# Creative Potential and its Measurement

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## Abstract

This article presents the concept of creative potential and its link to talent. Psychological measures to assess creative potential in children and adolescents (EPoC) and adults (Creative Profiler) are then described. Implications for developing creativity are proposed.

***Keywords*:** EPoC; divergent exploratory thinking; convergent integrative thinking; performance efficiency; profile; potential creativity.

## Creative potential and its measurement

Creativity has received increasing attention over the past decades. It is viewed as a valuable asset for individuals in their daily problem solving and their professional careers. Organizations seek creative ideas to improve themselves and stay competitive. Societies benefit from creativity in terms of social and technical improvements in quality of life and cultural development. Recent surveys rank creativity among the most sought-after characteristics; for example, an IBM worldwide survey of 1541 CEOs in sixty countries and thirty-three major industries found creativity to be the most valuable ability for future top managers (Berman & Korsten, 2010). An ADOBE survey of 2000 teachers (K-12) and 2000 parents in the United States, United Kingdom, Germany, and Australia found creativity as a highly desired educational goal (ADOBE, 2013). Creativity is one of the four key "21st century skills", together with critical thinking, collaboration, and communication (http://p21.org). Creativity can be defined as the ability to produce original work that fits with the context and responds to task constraints (Sternberg & Lubart, 1995). Compared to classical intelligence, which focuses on analytic ability, knowledge and expert resolution of familiar problems with known solutions, creativity concerns generating new, previously unknown ideas and behaviours in novel situations or treating familiar situations in new ways (Sternberg, 1985; Lubart et al., 2003). Whereas intellectual ability results typically in academic success, creative ability is best manifested in unique accomplishments, recognized as valuable in a domain-based context.

## The concept of creative potential

An important distinction can be made between potential and talent. Gagné (2004) in his Differentiated Model of Giftedness and Talent (DMGT) notes that *giftedness* designates outstanding abilities, called aptitudes whereas *talent* is linked to achievement and designates the outstanding mastery of systematically developed abilities, called competencies (knowledge and skills). In this vein, potential refers to a latent state which may be considered part of an individual's "human capital" (Walberg, 1988), as well as a resource for the person's larger social group or society. This potential may be put to use if a person has the opportunity. The individual may be aware of his/her potential or may be blind to it. Each person can be described as having more or less potential in a domain of work, and more specifically, in a given task.

The degree to which an individual shows different levels of potential across domains and tasks depends on the nature of the required cognitive and conative factors that are involved in each task; for example, making a creative still-life drawing and a creative collage most probably call upon similar factors. In comparison, there is potentially less similarity between a still-life drawing and poetry

composition, each task involving a somewhat specific set of factors. The degree to which tasks are similar can be estimated by correlational studies, in which people complete the two tasks and then shared variance is calculated; however, additional methods allow a fine-grained task analysis in order to specify the precise resources involved in a task (see Caroff & Lubart, 2012).

The extent of task similarity concerns the nature of factors solicited in each task, the extent to which each factor is solicited, and the way in which the factors come into play during task execution. Thus, if two tasks involve metaphorical thinking, there is some degree of similarity between the tasks. If this metaphorical thinking is involved to the same extent in each task, and comes into play in the same way during task execution, the similarity will be enhanced. Given that each task may be characterized as partially similar to other tasks and partially specific, it is most useful to conceive a person's creative potential in terms of a set of potentialities. An individual may show high potential in scriptwriting, average potential in poetry composition and low potential in graphic design. This heterogeneity is normal (Lubart & Guignard, 2004). Indeed, in studies of general population samples, it is common to observe relatively low correlations between creativity scores in tasks from different domains (Baer, 1993). In studies of eminent creators, it was found that high levels of creativity in several lines of work in a domain (e.g., painting and sculpture) are rare, and eminent creativity in more than one domain (e.g., visual art, literary work) is extremely rare (Gray, 1966).

