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What to Measure? A new look at the concept of creativity

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ABSTRACT *It is argued that the concept of creativity is too loosely defined, and too much driven from a bottom-up operationalist view. It is also argued that current popular definitions of creativity, by focusing on novelty and appropriateness, do not distinguish the concept of creativity in a satisfactory way from standard definitions of the concept of intelligence, which also focus on novelty and appropriateness as key defining features. A solution to this conceptual dilemma is offered by way of making a clear-cut distinction between novelty on the stimulus and novelty on the response side. This distinction is used as a platform for the development of a new taxonomy of different kinds of creativity and intelligent behaviour. A major feature of this new model is the distinction made between proactive and reactive creativity. Finally, the conceptual model is used as a basis for pointing out some shortcomings of existing tests of creativity and, with a practical-educational perspective in mind, some specific suggestions on the anatomy of a new kind of creativity assessment are made.*

Key words: *creativity; intelligence; novelty; cognitive style*

INTRODUCTION

After more than 30 years of intensive research following Guilford's call to arms to focus research on creativity (Guilford, 1950), the field of creativity research was declared somewhat of a scientific disaster area. Gardner and his colleagues (Gardner, 1982) launched their new research programme in creativity under the label Project Zero, implying that no firm knowledge of substantial significance exists in the field. Consequently, new inquiries had to start from scratch. In the same vein, Weisberg (1986) demolished the bulk of the leading theses in the field, claiming they have no sound and valid scientific underpinning and amount to little more than misguided myths. More recently he reiterated many of his claims (Weisberg, 1993, 2003). Also, as late as 1993, Intons-Peterson (1993) was able to point to the fact that the 1926 scheme by Wallas (1926), in which he lined up the four sequence stages of creativity consisting of preparation, incubation, illumination and verification, was still a core piece of the treatment of creativity in the general introductory books in cognitive psychology. To underscore her point, in current

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introductory textbooks in organisational behaviour, this model is still portrayed as the basic conceptual framework for studying creativity (see, for example, Wagner & Hollenbeck, 2002)!

Such devastating criticism of the field of creativity may seem unduly harsh, reflecting arrogance or ignorance of the real state of affairs (cf. Stein, 1987). In several recently published reviews of the state-of-the-art in creativity and innovation research (see, for example, Grønhaug & Kaufmann, 1988; Sternberg, 1988, 1999; Runco, 1997, 2002; Runco & Pritzker, 1999a,b) the impression is definitely conveyed that constant progress has, indeed, been made and that the critics may have somewhat overstated their case.

Nevertheless, a blinking warning sign may still be in order. It may be argued that the research programme in creativity has been driven too exclusively from an operational 'bottom-up' perspective, where development of tests of creativity has taken priority over the clarification of basic conceptual and theoretical issues. The proliferation of tests purporting to measure creativity without solid conceptual and theoretical foundation may be seen as justifying such criticism (see, for example, Treffinger, 1986; Hoecevar & Bachelor, 1988). The 'old-timers' of divergent thinking tests, the Remote Associate Test (Mednick, 1962) and Insight tasks are still major household measurements and leading operationalisations in creativity research. In fact, very little change in the basic measurement technology in the field has occurred.

Thus, there is a real danger that one may repeat the mistakes of the operationalist-oriented IQ tradition. Some limited practical success may be granted. No significant clarification of the nature of human intelligence seems, however, to have resulted from this approach (see, for example, Raaheim, 1974, 1985; Miller, 1984; Sternberg, 2000).

Particularly in view of the considerable fragmentation that characterises the field of creativity, both on the level of theory, measurement and empirical research, as well as the difficulty in pointing to core ideas and research findings (see, for example, Ausubel, 1978; Briskman, 1980; Weisberg, 1986, 1993; Hausman, 1987; Stein, 1987; Unsworth, 2001), it may be argued that a renewed and increased emphasis on 'top-down' approaches that could improve the conceptual and theoretical basis of creativity research seems to be required to increase returns on research investments. Making a contribution to this endeavour is the primary aim of the present discussion.

ORIGINALITY, NOVELTY AND CREATIVITY

The concept of originality is closely linked to the property of *novelty*, which is a focal feature of most standard definitions of creativity (Jackson & Messick, 1967; Barron, 1988; Ochse, 1990; Lubart, 1996). Novelty of product (or expression) is, of course, integral to the essence of the phenomenon of creativity. As many prominent authors on the subjects have emphasised, however, the novelty criterion is far from clear (see, for example, Hausman, 1987).

