Criterial Problems in Creative Cognition Research

'Although it is always possible for an ingenious philosopher or psychologist to invent criterial attributes defining a category, earlier research has shown that actual subjects rate superordinate semantic categories as having few, if any attributes common to all members (Rosch *et al*., in press).'

\- (Rosch & Mervis, 1975, p. 577)

In creative cognition research, the Romantic view about creative cognition is traditionally rejected in favour of the modern view. The Romantic view is the view according to which creativity is mysterious, unintelligible and unanalysable. However, this view provides no understanding of creativity and does not yield working theories so much as misleading myths about creativity and how it works (Koestler, 1964, Boden, 1990). The modern view about creative cognition maintains that creativity is neither mysterious nor unintelligible and that it is indeed susceptible to analysis. The paradigmatic objects of analysis in creative cognition research have been the creative output and the creative process. The degree of creativity of an output is assessed in accordance with certain *criterial definitions*. The degree of creativity of a cognitive process is assessed in accordance with certain models of creative cognition, psychometric test measures and neuroimaging studies that are grounded nonetheless in certain *criteria for assessment*. The reliance on *criterial definitions* and *criteria for assessment* in analysing either the creative output or the creative process suggests that creative cognition researchers remain under the sway of the classical, bundles-of-criteria theory of meaning. In this paper, I will critically evaluate the criterial problems that confront both *criterial definitions* and *criteria for assessment*, before proposing an alternative theory of meaning that might get the entire research tradition past these criterial problems.

According to the classical, bundles-of-criteria theory of meaning, there is a laundry list of features that serves as evaluative criteria according to which membership in a cognitive category is determined (Katz & Fodor, 1963, Katz & Postal, 1964). For example, the following laundry list of features (is animate; is human; is male; has never married) would serve as evaluative criteria according to which membership in the cognitive category 'bachelor' is determined. Likewise, the following laundry list of features (is animate; is non-human; is furry; has four legs; meows) would serve as evaluative criteria with respect to the cognitive category 'cat'. Membership in a particular category would therefore be determined by the possession (or lack thereof) of certain necessary and/or sufficient conditions. As categorization is based on the possession of certain necessary and/or sufficient conditions, this theory is also known in certain quarters as the NSC (necessary and sufficient conditions) model of categorization (Kortmann & Loebner, 2014). According to the NSC model, there exists a set of conditions that are necessary for membership in a category. These necessary conditions in turn would jointly form a sufficient condition for membership in a category. If we take this theory of meaning (or model of categorization) to be a compelling one, we might further hold that as 'creativity' is a cognitive category it might susceptible to this sort of bundles-of-criteria analysis. *Criterial definitions* of creativity in terms of necessary and/or sufficient conditions appear to be informed by precisely the sorts of assumptions that undergird the classical, bundles-of-criteria theory of meaning. The standard two-criteria definition of creativity, according to which creativity is defined in terms of novelty (or

originality, unusualness or uniqueness) and value (or usefulness, degree of fit or appropriateness or effectiveness), is discussed in Runco & Jaeger (2012) and may be traced to Stein (1953). Novelty or originality is a necessary but insufficient condition for creativity: for example, '7,363,474' is an original answer to the problem 'How much is 12 + 12?' but we would be confused about which bundles of features make up the category of 'creativity' if we were to take it to be creative (Mednick, 1962). Likewise, the word salad of psychotics and the typing produced by monkeys on type-writers are original but useless and would therefore not count as instances of creativity.[1] Rather, these might be thought of as instances of pseudocreative behaviour (Cattell & Butcher, 1968).