Creative potential for a task is envisioned, according to the multivariate approach as the confluence of several distinct, but interrelated resources (Lubart, 1999; Sternberg & Lubart, 1995; Lubart, Mouchiroud, Tordjman & Zenasni, 2003). These resources for creativity are specific aspects of intelligence, knowledge, cognitive styles, personality, motivation, affect, and physical and socio-cultural environmental contexts. Examples of each are: metaphorical thinking ability (intelligence); a rich, diversified associative network (knowledge); preference for intuitive thinking (cognitive style); risk taking trait (personality); intrinsic task-focused interest (motivation ); the presence of rich, idiosyncratic emotional experiences (affect); and a context with diverse stimuli or a rich setting (physical and/or social environment). These resources can be classified broadly into cognitive factors, conative factors, and environmental factors. Cognitive and conative resources are person-centred factors for creativity whereas environmental resources are context-centred factors.

With regard to the confluence of resources, Sternberg and Lubart (1995) propose that creativity involves more than a simple sum of an individual's level on each of the components for creativity. First, there may be thresholds for some components (e.g., knowledge) below which creativity is not possible, regardless of an individual's level on the other components. Second, partial compensation may occur between the components in which strength on one component (e.g., motivation) may counteract weakness on another component (e.g., knowledge). Third, although each component contributes in its own way to creativity, a component is always acting in the presence of other components and this coaction can lead to interactive effects; for example, high levels on both intelligence and motivation could multiplicatively enhance creativity. The interactive nature of the resources, in particular the person-centred and context-centred factors, is also developed in Gagné's Developmental Model of Giftedness and Talent, with the environment serving as a catalyst for person-centred "gifts" to be activated.

Creative potential remains latent until it is called into play in a task. At this point, through the application of an individual's resources during the creative process, a production (idea, work) occurs. Here, the creative process refers to a sequence of thoughts and actions. Based on more than a century of work, the process can be conceived in terms of divergent-exploratory actions, which are extensive or expansive, and convergent-integrative actions, which are intensive and bring focus (Lubart, 2000). These two "modes" occur in cycles, and various facets of the cognitive, conative, and environmental factors come together in these processes. Over time, the creative process leads to a production, which can be evaluated (by the creator, [him or herself], and by the creator's "social group", and appreciated as a more or less creative output. This output can be called a creative accomplishment, if it is deemed sufficiently original and context appropriate. By inference, the creative potential of the production's

author can be inferred. To the extent to which an individual produces consistent work that is evaluated as creative, it is useful to use the term "creative talent". Thus, a series of creative works or accomplishments is the hallmark of creative talent; however, the exact criterion for talent varies, in practice, from one domain to another.

## The measurement of creative potential

There are two main paths to the measurement of creative potential. The first is more holistic, whereas the second is more analytic. The first is more process-based, whereas the second is more resource-based.

### *1. The production-based (process-based) approach*

In the first approach, an individual is presented with a task and asked to produce creative work. This assessment situation solicits the creative act in a specific task context. It allows the process to be engaged during a limited, standardized time. The latent cognitive and conative resources can be activated and they enter the productive process as the individual judges fit. The extent to which a person produces work evaluated as creative in this context, compared to other individuals who have completed the same task is a measure of the person's creative potential. It is relevant to speak of creative potential rather than creative accomplishment because the work produced is the reaction to an elicit request to see what a person can do. In this logic, it is best to inform the individual that the goal is to be as creative as possible. In this way, the maximum potential can be observed.

In this tradition, Lubart, Besançon, and Barbot (2011) proposed a new tool, EPoC (*E*valuation of *Po*tential *C*reativity) to assess creative potential in children and adolescents. EPoC consists of four tasks in each domain of creative work. Two tasks engage divergent-exploratory thinking and two tasks involve convergent-integrative thinking. Thus the two modes of creative work are assessed per domain. The battery is comprised currently of three domains of creative production that include, graphic-artistic, verbal-literary, and social problem solving, with additional domains under development (such as musical creativity and scientific creativity). In terms of sample tasks, in the graphic-artistic domain, a simple graphic form is provided and the participant must make as many drawings as possible, which engages divergent-exploratory thinking. In the graphic-artistic convergent-integrative task, a set of photographs of objects are provided and the participant must produce a complete drawing using at least four of the eight objects provided. Tasks in each domain use a similar structure (e.g., literary divergent-exploratory: generate many endings to a story, literary convergent-integrative: generate a complete story based on descriptions of several fictional characters, which are provided). In each domain divergent-exploratory and convergent-integrative scores are obtained that allow an individual to be situated with respect to others of the same scholastic grade level.