What Kind of Novelty?

What do we mean exactly when we are talking about novelty? Do we think about novelty in the most literate way, as something that has never happened before or something that has never been done before? In this strict sense of the term novelty we are referring to what we may call objective novelty, that is the basis for what Boden (1994) links to what she calls historical creativity or H-creativity. This conception of novelty is sometimes employed as the basis for the suggestion often made by philosophers (see, for example, Briskman, 1980) to the effect that creativity cannot be submitted to normal, empirical scrutiny in the sense of determining the conditions that lead to discovery of new products. Briskman (1980) offered the following 'proof' for this contention:

> Consider what would be involved in such an explanation: take some specific creative scientific or artistic achievement C, and assume that we had some general theory of creativity, or of the creative process, T, according to which C was necessary. This would mean that given T, and a description of some relevant set of prior circumstances, or initial conditions P, we could actually deduce the attainment of C. But this implies that anyone in possession of T, and given the description P, would have ipso facto been in a position to create C himself; and would, moreover, be able in principle to simulate the actual creative process of the creator of C. Thus a general theory of creativity, or of the creative process, along the lines of T would provide a recipe for being creative; It would, in effect, provide a set of explicit instructions for attaining creative achievements. (pp. 84–85)

This argument seems to rest on a number of fallacious premises. Firstly, a theory of creativity, T, may contain a number of general conditions, like a certain level of certain psychological traits and capacities, or a subtle combination of such attributes, which may require a long developmental history and possibly biologically based capacities, extensive and specialised knowledge and technical expertise, and so on. It would be absurd to think that such attributes could be readily duplicated in another individual that, given certain initial conditions P, could then proceed happily to create a new product C. For instance, it is clearly possible for a psychologist to devise a test of musical ability without himself having the same ability.

Secondly, it is a mistake to believe that the requirements of a general theory of creativity imply the possibility of predicting the specific character of a creative product. What is required is the ability to state the general and initial conditions that maximise the probability of the occurrence of creative performance.

Thirdly, by focusing on objective novelty, Briskman (1980) fails to see that a general theory of creativity can be developed through the controlled study of the conditions that facilitate or inhibit creativity in tasks requiring only *subjective novelty*. In principle, the creativity involved in producing subjective novelty is just as genuine

as that involved in objective novelty. Thus, when we confront an individual with a difficult insight task in a laboratory experiment that has been solved by thousands of other participants in psychological experiments, and this task is completely unknown to him or her, we are certainly justified in believing that the processes employed to solve the problem would be the same as if the individual had happened to come across the task in question as the first individual to ever be confronted with it.

Certainly, research aimed at determining the conditions of real, historical inventions must consider additional variables as well, such as searching for gaps in existing knowledge, the environment of inventors, social and cultural conditions that facilitate or inhibit entrepreneurial activities, and so on. There seems, however, to be no reason why such inventor conditions could not be satisfactorily elucidated through scientific research.

From a somewhat similar philosophical stance, Hausman (1987) argues that the concept of creativity requires invoking the concept of 'radical novelty', in order to distinguish it from trivial forms of novelty, for instance in the form of minimal differences and variations. From this position he argues in favour of the following points: (i) The requirement of radical novelty raises the question of whether an explanation could be found that would specify and predict their newness or intelligibility of this event, rather than the trivial newness of simple difference; (ii) the requirement of value also raises the question of whether an explanation could be found which could foresee the values that contribute to created outcomes.

It is somewhat unclear from Hausman's exposition of his arguments what exactly is meant by 'radical novelty', i.e. whether it refers to objective novelty, in the sense that a completely new idea or product has been created, or whether the creation in question is of a particularly high magnitude. The strictures imposed on the creativity concept by the requirement of objective novelty have been criticised above. If the concept pertains to the magnitude of the novelty, like creating a new genre in art, a new paradigm in scientific research or a completely new kind of technology, the concept of radical newness is not *desirable*, since it exalts the concept to almost divine proportions and also contradicts the concept of degrees of creativity that is meaningful and should be preserved.

The point made by Hausman to the effect that we can never foresee the values operating in the judgement of a product as creative seems to confound the 'science' and the 'politics' involved in the creativity enterprise. The scientific ambition is to state the general conditions that maximise the probability of creative accomplishments taking place. There is no reason this cannot be done independently of the specific creativity values. We will return to the problems associated with employing 'value' as a criterion for genuine creativity later in our discussion.