Non-standard definitions of creativity might look either to reduce the standard two-criteria definition to a single criterion (for reasons of parsimony) or increase the number of criteria (for reasons of sophistication). A three-criteria definition of creativity in terms of novelty, value and surprise builds upon Bruner's (1962) account of creativity as effective surprise and has been defended by Boden (1990) and Simonton (2012). Simonton, in particular, based his argument for the three-criteria definition of creativity on U.S. Patent guidelines. To be certain, U.S. Patent Law provides a four- rather than a three-criteria definition of creativity: any output is patentable on creative grounds iff it is statutory, novel, non-obvious and valuable.[2] In order to embrace cross-cultural variations in the construct of creativity, Kharkhurin (2014) has defended a four-criteria definition of creativity in terms of novelty, utility, aesthetics and authenticity. What the single-criterion, three-criteria and four-criteria alternatives to the standard two-criteria definition point to is a worrying lack of agreement among creative cognition researchers about the necessary and/or sufficient conditions for creativity. This is worrying because the *criterial definition* that one accepts can significantly influence the way one goes about analysing creative phenomena and the types of explanations of creativity that one might be willing to consider *prima facie*.

There is a further problem with *criterial definitions*: the problem of value-judgments. Value-judgments are time-dependent, subjective, culturally relative and unreliable, as ably illustrated by Weisberg's (2015) van Gogh-Meissonier example. Vincent van Gogh, the Dutch Post-Impressionist painter who died poor and unknown in 1890, is today hailed as a creative genius: his works are now in every major museum, appear in all histories of art and rakes in multi-millions of dollars at auctions worldwide. The change in the artistic reputation of van Gogh for the better took years, as some value-judgments concerning creativity have a long time-scale. Jean-Louis Ernest Meissonier, on the other hand, is a French Academic painter, celebrated in his day for his small-scale and finely detailed historical paintings of Napoleon and military themes. Meissonier received prizes each year at the Paris Salon and won prestigious commissions during his lifetime. By the mid-twentieth century, however, Meissonier had faded into relative obscurity and his work today is mainly of mere historical interest. The change in the artistic reputation of Meissonier for the worse has to do with the

[1] Admittedly, monkeys hitting keys at random for an infinite amount of time might well produce the complete works of William Shakespeare (*cf.* the infinite monkey theorem). One might therefore look to add 'intentional' (or at least 'not completely random') to the laundry list of necessary but insufficient conditions for creativity.

[2] There are problems with basing an account of creativity on the necessary and/or sufficient conditions for patentability. Under §101 of the U.S. Patent Act, only processes, machines, articles of manufacture and compositions of matter are patentable. An idea, an economic theory, a mathematical method and a computer program cannot therefore count *stricto sensu* as patentable, no matter how novel, non-obvious and valuable they might be.

general sense in which Meissonier and other Academic painters were later left behind by a succeeding generation of painters (viz. Manet and the Impressionists). Weisberg's (1993, 2015) response is to come up with an alternative definition of creativity, based on the following criteria: any output is creative iff it is novel and was produced intentionally. Weisberg's solution to the problem of value-judgments and their time-dependence, subjectivity, cultural relativity and unreliability is therefore a *criterial definition* that does not include reference to value in any form. While Weisberg's non-standard two-criteria definition of creativity as intentional novelty is correct in recognizing the problematic nature of value-judgments in *criterial definitions*, it has the following (unfortunate) implication: any novel product, produced intentionally, is creative, whether or not it is of value to anyone.[3] If I were to intentionally produce novel sentences of the 'There are thirty-three blind purple-spotted giant hedgehogs living in the Tower of London' and 'The deckchairs are on the top of the mountain, three miles from the artificial flowers' variety, then it appears that these novel sentences would comfortably meet Weisberg's non-standard two-criteria definition of creativity and therefore count as examples of creativity.[4] Surely this would run counter to how we normally think about creativity: there ought to exist certain evaluative constraints as to what could count as an example of creativity.

