum *Process and Reality* (1978, 1929). In this tome, he raises an almost pre-psychology and pre-sociological view on creativity. Coming from his complex philosophical discourse on the meaning of ‘potentiality’ in humankind being both a “general bundle of possibilities” but also “real”, being conditioned by the actual world (1978, 1929), hint at what later influences more sociocultural views of creativity (Csikszentmihalyi 1988) and the confluence models of creativity (Amabile 1996) that would later appear in mid century.

To quote the words of one scholar on Whitehead: “[he] insists that creativity is in no way to be limited to human activity or consciousness and that a wider understanding of creativity, based on the relativity of the potential and the actual, must be recognized” (Halewood, 2013 p76). Creativity, was by the 1930s, philosophised as being a universal and cosmological truth, a systemic potentiality process, and as Whitehead’s magnificently named ‘Category of the Ultimate’ stated: “Creativity is without a character of its own...It is that ultimate notion of the highest generality at the base of actuality. It cannot be characterized, because all characters are more special than itself ” (Whitehead 1978, 1929 p31). By invoking the idea of the potential and actual, Whitehead’s lectures at Harvard disseminated the first modern usage of the term ‘creativity’ as more aligned to a natural process - the *creare* of bringing about in nature, rather than through a ‘gift’ of inspiration of something in the mind alone. Creativity through this philosophical lens can therefore be associated with ‘normal’ everyday processes - the sort of creativity far removed from the ‘subliminal’ endeavours of fine art. In the words of those that saw creativity in this way, such as art historian John Dewey by the mid 19th century, creativity is about breaking convention, “in re-creating them…it brings refreshment, growth and satisfying joy to one who participates” (1948) - definition adopted in 21st Century by neo-craft media philosophers such as David Gauntlett (2011) who theorised the importance of social connections and role of improving social capital that a creative ‘making’ culture might have.

Despite this progressive and emerging view from philosophy on the campuses of American and British universities in the 1930s and 1940s, mainstream culture took much longer to change what Sawyer (2012) points out as an already established story. Summarising this view of creativity at the time, it was one of ‘people with a unique vision’, being solitary with imagination expressed through their genius in art – and art alone. As a ‘story of creativity’ it was, in his words, “fully formed” by then (Sawyer 2012 p23). The myth busting challenges from Whitehead provided many unsolved questions about creatives and creativity. By Freud’s own admission, as far as creativity went, he did not have all the answers in the mind – specifically not being able to explain the ‘effect of joy and pleasure [as it was the artist’s]… innermost secret’ or what he called ‘talent’ – something that required Whitehead’s ‘potentiality’ of the ‘real’ external world and not psychodynamic cognitive analysis in the way he applied it (Drobot 2018).

**Creativity of the mind: Intelligence, divergent thinking and psychology**

The quest for providing more science to the potentiality of the mind, became the domain of the emerging Post World War II field of cognitive psychology. Led by the quest by BF Skinner (1938), its approach was to provide reason through observable data in psychology and not through a philosophical or conceptual neural processes theorised by Freudian psychology. Although creativity was seen by ‘behaviourists’ as a function of intelligence, some scholars in the area were not satisfied that it remained untestable and hidden. The loudest complainant of them all was US military psychologist JP Guilford. Numerous authors and texts cite Guilford’s 1950 address to the American Psychological Association (upon his inauguration as president), one where he called for more study in the area, as the birth of modern research in creativity (Sternberg and Lubart 1991 p3).

It is said, historically, the motive for this type of research was the unreliability of IQ based studies, which assumed creativity was part of general intelligence. According to Runco & Roberts (2010) as early as the 1920s, Catherine Cox a PhD student under Terman (the author of the IQ test itself), is said to have exposed that trait theories, confidence and persistence were not subconscious acts for creativity and therefore cautioned the over-emphasis of the influence of IQ on determining creativity (Runco & Albert 2010 p15). According to Sawyer (2012), these early insights into personality and genius provided the basis for the interest in creativity theory in the US during World War II, where testing for individual cognitive skills gave early (but limited) insight into its usefulness (p16). Guilford himself worked in the US Air Force, developing tests for intellectual abilities for flying aircraft before developing his research at the Institute of Personality Assessment at University of Southern California (Sawyer 2012 p 17).