A solution to the problems raised above is to settle for subjective novelty as sufficient for most of the needs involved in the scientific pursuit of creativity. Thus, an idea deserves to be described as original if it is novel for the individual who produces it without necessarily being novel for society as a whole (see, for example, Kaufmann, 1993; Boden, 1994). In Boden's terms we can base our inquiries into the core issues of creativity by examining P-creativity.

How Much Novelty?

The question of the level or magnitude of novelty of an idea or product that is required to qualify as genuinely creative is certainly not an easy one to answer. At the lowest level, novelty could be taken to mean just 'different'. But, as Hausman (1987) and Boden (1994) point out, this would make everything novel, since every single thing is in principle different from all things in the past. At the very least, they exist in a different time or location.

One step up the ladder, Weisberg (1988, 1993, 2003) argued for a problem solving perspective on creativity and made the claim that any solution to a problem is creative as long as it is novel and fulfils the requirements of the task. The basic idea seems to be that of a continuum of creativity, ranging from minimal to maximal novelty in problem solution. This approach has considerable intuitive appeal, and the concept of degrees of creativity certainly makes good sense. We are, however, left hanging as far as determining where to set the threshold for a minimum level of novelty in order to employ the concept of creativity. On closer examination other difficulties also arise, suggesting that the concept formulated by Weisberg may be too crude and in need of some constraining qualifications. In addition to the problem of locating the minimum threshold of level of novelty, a basic complication for such a straightforward novelty conception of creativity is its failure to distinguish the concept of creativity from the concept of intelligence.

THE COLLISION BETWEEN INTELLIGENCE AND CREATIVITY

In his seminal analysis of the concept of intelligence. Spearman (1927) emphasised the ability to create novel mental content as the essential hallmark of intelligence. Sternberg (1985) and, more recently, Gardner & Sternberg (1994) have pointed to task novelty as the basic dimension in the intelligence domain. In an exceptionally thorough analysis of the concept of intelligence, Gregory (1981) concluded by singling out two features as hallmarks of intelligent behaviour.

1. An intelligent solution must have some novelty, at least for the person that produces it. Merely reproducing what already exists does not display intelligence, at least as I wish to use the term.
2. An intelligent solution must be in some degree successful (Gregory, 1981, p. 299).

By the claim that 'successful novelty' should be seen as the basic defining characteristic of intelligent behaviour, Gregory moved the construct of intelligence to a point where it is really too close for comfort in terms of cohabiting with standard definitions of the concept of creativity along the lines suggested by Weisberg (1986, 1993, 2003).

On the conceptual level, the construct of intelligence does not intrinsically imply creativity. Few will endorse the idea that straightforward analytical reasoning necessarily implies imagination and creativity. In line with this contention, the main thrust of extensive empirical research seems to lead to the conclusion that analytical and creative abilities are substantially independent (see, for example, Getzels &

Jackson, 1962; Wallach & Wing, 1969; Sternberg, 1985, 1988, 2000). Some even argue that they are fundamentally independent processes (see, for example, Hayes, 1989).

It seems clear, then, that the concept of creativity has to be linked to novelty in a way that distinguishes it from the concept of intelligence in a legitimate and meaningful way. A possible option would be to retain a unitary novelty concept and simply locate creativity at the upper end of this continuum. However, this solution requires a highly arbitrary decision as to where intelligence ends and creativity begins. As seen above, some scholars in the field have argued that the term creativity should be reserved for the phenomenon of 'radical newness'. Hausman (1987) argued that creativity should be restricted to accomplishments containing 'Novelty Proper', which he defines as 'a difference in intelligibility or character' (p. 382). It is still not exactly clear what such radical novelty entails. From the examples given, it seems primarily to relate to high-level creative feats like a shift in scientific paradigm or the creation of a new artistic genre. From the vantage point of the task environment, Raaheim (1974, 1985) argues that intelligence essentially deals with the transformation of partly unfamiliar situations into familiar and tractable situations and reserves the term creativity for total task novelty, where a familiar pattern is no longer recognisable. This seems to be the solution that Gardner & Sternberg (1998) also are opting for when they claim, with reference to the work of Raaheim (1974, 1985), that intelligence is best captured at the medium ranges of novelty, where the opportunity for people to make intelligent use of their previous knowledge is optimal. When the task contains so much novelty that '… the individual cannot find any relationship between the current situation and past experience' (p. 39), the concept of intelligence cannot be employed in a logically meaningful way. Further they claim that 'While such situations may be poor measures of intelligence, they may be good measures of creativity, in that they require a completely unique approach for their solution' (p. 40).