The problem of value-judgments is therefore not to be dealt with by removing reference to value in any form in *criterial definitions*. The concept of creativity appears to be necessarily value-laden and any proper account of creativity must take this into account. We might look to address the time-dependence, subjectivity, cultural relativity and unreliability of value-judgments about creativity by appealing to a hypothetical group of appropriately situated and ideal observers and the independent consensus that may be elicited from this group. This appeal to expert judges to resolve the problem of value-judgments may be found in Amabile (1982) and Stein (1953), and it is analogous to the appeal to ideal observer theory to deal with the issue of moral value-judgments in moral philosophy (Hume, 1740, Firth, 1952, Hare, 1989). In order for the appeal to an ideal observer or an expert judge to work as a heuristic device in the context of *criterial definitions*, she cannot simply be defined as someone who always gets creativity value-judgments right. Over-idealization of this sort will result in the hypothetical ideal observer or expert judge being so far removed from our everyday lives and concerns that the appeal to ideal observers and expert judges would simply become ineffective as a heuristic device. Even if an independent definition could be provided of an ideal observer or an expert judge, one might still feel entitled to ask the questions previously posed by Murray (1958): Who is to judge the judges? And the judges of the judges? Runco (1999, p. 238) has characterized these questions in terms of the problem of circularity. Therefore, on top of a worrying lack of agreement among creative cognition researchers about the necessary and/or sufficient conditions for creativity, any appeal to ideal observer theory to address the problem of value-judgments would have to handle the challenge of providing an independent definition of these ideal observers and the separate problem of circularity.

[3] Weisberg (2015, p. 111) has himself acknowledged this implication of his non-standard two-criteria definition of creativity. He might therefore have committed himself to a position that would require a fair amount of bullet-biting.

[4] These examples of novel yet intelligible sentences have been taken from Boden (1990).

The third problem with *criterial definitions* has to do with how *criterial definitions* address the creative output but not the creative process. This might cause us to overlook an important distinction between the creative output and the creative process. As Ghiselin (1952) has observed, the impression of unlaboured force that a creative output gives might mislead us into underestimating the labour of invention in the creative process (of which the creative output is merely the culmination). Creative cognition researchers might look to certain models of creative cognition, psychometric test measures and neuroimaging studies to analyse the creative process rather than the creative output. Among these models of creative cognition are the Geneplore model (Finke *et al*, 1992) and the blind variation and selective retention (or BVSR) model (Campbell, 1960, Simonton, 1999). According to the Geneplore (or generate-explore) model, we alternate between generative and exploratory phases: we generate potential ideas or preinventive structures (or internal precursors to the final, externalized creative output) and then explore and interpret these potential ideas or preinventive structures (Finke *et al*, 1992, Ward *et al*, 1999). According to the BVSR model, we alternate between the blind variation and selective retention phases. In the blind variation phase, variations are emitted that must be independent of the environmental conditions of the occasion of their occurrence and the occurrence of individual trials must be uncorrelated with the solution. In the selective retention phase, scores of thought-trials and ideas are filtered through the mind (generated in accordance with the BVSR model) and selective retention allows for the less useful ideas to be eliminated in favour of the more useful (Campbell, 1960. Turning to models of creative cognition to analyse the creative process does not however get us out of trouble. In the Geneplore model, we refine potential ideas or preinventive structures according to the demands or constraints of a particular task. These demands or constraints and the degree to which the structures might be appropriate for the problem-solving task would require evaluation. The Geneplore model would therefore be grounded nonetheless in certain *criteria for assessment*. Things are no different for the BVSR model: in the selective retention phase of this model, we are concerned with the probability that a particular variant proves maximally useful, adaptive or functional, in accordance with the appropriate *criteria for assessment*. Within each of these two models of creative cognition, we would still require *criteria for assessment* for evaluating potential ideas or preinventive structures (in the case of the Geneplore model) and which thought-trials and ideas will get selectively retained (in the case of the BVSR model). Furthermore, would we still not require *criteria for assessment* in order to select the most appropriate among these models of creative cognition? With a lack of agreement among creative cognition researchers about which model of creative cognition is the most appropriate, we do not seem to be able to get much farther than where we might have left off with *criterial definitions* that address the creative output.