According to Kurtzberg & Amabile (2001), Guilford’s first address as the president of the APA came as a great surprise, given the context of the field of psychology at the time: “Suddenly, the appealing but nebulous concept of creativity had scope, depth, and breadth that could be measured and explored” (p 285). In the 1950s creativity was seen as something that could not be scientifically examined and the entrenched views, although challenged by Treman, Cox and even Galton in the 1920s (Sawyer 2012 p19), was that creativity was an obscure phenomenon, one theorised mainly through Freudian analysis as a subliminal drive (discussed above). It could not really be encouraged through the predominant behaviourist methods of reinforcement either, Sawyer pointing out that arch behaviourist B.F. Skinner did try to respond to this criticism in a paper on technology and pedagogy (Skinner, B. 1968) but failed (Sawyer 2012 p17). At the time of common usage of the IQ intelligence tests (such as the Standford-Binet test by Terman in 1916), one of the leading 1950s behaviourist psychologists EP Torrance, outlines creativity at the time as simply a problem-solving faculty: “Whenever one is faced with a problem for which he has no practiced or learned solution, some degree of creativity is required” (Herbert et al, 2002, p. 39). High IQ and problem solving to the world of psychology, was a relationship set in empirical stone.

Guildford’s call for creativity research, however challenging, did not fall on deaf ears, and eventually led the field of psychology over the next two decades toward development of theory and measurement tools compatible with the measurement of IQ – creativity as an observable ‘production’ using thinking skills, ‘divergent thinking’, given as *fluency of thought, flexibility, originality and elaboration* (Sawyer 2012 p47). Developed as a DT test (the most common of which being the TTCT the Torrence Test of Creative Thinking: Torrence, 1974), these thinking skills tests became a hugely popular psychometric tool, working hand in hand with IQ testing. Getzels and Jackson (1962) showed, through data, how these two parameters (IQ and DT) co-varied and were related to one another - proving a strong relationship. Getzels and Jackson’s threshold theory showed that the two go hand in hand, but only up to the point of an IQ of around 120- after this, it’s theorised that too much intelligence can hamper creativity. Today, although this idea of creativity belonging (mainly) to the outstandingly intelligent, is contentious. Sawyer states clearly that “many decades of research show that creativity and intelligence are related” (Sawyer 2012 p57). Proponents of this type of psychology, such as Dean Simonton, provide an example of a domain where this might be evidenced: “intelligence level impacts everyday creativity, such as that involved in problem-solving...You need an IQ of around 140 to *learn* enough physics to be truly creative in it ” [emphasis added] (Simonton 1989 p40).

Simonton’s mention of the potential to *learn* is seen as significant in this quote, as when testing for talent. As Sawyer points out, “intelligence predicts less than half the variance in creativity measures, [while still] providing evidence for the discriminant validity of creativity tests” (2012 p57). A history of Terman himself, shows he proved the point. Having had a number of high IQ participants in his experimental work on people’s life outcomes based on intelligence (the so called ‘Terman Termites’ experiment), William Shockley, a boy who failed the requisite criteria of IQ for his pool, showed more creativity in his life’s work than anyone else in the group as a Nobel Prize winner for the invention of the transistor (Kaufman 2009 ). Given these limitations, historiometric researcher, Weisberg (1993 p97), explains how the psychometric approach of intelligence and divergent thinking skills “led to the development of confluence models of creativity” - one that recognises other less predictable or testable factors in determining creativity. By the end of World War II, according to Runco & Albert (2010), creativity was being increasingly explained by psychologists through “the personalities, the values, the talents *and the IQs* of exceptionally creative mean and women” [emphasis added] (p 15).