By requiring radical novelty on the stimulus or the response side, the concept of creativity stands out as clearly separate from the concept of intelligence, and a tight and clear demarcation of the creativity domain is, in principle, possible to attain. This line of thinking may, however, be criticised for leading to an excessively constricted and exclusive definition of creativity. By placing the concept of creativity on the 'Einsteinian' level, so to speak, the theorists above may exclude too large a domain of activities that seem clearly to entail creativity, as ordinarily and reasonably conceived. Such a position is also difficult to reconcile with a concept of *degrees of creativity*, which, as argued above, is a notion that is deeply entrenched, makes good sense and should be preserved.

The Raaheim and Gardner–Sternberg solution also entails some basic difficulties. By pushing the domain of creativity beyond the upper threshold of recognisable familiarity, creativity becomes a neo-Darwinian process, where the generative stage consists of a random, trial-and-error-like production of responses that are subsequently screened for possible value. This manoeuvre shifts the emphasis of relative importance in the act of creation from the generation to the evaluation process (cf. Campbell, 1960; Briskman, 1980).

As Johnson-Laird (1987) and Boden (1994) have pointed out, however, a neo-Darwinian process is grossly inefficient and at odds with natural properties of cognitive mechanisms. We agree with Johnson-Laird and Boden that a mechanism that applies some criteria in the generation stages and others in the subsequent selective stages seems to be a much more sensible and likely model for the processes that are involved in acts of creativity. Furthermore, the Raaheim and Gardner–Sternberg view is one-sided in the sense that creativity is linked exclusively to new task environments. However, creativity frequently occurs in response to a highly familiar task, where a new twist is made, resulting in a novel and creative solution (cf. Kaufmann, 1988; Nonaka, 1994; Unsworth, 2001).

The question remains, then, where to place the concept of creativity between two extremes, one viewing creativity as being involved in every little piece of change and novelty, criticised by Arieti (1976) as pseudo-egalitarianism, and, on the other hand, the elitist restriction of creativity to the most grandiose and revolutionary accomplishments only.

THE PASSAGE BETWEEN SCYLLA AND CHARYBDIS

In our view, a navigable passage is through the route recommended by Newell *et al.* (1979), who qualified the notion of novelty by restricting it to cases of *unconventional* thinking. A *modification* or *rejection* of previously accepted ideas in *addition to* novelty is, according to this view, required in establishing an act as creative. Similar views have been expressed by Stein (1974), discussing a 'leap' away from what has previously existed as a fundamental criterion, and Briskman (1980) claimed that creative accomplishments are characterised as being in conflict with an existing background, aiming at its modification. Recently Boden (1994) added a lot of interesting substance to such a distinction when she singled out the domain of creativity proper as being activity involved in replacing an existing generative system of rules for a certain conceptual space with a new and different one. As an example she points to the development of classical music, which originally relied on a 'home key'. Here the melody started and had to finish. This scheme was gradually stretched more and more and then dropped altogether by Arnold Schoenberg, who suggested new types of constraints to structure music making, such as using every note in the chromatic scale.

The combined requirements of novelty and unconventionality may be seen as offering a possible solution to the conceptual problems discussed above.

1. There is no confounding of the concepts of intelligence and creativity, since the concept of intelligence does not require reasoning to be unconventional.
2. The concept of creativity can be applied both to high task novelty, where there is no previously accepted solution ready at hand, and to high solution novelty, which requires modification or rejection of previously accepted ideas. This accords well with the view that problem finding, i.e. the development of new problem formulations, is a cardinal component of the creative process (see, for example, Mackworth, 1965; Getzels & Csikszentmihalyi, 1976; Csikszentmihalyi, 1988; Unsworth, 2001).

3. Creativity is not restricted to rare, high-level 'breakthroughs' that are implied by the notion of 'radical newness'. Neither is the concept applicable to any small difference relative to the existing state of affairs. Stein (1987) warns about the hazards involved in generalising from what he calls 'creativity little c' to 'Creativity Big C'. The way of constraining the concept of creativity advocated here may be seen as lessening the tension in this potential conflict, at least to some degree. At the same time, the notion of degrees of creativity remains intact. Creativity may range from a low level, as for instance in solving a typical insight problem, to the very high level involved in the shift of genres involved in science and art.
4. The notion of creativity does not necessarily presuppose the inefficient and 'contra-cognitive' mechanism of a neo-Darwinian, trial-and-error type of process.