Psychometricians might suggest analysing the creative process in terms of its psychometric properties. There is a range of psychometric test measures, including but not limited to the following: the Alternative Uses Task or AUT (Guilford, 1967), the Remote Associates Test or RAT (Mednick & Mednick, 1967) and the Torrance Test of Creative Thinking or TTCT (Torrance, 1966, Torrance, 1990). Similar problems dog the psychometric test approach: how are we to know that we are using the correct *criteria for assessment* when we design and implement psychometric tests? Unless there is an agreement among psychometricians about the *criteria for assessment* in psychometric tests for creativity, then a certain amount of question-begging remains even if we look to the *criteria for assessment* in psychometric testing. As things stand, these diverse test measures employ a range of *criteria*

for assessment: psychometric tests that measure divergent thinking employ a plethora of *criteria for assessment* whereas psychometric tests that measure convergent thinking employ *criteria for assessment* that have to do with highly constrained, single solutions being found (the semantic association for three words in each item, in the case of the RAT).[5] The problem of knowing whether we are using the correct *criteria for assessment* when we design and implement psychometric tests is known as the *criterion problem*.[6] As I hope to have demonstrated, the *criterion problem* may be generalized to cover both *criterial definitions* that address the creative output and *criteria for assessment* that address the creative process. Even neuroimaging studies that look to uncover the neural substrates of the creative process do not finally escape the reach of the *criterion problem.* As the literature review of Arden *et al* (2010) makes sufficiently clear, neuroimaging studies on creative cognition rely extensively on the AUT, RAT and the TTCT. Basic psychometric work is necessary for the field of creative cognition research: without it, we cannot know what we are imaging. Until the psychometric properties of creative cognition are better characterized, neuroimaging studies will have only limited use. Furthermore, given the diverse range of psychometric test measures employed by neuroimaging studies, we are unable at present to interpret or integrate across these studies and consolidate their results (Arden *et al*, 2010, p. 152).

Perhaps the time has come for creative cognition researchers to move beyond the sway of the classical, bundles-of-criteria theory of meaning (or NSC model of categorization). We might look to move beyond our cognitive habit of thinking of creative output in terms of bundles of features (viz. novelty, value, surprise, etc) or of the creative process in terms of bundles of psychometric properties (viz. originality, fluency, flexibility, elaboration, etc). In the classical, bundles-of-criteria theory of meaning, membership in a category is an all-or-nothing affair: boundaries between members and non-members are clear-cut and non-fuzzy and categories do not have a graded structure. This all-or-nothingness has to do with the context-independence and objectivity of the laundry list of necessary and/or sufficient conditions that are part-and-parcel of an NSC model of categorization. Weisberg's (2015) van Gogh-Meissonier example demonstrates the instability, variability, contingency and defeasibility of categorizations about creativity. Given the value-ladenness of the concept of creativity and the time-dependence, subjectivity, cultural relativity and unreliability of value-judgments about creativity, we might look instead to a model of categorization for creative cognition research that admits of fuzzy boundaries, graded membership and non-monotonicity. An interesting alternative to consider might be the prototype theory of meaning (Rosch, 1973, Rosch, 1978). According to this account, our cognitive categories are formulated around prototypical instances. Membership in a cognitive category is not organized around a laundry list of necessary and/or sufficient conditions (or NSCs) but rather around a prototypical member (or a central instance of a concept). For example, a male human who has never married would normally constitute a prototypical member of the 'bachelor' category whereas a young male seal that has not yet mated would

[5] The *criteria for assessment* for the AUT (Guilford, 1967) are: originality, fluency, flexibility and elaboration. While the *criteria for assessment* for early versions of the TTCT (Torrance, 1966) closely resembled those of the AUT, later versions of the TTCT (Torrance, 1990) removed flexibility but added resistance to premature closure and abstractness of titles to their *criteria for assessment.*

[66] The criterion problem was first discussed in the late 1950s and 1960s at a series of conferences in Utah (later published in a volume edited by Calvin Taylor and Frank Barron). I am grateful to Mark Runco for having pointed this out to me.