**Today: a legacy of two narratives G-Creative and N-creative**

Given this history of specialness, creativity in the mind and the alternative creativity through learning, and social even pleasurable process, two clear strands exist in present day research around creativity – and they are yet to be unified, say Still and D’Inverno (2105). ‘N-creative’ (perhaps nature creative) or creativity defined by people “living and acting in the world [that is] inherent in all activity,” (2015 p7) based on actions, attentive enquiry and the impact it makes and the dominant ‘G-creative’ (perhaps God creative) or the ‘creativity in the mind’ narrative, which lives in the contemporary creativity in psychology and the cultural legacy of genius. In Weisberg’s review (2006), a confluence theory acknowledges a number of factors coming together: “Creativity requires a person with a particular thinking style, knowledge base, and personality, who is in a particular environment (p97)”. Although a number of personal and extra-personal factors were considered for some time in the mid 20th Century as causes of creativity, the two most cited contemporary confluence models of are undoubtedly from the late 20th Century: Amabile’s Componential Model of Creativity (1983, 1996) where creativity is *judged* as being something novel and appropriate and explained as arising from a person’s *domain-relevant skills*, his or her *creativity-relevant skills* and finally their *task motivation*; and Sternberg & Lubart’s (1991) Investment Theory of Creativity, where creativity is like an economic metaphor of a marketplace, where creative thinkers “buy low and sell high” (Weisberg 2006 p 100).

Perhaps the most well known N-creative – or socially constructed creative model - in recent decades, invoking the earlier work of AF Whitehead in the 1920s, comes through the social ‘systems’ explanation of creativity as emerging from both minds, people, gatekeepers and tastemakers. Within this model the individual and his or her mind is only one part of the more complex process that perhaps leads to creativity that is ‘domain changing’. While the model deals with explanations of any type of creativity, it is seen to be particularly useful in explaining creativity that is sometimes referred to as ‘Big C’ creativity or historically important creativity – as opposed to short range or ‘Small C ‘creativity, which may be no more than an idea for a new bus journey. Creativity in this model is ‘rated’ in a cultural system – something its author Mihaly Csikszentmihalyi used to explain why creativity has ‘clustered’ throughout history in scenes, milieu, geographic places and in industrial contexts, for example renaissance Florence in art or Sixties London in pop music.



Fig. 1 An N Creative model of creativity. Adapted from Csikszentmihalyi, 2006

According to Csikszentmihalyi’s tripartite model (1996) in Fg 1, *“Creativity results from the interaction of a system composed of three elements: a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognise and validate innovation. All three are necessary for a creative idea, product or discovery to take place”* (Csikszentmihalyi 1996, p6)

Csikszentmihalyi’s model explains that real world creativity is only meaningful as a social process, after being an internal one. Fig 1 above conceptualises “a process that can be observed only at the intersection where *individuals*, *domains*, and *fields* interact” [emphasis added] (2006 p3). Creativity seen this way is explained by a *person*, with a set of confluence and cultural factors making a change to a *domain* – a value and cultural system (a knowledge base, subject or even an industry), which is rated (and selected therefore as creative) by its *field* – a community of gatekeepers, experts and tastemakers who form part of the social system for that domain. When it comes to the individual, alongside the various character, traits and abilities of the psychologists’ confluence approaches, Csikszentmihalyi’s provides a number of more culturally and historically formed ideas about *people*, such as a cultural capital, a person’s ethnicity and cultural background and even marginality to a field (people from less conventional backgrounds), pointing to biographical accounts of some of the most eminent creative achievers in history, who very often lived within uncomfortable unconventional contexts, such as India’s Ghandi during his formative period under British rule in South Africa, the Catalan Picasso residing in the heart of the Parisian art scene at the turn of the 20th Century and Freud being a Jewish Catholic in Vienna (Csikszentmihalyi 2006 p 13).

**A tale of two creatives: G-Creative and N Creative**

We have seen that the historical narratives of where creativity comes from, how it’s measured, considered a supernatural gift, a talent, a skill or many ‘things’ in the mind. These narratives, discourses or ‘rhetorics’ (Banji et al 2006) can be grouped loosely around two types of creativity: (i) creativity a closed ‘in the mind’ cognitive process or (ii) creativity as an open social process of a person in the ‘real world’. These two ‘directions’ were termed by Still and D’Inverno (2015) as N-Creative (perhaps nature-like) and G-Creative (perhaps God like) in a paper made to the last International Conference of Computational Creativity, to aid the development of creative AI (artificial intelligence) systems, models and its development away from closed G-Creative ‘in the mind’ analogous processes – a type of human-machine manifesto for AI development.