DIFFERENT STYLES OF CREATIVITY

The limits set by the definition proposed here for the conceptual domain of creativity do, however, seem to be incompatible with the increasingly popular view of different modes of creativity proposed by Kirton (1976, 1987, 1988). Kirton distinguished between the cognitive style of 'innovators', who prefer to do things differently, restructuring problems and frameworks and breaking boundaries, in contrast to 'adaptors', who prefer improving things within existing frameworks and boundaries. Rather than viewing this distinction within the broad category of problem solving, Kirton sees it as a distinction between different modes of creativity, which he claims to be orthogonal to level of creativity. It is, of course, possible to imagine a hierarchy of levels of frameworks, with problem solvers operating within the framework at a general level while going beyond the framework governing a more local level. A researcher could, for instance, stay within the existing, information processing paradigm of cognition and go beyond at the more local level of theory constituted by the multistage theory of memory.

Problems arise, however, through the absolutist way Kirton treats the distinction. If the term creativity is to cover the whole range of behaviour from patient conformity to paradigm breaking, the question is what creativity is *not*. It seems that this question would be a difficult one to answer and that Kirton's concept of creativity consequently is totally unconstrained, and therefore devoid of meaning.

The problems involved in Kirton's distinction are also seen in a closer examination of the core logical formula that makes up the concepts of innovative and adaptive creativity. Whereas innovative problem solving logically requires creativity, adaptive problem solving does not. It could be just 'efficient' or 'intelligent'. Thus, from a purely conceptual point of view, innovative and adaptive modes of problem solving cannot be treated as symmetrically distributed over levels of creativity. The innovative orientation, as measured by the KAI self-report questionnaire, is, in fact, significantly and often substantially positively correlated with various indicators of level of creativity (Goldsmith & Matherly, 1987; Isaksen & Puccio, 1988). This

raises the question of whether the KAI measure of cognitive styles really is an indicator of level rather than mode of creativity.

EXPANDING THE PERSPECTIVE ON CREATIVITY, NOVELTY AND INTELLIGENCE

We have argued that in the creativity literature there is considerable confusion about the locus of novelty in intelligence and creativity. Gardner & Sternberg (1994) interestingly point to two kinds of novelty that they describe as 'novelty of component mental operation' and 'novelty of the content of the task'. Making us aware of the fact that 'novelty' may not come down to 'one thing' is most applaudable. However, the distinction does not seem to be applicable in our effort to clarify the distinction between the concepts of creativity and intelligence. It is also unclear what the 'novelty of component mental operation' really means. Does it refer to the peculiar nature of the mechanisms involved in creativity, such as incubation and the like, or does it relate to the product of the process, i.e. the solution to the problem.

Here we will distinguish between two kinds of novelty in a very straightforward way. What we have in mind is the distinction between novelty on the *stimulus* and novelty on the *response* side. Then we shall make the further claim that making this straightforward distinction offers the opportunity of even further sorting out the different conceptual domains of intelligence and creativity, as well as enabling us to point out some major differences between different kinds of creativity, which we believe may help to clarify the nature of major issues involved in creativity research.

THE NOVELTY–CREATIVITY TAXONOMY

As seen from Figure 1, we may now distinguish between four different categories involving different combinations of task novelty (novelty on the stimulus side) and novelty in the solution required (response novelty).

Familiar Task–Familiar Solution

In this category we find typical routinised problem solving, involving standard operating procedures (SOPs). This could, for instance be routines for ordering new products, routine procedures for adjusting prices, using a known formula to solve a familiar equation in mathematics, etc. Little creativity is involved in this kind of problem solving endeavour, although sometimes we may be confronted with small deviations to be adjusted either on the task or the solution side.