normally constitute a non-prototypical member of the 'bachelor' category (even though bachelor seals are a zoological reality). A candidate for membership in a category is a member to the degree that it resembles the prototype. According to the prototype theory of meaning, we compare encountered instances with the prototypical member of a category to assess whether these instances belong to the category in question. Cottrell's (1990) face recognition networks are based on the typicality-recognizability principle that undergirds the prototype theory of meaning: we store a representation of the prototype or average face, against which all other faces are compared and encoded in relative terms.[7]

Former prototypes can be adjusted or discarded and new prototypes can be constructed, allowing for old cognitive categories to be revised or new ones to be acquired with experience. This grants prototype theory a non-monotonicity that is absent in the NCS model of categorization: we can therefore make sense of how value-judgments about creativity may be updated and revised in a time-dependent and culturally relative fashion (as we find in Weisberg's (2015) van Gogh-Meissonier example). A prototype also includes a similarity metric to determine whether an encountered instance resembles the prototypical member of a category to a sufficient extent: such an approach to concepts would therefore be a statistical or probabilistic one. Typicality becomes essential to our understanding of concepts: typicality is a graded phenomenon, in which items can be extremely typical (almost indistinguishable from or close to the prototype), moderately typical (fairly close), atypical (not close) and borderline category members (equidistant from two different prototypes) (Murphy, 2002, p. 31). We can explain the otherwise worrying lack of agreement among creative cognition researchers about the necessary and/or sufficient conditions for creativity in terms of the fuzziness of boundaries between members and non-members, which is a constitutive feature of prototype theory but not the classical, bundles-of-criteria theory. If we were to discard the classical, bundles-of-criteria theory of meaning in favour of the postclassical, prototype theory of meaning, we might get past the criterial problems that afflict both *criterial definitions* and *criteria for assessment*. We could predict that Shakespeare would easily be identified as a prototypical member of the category 'standard exemplar of creativity' whereas monkeys hitting keys at random on type-writers might not. Indeed, monkeys hitting keys at random on type-writers would form an image closer to the prototype of the category 'randomness'. A child who fixes the bell on his tricycle for the first time or subjects who manage to solve Karl Duncker's (1945) candle problem and Norman Maier's (1931) two-string problem demonstrate some degree of closeness to the prototype of Shakespeare warbling his native wood-notes wild. The graded structure of categories in prototype theory will allow a creative cognition researcher to better explain why members of the same category (viz. Shakespeare, the child who fixes the bell on his tricycle for the first time, subjects who manage to solve the candle problem and the two-string problem) are thought to exhibit different degrees of membership. This explanatory route is not available to someone who maintains a classical, bundles-of-criteria theory of meaning (or NSC model of categorization), according to which membership is a straightforward, binary and all-or-nothing affair. There may be cross-cultural differences in prototype selection: for example, a robin would be a prototypical member of the category 'bird' in Western cultures whereas a chicken might be a prototypical member of the same category in Southeast Asian cultures.

[7] For further critical discussion about the relationship between the prototype theory of meaning and face recognition technologies and its implications for cognition in general, see O'Toole (2004).

These cross-cultural differences, which can be neatly captured in a prototype theory that is suitably grounded in encountered instances with prototypes, might help to explain how the concept of creativity varies between cultures.