The prising apart of these two differing narratives and theories: G-creative (largely psychological understanding of creativity) and N-Creative (largely socially constructed) is said by many to be important, and is summarised here in an analysis of creativity and AI in Table 1. A simplified ontology of creativity might suggest that, given the historical context we have seen, G-Creative aligns with a traditional idea of special people, who male special things and are somehow gifted with unique and increasingly measurable and ‘unlockable’ abilities (especially problem-solving ones) located in the mind. N-Creative, on the other hand, hails from the Latin meaning of *creare* (to bring forth) aligned to humanistic ideas of creativity through exploration, intrinsic motivation, joy and only meaningful in relation to a ‘real world’ setting.

|  |  |  |
| --- | --- | --- |
| **Type of Creativity**  | **G Creative (psychological creativity)**  | **N Creative (socially constructed creativity)** |
| What is created? | Creation as separate from the creator  | Creation as expressive part of the creative |
| What location or ‘P of creativity’People, Products, Place | Focus on ‘products’ as novelty + appropriateness | Focus on ‘people’ and ‘process’ |
| How it happens (system) | A closed system inside the mind | An open system in a sociocultural context |
| Aiding, managing and developing it | Cognitive ability (IQ and DT)Brain stormingMind mapping Trial and error | Intrinsic motivationConfluence models:Knowledge + motivation + creativity skills)Play and pleasure |
| Theorists | Psychologists, computational creativity theorist, scientists, AI, business studies | Social psychologists, educationalists, historians, media and culture theorists |
| How is it assessed | Expert assessment (C.A.T. consensual assessment technique) | Field and wider cultural assessment |
| Creative Industry Relevance | New product ideasInventionProblem solvingGround-breaking | New product categoriesInnovationProblematisingTaste-making |
| Cultural narratives | IndividualisticGeniusInspirationTrial and ErrorSpecific rules and methodsBrains | CollaborativeTalent EffortExperimentationInterdisciplinary methodsSkills |
| Development in Artificial Intelligence AI | Computational Creativity (Turing Tests) | Generative Adversarial NetworkAugmented technologies |

Table 1: G Creative vs N creative narratives

**AI and Computational Creativity**

Margaret Boden’s seminal work on artificial intelligence (AI) and computational computing (1998) outlined three types or categories of computer creativity, namely: *combinational, exploratory and transformative.* This hierarchy of computational creativity is akin to what creativity theorists have discussed as ‘Big C’ and ‘Cmall C’ creativity, the former being creativity of the type akin to combining two new ingredients in a food recipe (something we all do often), and latter being creativity that is historically important or to use the Csikszentmihalyi model (above), is domain changing, like the Bauhaus’ break with decorative architecture or 1970s rap music’s redefining of disco music.

Computational ‘combinational’ creativity by machines has been a feature for at least last five decades. Boden explains that this might specifically mean the autonomous combining of two types of improbable yet familiar ideas / things. As far back as 1957 a computer algorithm was used to compose the Illiac Suite, a string quartet in the Classical style. When played by real musicians, it passed the ‘Turin Test’ of it being indistinguishable from something that might have been written by a composer judged by a human bystander. In 1997 the JAPE (Joke Analysis and Production Engine) went a step further, and could create jokes and puns such as “what do you call a Martian who drinks beer? An ale-ien!”, passing a type of Turin Test good enough, perhaps, as something drafted by a person for a Christmas cracker.

The problem, acknowledged by Margaret Boden herself, was that for machines to be transformative or Big C in their creativity, it “depends largely on unarticulated values, including social considerations of various kinds. These social evaluations are often invisible to scientists” (1998 p355). Describing a distant future where machines might be able to make these kind of evaluative and even persuasive processes (like those of Sternberg’s, 1991, investment model of creativity where an idea is ‘sold’), a recent example in 2018 by a group of experimentalist coders in France called Obvious Collective points in this transformative direction.