Novel Task–Familiar Solution

This is an interesting category and, in our view, the conceptual home base of intelligence proper. By definition, intelligence refers to the activity of employing previous experience in new task situations. As Gardner & Sternberg (1994) point out, tasks of rule induction and rule deduction are the kind of tests that are most

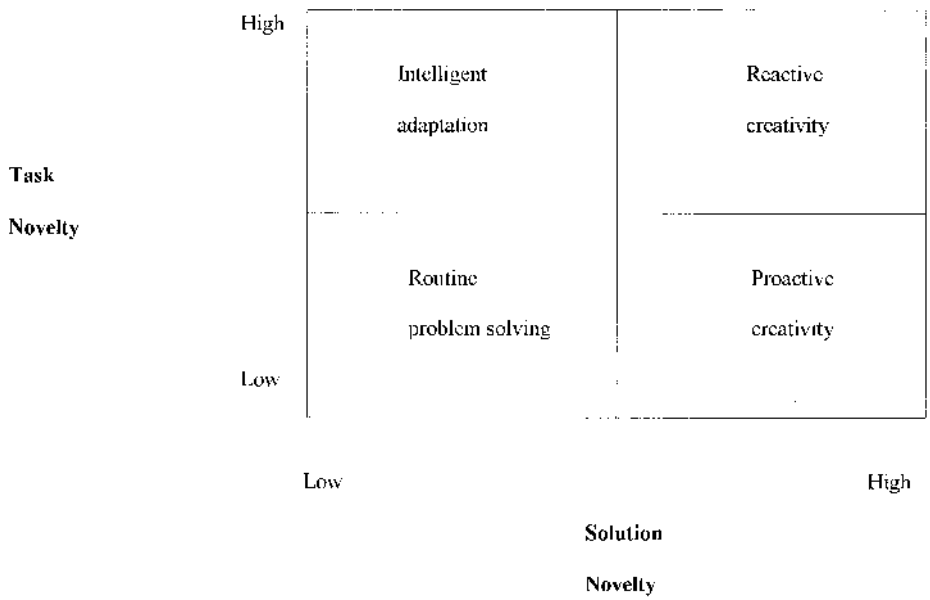

FIG. 1. The novelty–creativity taxonomy.

representative of the function of intelligence, also seen in a circumplex model as the tasks at the centre of batteries of intelligence tasks. We may call this category *adaptive intelligence*, since we are here dealing with tasks that, despite their novelty, are amenable to solutions derived from an existing generative rule system for a given problem space.

Familiar Task–Novel Solution

As we have pointed out previously (Kaufmann, 1980), problem solving not only involves transforming an unfamiliar situation into a familiar one, as argued by Raaheim (1974), and implicitly by Gardner & Sternberg (1994). In a very important sense it also involves transforming a familiar situation into an unfamiliar one! Here we are presented with a paradox between theory and practice. As we have argued previously (Kaufmann, 1980, 1988, 1995), the psychological theory of problem solving traditionally has been, and still is, dominated by a paradigm of reactive responding, in the sense that the givens, or initial situation, is explicitly or implicitly seen to exist in the form of some 'disturbance', 'deviation', 'difficulty', 'conflict' or 'uncertainty' with respect to finding the means to reach a goal. In this view, the individual is seen as having to be triggered by this kind of disturbance in order to act. This perspective is most clearly seen in the traditional behaviourist treatment of problem solving. But it is also evident in Piaget's cognitive theory of equilibration through the adaptive processes of assimilation and accommodation (for empirical evidence and conceptual arguments bearing on this critique see Arlin, 1975; Kaufmann, 1995). As Nonaka (1994) has argued, these general assumptions also seem to underlie the standard information processing input–output perspective that has

dominated modern cognitive psychology for the last decades. Interestingly, Nonaka points out that such a perspective precludes accommodating innovation into the research programme. More specifically, we would argue that the aspect of innovation that is linked to proactive creativity, which obviously comprises a large part of the activities that occur in real life in the field of innovation, is precluded, because there is no external trigger in this process.

But such views of problem solving do not enable us to capture some essential aspects of creativity and innovation. In order to obtain a competitive edge, companies have to constantly try to find inadequacies in existing products and technologies compared with a vision of a future desired state that involves an improvement over the status quo. As an example, imagine existing TV technology. The standard TV set has a fixed sized monitor, which people seem to accept as natural. There is nothing inherently 'wrong' or 'disturbing' or 'deviating' about this technology. But if we create a vision of a future state of affairs that offers a flexible sized monitor, that could be adjusted to small or large size according to our needs and desires, we may realise that we have created a disturbance or deviation by comparing the existing state of affairs with a possible future and potentially improved state of affairs. In this scenario, we may argue that what we are doing is to try to find a new solution to a familiar situation. In this process, the most interesting part of creativity is first to find an interesting new *problem* to engage our imagination and to enable us to innovate. This process of first finding an interesting new problem, through envisioning a possible desired future state of affairs as a stepping stone to find new solutions to problems, may be called *proactive creativity* (for a similar argument that is based on a somewhat different conceptual framework see also Unsworth, 2001). It is readily seen that this kind of creative problem solving, proceeding through the gates of new and smart problem finding, is at the very heart of the concept of creativity we have argued to be the prototypical one above.