According to the prototype theory of meaning, each concept consists of at least some statistical information about the features that are characteristic of a class (Hampton, 1979, 2006).[8] Membership in the cognitive category of 'creativity' might be determined by computing a measure of similarity between an instance and a prototype, based on degree of feature overlap and an admission threshold on the feature-based similarity metric.[9] Experimental subjects could first be asked to think about the superordinate concept of 'creativity'. Once certain related and subordinate concepts (e.g. 'artistic creativity', 'scientific creativity', 'sporting creativity', 'culinary creativity', 'creative problem-solving', 'creative personality', 'creative process', 'creative output') have been identified on their behalf, these subjects could then be asked to identify category members for each subordinate concept and enumerate the features that they take to be true of members of each category.[10] These subjects could also be asked thereafter to define the superordinate concept of 'creativity' in terms of necessary and sufficient conditions. Depending on the frequency with which certain members and features have been identified, we might then look to establish prototypical members and features and determine our similarity metric in terms of a weighted sum of overlapping features. Once these results have been obtained, we might present another group of experimental subjects in a follow-up experiment with the same subordinate concepts, itemized with prototypical members alongside other randomly selected members, and ask them about the degree to which members (prototypical or randomly selected) fit their notion of that cognitive category and whether or not a general *criterial definition* or *criteria for assessment* might be provided for the superordinate concept of 'creativity'.

The prototype theorist will predict the following: there will be few (if any) features in common to all subordinate concepts of 'creativity', subjects will list category membership features with ease even though they might find it difficult to provide an explicit definition of the superordinate concept of 'creativity' in terms of necessary and sufficient conditions (this could be determined by using reaction time data), certain members will be rated as more prototypical than other members of the same category (e.g. 'Shakespeare' or 'Picasso' in the category 'artistic creativity'), categorization might be time-dependent and culturally relative (once we allow for longitudinal and cross-cultural prototype theory approaches) and a certain skepticism will prevail about the existence of *criterial definitions* or *criteria for assessment* for the superordinate concept of 'creativity' in the follow-up experiment. A prototype theory

[8] The relevant prototype model that I have in mind is neither the attribute-free prototype model (Posner & Keele, 1968), in which the prototype does not have a clear attribute structure, nor the spatial prototype model (Rips, Shoben & Smith, 1973), in which the prototype is a point in space corresponding to the centroid of an instance cluster. Rather, I am concerned with the featural prototype model, in which similarity to the prototype is determined by counting the number of overlapping features between the prototype and an instance. The featural prototype model is better able to deal with the degrees of abstraction and elaboration that we will expect from creative cognition (when we deal *inter alia* with creative personality traits, creative mental activities and creative evaluations). For further discussion, see Hampton (1995).

[9] See the similarity measure of Hampton (1979) and the family resemblance score of Rosch & Mervis (1975) for examples of similarity metrices.

[10] As our experimental subjects would consist of members of the laity (whom we would presume to lack the domain-specific knowledge of experts), we would hold our prototypes to be standard exemplars (in which statistical information is encoded) rather than best exemplars or category ideals.

approach to creative cognition research is statistically driven and empirically oriented: it will therefore be less vulnerable to the criterial problems that plague the *a priori* approach of creative cognition researchers who remain captive to the classical, bundles-of-criteria theory of meaning. Instead of determining the *criterial definitions* and *criteria for assessment* in advance and applying them thereafter to creative individuals, creative output and creative processes, we submit our long-standing questions about the superordinate concept of 'creativity' (and its related subordinate concepts) to the laity, in order to derive statistical information about standard exemplars and prototypes of creativity, the characteristic features of members of a cognitive category in creative cognition research, how category membership might be determined in terms of degree of similarity (or an overlap of features) between an instance and a prototype and the degree to which category membership might be time-dependent and culturally relative.

I do not wish to deny that there will be challenges ahead if creative cognition researchers decide to heed my proposal and adopt the prototype theory of meaning as their theory of categorization. For instance, would it be possible for cognition to deal with deciding (a) about which phenomena are prototypical or (b) on boundary cases for atypical cases, without having to rely on criteria? This is a counter that one might anticipate on behalf of the classical, bundles-of-criteria theorist of meaning. In addition, the exact nature of a prototype remains ill-defined and unclear, and we might well end up mired in the sorts of interminable disagreement that afflict discussions about the necessary and/or sufficient conditions for creativity. Furthermore, recent work has suggested that creative cognition is domain-specific rather than domain-general (Baer, 2012). If there are no domain-general creativity-relevant skills or attributes that exist, then there are no domain-general creativity-relevant skills and attributes to measure and the predictive value and utility of such generalized psychometric tests as the AUT, the RAT or the TCTT would suffer as a result (Simonton, 1999). Would the argument in favour of domain-specificity weaken the case for a prototype theory of meaning, as it appears to have done in the case of generalized psychometric tests?