On the portrait of Edmond Belamy, by the Obvious Collective, a blurry canvas of art reminiscent of an Old Master, a telling signature by its algorithm makers *‘min G max D x [log (D(x))] + z [log(1 – D (G(z)))]’* makes a point of a bold AI project that that might not only pass a Turin Test of ‘realness’, but be transformative in the way Boden describes AI futures. The ‘painting’ sold for around £300,000 in 2019, and although that might not signify ‘creative success’ in itself, it was made by a programme that did consider its social context. From a computational creativity point of view, this painting was different from many other AI creativity attempts in the past, in that its algorithmic basis programmatically modelled a form of human evaluative system called a ‘Generative Adversarial Network’. It could be argued, therefore, that the Portrait of Edmond Belamy is perhaps one of the first creative AI projects that has responded in part to Still and D’Inverno’s call for N-Creative computer creativity – and an end to closed system G-Creative computational processes that ignore a socially constructed view of how man and machine might co-create.

In many ways, the Obvious Collective developed their algorithm according to Mihalyi Csikszentmihalyi’s ‘systems’ model of creativity (1988), one largely explained in this chapter as an N-Creative model. Using his model Fig. 1 we can analyse the Portrait of Edmond Belamy thus:

* *Domain:* the team behind it fed 15,000 artwork images spanning 600 years of portraiture.
* *Person:* the generative network selected candidate images to adopt, just as an artist might.
* *Field:* the ‘Generative Adversarial Network’ did the important art criticism part, acting as a gatekeeper of what to keep and what to cut in a form of machine learning.

Although this cannot be considered a part of a real cultural system, and the algorithm needed the human programming team to persuade the artworld of its novelty (and appropriateness), it represents a step towards more N-Creative software development, and perhaps an end to the assumption of machines as creators with defined machine learning algorithms. Individualistic models of creativity ignore group, team and incremental process. Computational creativity of the combinative type ignores the co-creative way creative work is organised by a human and therefore replicates such G-Creative theories, ones Stills and D’Inverno (2016) suggest as unhelpful for the field to develop AI creativity.

[insert fig 2 here: caption the portrait of Edmond Belamy]

**In conclusion: a manifesto for (wo)man and machine in the creative academy**

This chapter has shown the complexity tied-up in the meaning of creativity, outlining its origins, cultural history and etymology adding to the complexity of theories and narratives around it. In reviewing some of these, we see that there exists today two related but separate theories, ones Stills and D’Inverno called G-creative (creativity in the mind) and N-Creative (creativity in a socially defined person). The ontological facets of these two theories provided in Table 1, shows a leaning towards G-Creative theories in the development of computational creativity, something hinted at over 22 years ago in Margaret Boden’s paper on the subject in 1998. In this light, AI developers have much to gain from working with creative art schools, technologists and creative business students in the N-Creative areas listed in Table 1 with regards to experimentation, interdisciplinary methods, taste-making and domain skills.

With regards to AI, to echo Still & D’Inverno’s call for less psychology-inspired AI computational creativity closed-systems and more human and sociocultural related ones, AI system designers should be grounded in the theory of sociocultural processes and less reliant on the post war ‘Guilford School’ of intelligence and divergent thinking with its implied computational creativity. The portrait of Edward de Belamy is not only an example of an attempt at employing this, with its machine learning ‘gatekeeper’ factoring of sociocultural of fields and domain knowledge, it also challenges the art world about its long cultural history discussed here around genius and the deification of fine artistry.

Knowing that N-creative human design and cultural context is realistically the only way machines can become part of a ‘Big C’ or transformative creative process, can anyone really imagine a Blade Runner ‘replicant’ android in the next two decades, against present examples of anthropomorphic innovation of Amazon Alexa? As a journalist once joked, if a computer alone was creative enough to ‘fool’ us (Turing Test) into being the next Banksy or Top Ten record producer, we would probably never know, as its first job would be to eliminate us! Creativity ultimately is a social process and one where researchers, students, experimentalists need to develop AI research (such as augmented technologies) in the way that creative people, teams and disciplines work and learn collaboratively when incredible things are achieved. The clear message here, is that when it comes to creativity, it is not *all* located in the gift of a ‘mind’ - be that a person’s or a one of a computer.

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