Very little is known about this aspect of creativity, which we believe is due to the constraints put on the concept of creative problem solving in the traditional theoretical paradigms, as pointed out above. Also, this kind of process is more difficult to study, as Unsworth (2001) points out, than the typical case of a controlled laboratory situation, where the experimenter presents the task to be solved. In proactive creativity the most interesting element is for the individual to find an interesting task for him or herself!

From a practical point of view, we can also point to new and interesting ways of testing creativity with the concept of proactive creativity in mind. We could present individuals with a familiar situation, which could be a traditional object, like the TV set mentioned above, a standard procedure of billing customers and so on, and ask the participants to challenge the assumptions underlying these familiar objects, procedures or scenarios, by pointing to important limitations that could be used as a platform to create novel future desired states that could be realised through more standard ways of creative problem solving.

Another way of operationalising potentially interesting personality attributes of this kind of creativity has been developed by Bateman & Crant (1993) in their concept of the proactive personality.

Novel Task–Novel Solution

The final category in the present creativity–novelty taxonomy is the situation where there is high novelty on the task situation coupled with a requirement for a novel solution. At first thought this appears to be the one category that requires the most creativity, since there is novelty both on the stimulus and the response sides. But this is not necessarily the case. Since there is novelty on the task level, this represents a more or less explicit cue that a novel solution is required. In that sense there is an external stimulus that actively triggers the individual to consider whether a novel solution is required. This is different from the previous case, which involves breaking through the appearance of familiarity and stability in order to break it down to generate an interesting novel problem. In addition, the individual has to find an appropriate novel solution after the creation of the novel problem.

The novel task–novel solution scenario is an important one. Under controlled laboratory situations it is illustrated through the classical Einstellung effect in problem solving (see, for example, Luchins, 1942), where the individual first solves a series of problems according to a certain formula. They are then confronted with a slightly deviating task that can be solved according to the old formula, but are more easily solved through a new formula. A large number of participants in these experiments continue to use the old complicated formula, rather than the newer, more convenient one. In the next stage of the process, a new problem is presented that cannot be solved according to the standard formula, but are easily solved through a new and simple formula. The results show that a surprisingly large number of people are unable to solve this simple problem, because of the new accommodations in solution finding required.

This kind of scenario strongly resembles what is called the *success trap* in organisational learning and problem solving, when organisations come to over-rely on their own past experience and are consequently unable to adjust to new demands and challenges (see, for example, Lewinthal & March, 1993). As an example we could imagine a manager who had great success in a company that then entered into a radical new, virtual organisational style. The old form of leadership would probably have to be significantly reshaped in this new leadership situation.

In the creativity literature, Amabile (1983, 1996) has always been a champion of the idea that looking at the factors that *obstruct* creativity may be the most fruitful perspective. We can now see that this angle is particularly pertinent in the novel task–novel solution scenario.

In this problem category, creative problem solving also becomes closely intertwined with the single- and double-loop learning described by Argyris (1995). Single-loop learning premised on doing the same type of action in an improved and more efficient way now has to be substituted by double-loop learning, where fundamental assumptions underlying established practices are re-examined.

The task novelty–solution novelty situation may be termed *reactive creativity*, since actual changes in the external situation that are brought about for different reasons trigger the search for novel solutions. In this category we may posit that

problem sensitivity, in the sense of being able to see that real and important changes have taken place or are taking place is a most important quality. The problem has been addressed primarily at the conceptual and theoretical level (see, for example, Lai & Grønhaug, 1995) and very little has been done in terms of trying to operationalise this as a construct. Way back, Guilford (1967) talked about problem sensitivity as a potentially interesting sort of ability that had to do with implications in the product category in his model. Since then, however, no new serious attempts at operationalising the concept as a candidate for a potentially interesting and important problem solving ability have been attempted. In a new research programme, we (Kaufmann & Meland, 2002) are employing signal detection theory as a model for developing diagnostic situations of problem detection ability. The context is a military one and the participants are presented with scenarios that, through consensual validation from experts, are categorised as (a) problems that appear like problems, (b) real problems that do not appear like problems, (c) problems that are not real problems but are subjectively perceived as problems and (d) problems that are not problems and are not subjectively perceived as problems.