These are all valid considerations. My response would be the following: I do not presume to have presented a knockdown argument against the NSC model of categorization (nor do I believe that such a knockdown argument exists). Criterial considerations could well return in a different and more diminished guise, when thinking in terms of prototypes of creativity becomes adequately developed. A prototype theorist could also concede that more work remains to be done, in order to articulate how precisely a prototype might be set apart from non-prototypical members and non-members. These are all, however, empirical matters that are contingent upon the future development of the theoretical alternative that I have advanced. Depending on the empirical results of a prototype theory approach to creative cognition research, we might even be given in the final instance to concede the heterogeneity hypothesis, according to which the concept of creativity does not constitute a singular natural kind (Piccinini & Scott, 2006, Machery, 2005, 2009, 2010). Rather, it might well split into a plurality of natural kinds because different kinds of mental representation that are processed independently must be posited to explain different sets of relevant phenomena in creative cognition. The creative mind could legitimately use different natural kinds that have little in common: it could sometimes use prototypes, sometimes exemplars, sometimes theories and sometimes even definitions from the NSC model of categorization. Again, the value in developing the theoretical alternative I have proposed would lie in moving creative cognition

researchers beyond the staid and stuffy confines of the analytical, classical approach in which creativity is conceptualized strictly in terms of necessary and sufficient conditions.[11]

Furthermore, there is nothing contradictory about maintaining a prototype theory of meaning and the domain-specificity of creative cognition and its concepts: unlike in the NSC model of categorization, membership in a category is not an all-or-nothing affair. A prototype theorist could always maintain that we scale up from prototypes (or prototypical and statistically representative members of a category) to category ideals (or best exemplars of a category). For the laity lacking in the domain-specific knowledge of a particular creative domain, conceptualization takes place in terms of prototypes. For individuals possessing the requisite domain-specific knowledge, on the other hand, conceptualization could take place in terms of category ideals (Barsalou, 1983, 1985). One could in principle maintain conceptual pluralism and an appropriately modified version of prototype theory (or at least, a context-dependent and similarity-metric-based theory that is a departure from the context-independent bundles-of-criteria or NSC norm).[12] I take myself to be offering a compelling alternative to the prevailing norm of thinking in terms of necessary and sufficient conditions (or NSCs) for creativity. I take my theoretical alternative to be well-equipped to deal with such phenomena as Weisberg's (2015) van Gogh-Meissonier example and in a strong position to steer us past the roadblocks that appear to be impeding progress in the creative cognition research tradition.

One might also object that there is something facile in reducing creative cognition to the sort of categorization that we find in the face recognition technologies of Cottrell (1990). After all, might it not be urged that creativity is not about recognizing something that is already known but rather about generating something new in an as-yet unravelling conceptual space? Surely the act of producing or generating novelty defies categorization (how else might it count as unique or surprising)? One might have in mind here Boden's (1990) thesis that creativity is the mapping, exploration and transformation of conceptual spaces. Boden's suggestion is at once both tantalizing and misleading: it proceeds in the spirit of definitionism (with an emphasis on identifying necessary and sufficient conditions for creativity) and concept monism (according to which there is one and only one concept to which the term 'creativity' refers). Boden's thesis about creativity comes to grief in certain instances of sporting creativity: might a creative temperament, sensorimotor intelligence, perceptual ability, technical skill, intuition, excellent reaction speed and a gift for improvisation not be all there is to a brilliant passing shot by Roger Federer? Some creative actions in sport and in music are so fast that it would appear implausible to maintain that every creative action ought to be preceded by some creative thought: jazz musicians improvising at full speed often express surprise at having played note-sequences that they would not think they had known well enough to play and jazz pianists have rejected perfectly accurate transcriptions of their