In this way we hope to be able to diagnose accuracy in problem detection ability. So far the results are promising, and seem to suggest that there are consistent and reliable individual differences in the ability to make valid problem detection, e.g. perceiving that there is a problem when the problem does not appear like a problem in its surface presentation (hits) and avoiding false alarms, i.e. being able to see that a scenario that has the appearance of a problem really is not.

We believe that more research along these lines may throw interesting new light on the nature and determining conditions of problem sensitivity, and possibly also bring forward new diagnostic and training implications for the purpose of better handling the category of novel task–novel solution.

It should also be mentioned that the heuristics and bias tradition is particularly rich on concepts, theories and research findings that are clearly relevant to research in this category of creative problem solving (Plous, 1993; Bazerman, 2002). In a recent work, Kilbourne & Woodman (1999) present a lucid and creative discussion on how to link reasoning biases to the issue of what kind of psychological and organisational barriers prevent people from realising that novel circumstances have occurred or are about to occur, which have to be responded to with novel solutions.

CONCLUDING REMARKS

In the present discussion we have pointed to some serious problems in creativity research that we believe arise from a far too loose and unconstrained treatment of the concept of creativity in the literature. The lax definition of creativity as 'novel' and 'useful' is, indeed, revealed to be a quick and dirty approach that leaves the door open for all sorts of differing approaches to the scientific study of the field. This is perhaps most clearly illustrated in the problems involved in distinguishing the concepts of intelligence and creativity from each other. Moreover, when a distinc-

tion between different styles of creativity is introduced along an undifferentiated dimension of novelty, it makes it impossible for us to say what creativity is *not*, and the concept of creativity is turned into an empty bubble and loses all its substantial and operational meaning.

On the practical educational level, we see this in the proliferation of all sorts of 'tests of creativity' with either no or very loose theoretical–conceptual foundations. Characteristically these various indicators of creativity exhibit a most confusing correlational pattern, and nowhere is there a theory of the structure of creativity that would correspond to the theories of the structure of intelligence, or the structure of personality for that matter.

The main objective of our discussion has been to introduce some constraints into the conceptual frameworks that are circulating in order to achieve a clearer separation of the concept of creativity from the concept of intelligence, which certainly seems to be necessary for a starter. Then we used these deliberations as a point of departure for developing a taxonomy of problem solving with regard to novelty, where we distinguish between two kinds of novelty; task novelty on the stimulus side and solution novelty on the response side. We have argued that in this taxonomy we find the home base for the concept of intelligence mainly in the category of task novelty–solution familiarity, where solutions to new problems can be found by way of extrapolating from the generative rules that constitute established conceptual spaces. Creativity spreads over two main categories. We placed the concept of proactive creativity in the task familiarity–solution novelty category, where problem finding is an essential first element. It was pointed out that very little empirical research has been directed at this category of creativity. From an educational psychological perspective, we sketched the principles of how some new tests of creativity could be developed that could offer some promising ways of measuring proactive creativity.

In the other creativity category there is both task novelty and solution novelty. We used the term *reactive creativity* to characterise this category, since the novel solution is required by external demands of a novel problem situation that confronts us. In this category there are some new and interesting challenges in terms of clarifying the conditions that are important in determining ease and difficulty of problem detection. The interesting complex of issues concerning unravelling the conditions, both personal and contextual, that tend to block creativity clearly belongs to this category and deserves to attract more research attention. There are also interesting points of convergence here between issues involved in organisational learning and creativity and innovation. Specifically, the issue of the success trap, dealt with in the organisational learning literature, and the classical Einstellung and fixation effects addressed in the psychological problem solving literature are clearly strongly related, and opportunities for synergies between these research programmes are promising targets to explore in future research.

With an educational psychological perspective in mind, we also believe that the biases in judgement and thinking uncovered in the behavioural decision making tradition may offer interesting leads on how to develop new measures relevant to creative thinking that focus on cognitive mechanisms that may tend to inhibit creative thinking, such as, for example, confirmation bias in hypothesis testing and

conservatism in information processing due to capacity limitations of working memory and attention.

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