[11] One could maintain the heterogeneity hypothesis, according to which the class of concepts under which creative cognition researchers look to investigate creativity is made up not of one natural kind but rather of several distinct natural kinds, and reject conceptual eliminativism (as espoused by Machery). One could for instance be a conceptual pluralist (Weiskopf, 2009, Chalmers, 2011) or a selective conceptual eliminativist (Taylor & Vickers, 2017). Given the foundational nature of the superordinate concept of 'creativity' in human cognition and endeavour, I believe that we are better off maintaining a certain conceptual pluralism about 'creativity'.

[12] For further discussion about prototype theory and scaling from prototypes to category ideals in the context of conceptual pluralism, see Weiskopf (2009).

solos on the grounds that these transcriptions contain notes that they maintain they could not have played (Berliner, 1994). We might therefore look toward an account of creativity that reserves a place for creativity of action in addition to creativity of thought and hold at bay the concept monism according to which there is one and only one concept to which the term 'creativity' refers.[13] In addition, creativity is not just that which is generated by an individual but also that which is recognized as such by the community at large. There is a division of labour here in creativity-recognition: once an output, a process or an individual has been recognized as creative by experts with the relevant domain-specific knowledge of a particular creative domain, it will constitute a category ideal or a best exemplar. Over time and contingent upon certain things being statistically the case, this category ideal or best exemplar might stand in the cultural memory of the laity (who normally lack the relevant domain-specific knowledge) as a standard exemplar. We have therefore at least two concepts of creative cognition here: creativity as generated during a *eureka* moment or in a creative process and creativity as recognized either by experts or by the laity as creativity. It is my belief that the prototype theory approach to creative cognition will shed light on creativity-recognition and my hope that it will also have important things to say about creativity-generation.[14] Furthermore, as category membership is determined by the degree of feature overlap and an admission threshold on the feature-based similarity metric, we are dealing with family resemblances rather than necessary and sufficient conditions. Eschewing the NSC (necessary and sufficient conditions) model of categorization in favour of the prototype theory of meaning would appear to allow us to make better sense of the conceptual pluralism toward which we are irresistibly led on the creative cognition front, when confronted with domain-specific creativity-relevant skills, creative actions, creative thoughts, prototypes, category ideals and time-dependent and culturally relative categorizations of creativity.

To conclude, I am not denying the modern view that creativity is neither mysterious nor unintelligible and that it is indeed susceptible to analysis. What I deny rather is the supposition that the classical, bundles-of-criteria theory of meaning is the only theory that we may subscribe to when looking to analyse the creative output and the creative process. I have argued that the creative output is assessed in terms of certain *criterial definitions* whereas the creative process is assessed in accordance with certain models of creative cognition, psychometric test measures and neuroimaging studies that are grounded nonetheless in certain *criteria for assessment*. I have argued that *criterial definitions* and *criteria for assessment* come with certain criterial problems and that captivity to these problems is entailed by an uncritical subscription to the classical, bundles-of-criteria theory of meaning. I have critically evaluated these criterial problems and proposed a cognitive alternative, the prototype theory of meaning, that might help get the entire creative cognition research tradition past these criterial problems. If my analysis is correct, then we ought to shift from thinking in terms of necessary and sufficient conditions for creativity to thinking in terms of prototypes of creativity and see how far this shift in perspective might take us.

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[13] Carruthers (2006) has similarly defended the place for creativity of action in any adequate account of creativity. According to the prototype theory approach, we ought to move away from thinking in terms of necessary and sufficient conditions for creativity (viz. creativity of thought and the transformation of conceptual space) and toward thinking in terms of prototypes of creativity. Prototypes of creative action and prototypes of creative thought might for example share a featural overlap that would allow us to characterize them in terms of the superordinate concept of 'creativity'.

[14] In the final resort and as aforementioned, I am also willing to maintain the heterogeneity hypothesis and conceptual pluralism.

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