As there are scores for the two creative process modes in each domain of creative activity, a person's intra-personal profile can be examined, showing the relative strengths and weaknesses of the individual child or adolescent. Based on the multivariate approach, this kind of measure allows an estimation of the joint involvement of cognitive and conative components of creativity, as well as interaction effects between cognitive and conative components, rendering it an interesting and powerful approach to the measurement of creative potential in children and adolescents.

New versions of EPoC were developed by the International Centre for Innovation in Education (ICIE). More recently, the ICIE has developed the EPoC online system for scoring. Online training is also available. This system will offer EPoC to researchers and institutions interested exploring and assessing creative potential. There are international versions in English, French, German, Turkish, and Arabic. The norms are constantly being enhanced and updated as new people complete the measures; this dynamic norming procedure avoids outdated norms and allows norms to be refined using the largest available sample. The use of technology has also offered a new perspective on training judges

to score children's productions in the convergent-integrative tasks. For the convergent-integrative tasks, an elaborate drawing, story, or other production must be scored for creativity. Judges learn the scoring system through an interactive website in which they are shown sample productions (such as drawings from the convergent-integrative task), they suggest a score, and the system gives feedback on this proposed score. Judges learn interactively, and develop knowledge of the diversity of productions that children may show. After a training sequence, a judge-in-training can take a test of his/her mastery of the scoring system by scoring a new set of productions (previously scored by expert judges). The judge's ability to score children's productions in accordance with EPoC's guidelines is enhanced through this kind of training.

### *2. The components (resource-based) approach*

In this second approach to creative potential, an individual is presented with a series of measures designed to assess the components or resources underlying creative work. This assessment situation covers, ideally, both cognitive and conative factors. It allows the "ingredients" of creativity to be inventoried. In contrast to the production-based approach, the individual being tested does not produce samples of creative work. Instead, several measures (tasks, questionnaires) are presented to assess specific cognitive and conative resources relevant to creativity. The resources, as noted earlier, combine in interactive ways. The set of cognitive and conative resources can be summarized in a person's profile. The term "profile" comes from the Italian word "profilo" meaning "a drawing of outline". In order to propose a relatively complete profile of creative potential we selected five cognitive and five conative resources, based on their importance as identified in the literature.

## Cognitive resources

### (a) Divergent thinking

Introduced by Guilford (1950), *divergent thinking* is often considered to be an "essential" ingredient of creativity. This generative/ quantitative capacity enables the individual to consider alternative pathways of exploration in problem solving, which increases the probability of finding a rare idea. Classic standardized measures of divergent thinking (e.g., Guilford, 1950, Torrance, 1988; Wallach & Kogan, 1965) elicit multiple responses for a single familiar stimulus in a given time, such as generating uncommon uses from common everyday objects during five minutes (e.g., a chair). The divergent production can be scored for the number of ideas (ideational fluency). High fluency is important for creativity because there is a trend for common, socially-available ideas to come first and more idiosyncratic, rare, and unusual ideas to come later (Lubart, Mouchiroud, Tordjman & Zenasni, 2003; Beaty & Sylvia, 2012).

### (b) Analytic thinking

Although analytic thinking has sometimes been opposed to creative cognition, authors such as Guilford (1967) suggested that analytic thought is necessary in creative work because it allows ideas to be filtered and evaluated systematically (Lubart , Mouchiroud, Tordjman & Zenasni, 2003). The involvement of analytic thinking allows strengths and weaknesses of new ideas to be considered, weighed, and isolated. Indeed, examining new ideas for value may be both a conscious and unconscious part of creative cognition. In this regard, Henri Poincaré (1921) in his introspective account of creative thinking highlighted how his "intelligence" served as a "delicate sieve" screening out poor mathematical ideas and allowing the most valuable and aesthetic ones to break into consciousness for further elaboration. The involvement of analytic thinking leads to a weak positive link between creative ability and general intellectual ability.

### (c) Mental flexibility

Flexibility refers to the capacity to change perspectives, to explore a new direction during problem solving. It is often contrasted with mental rigidity, or fixedness. Associated with divergent thinking, flexibility allows a person to move from one line of ideas to another and thus explore a topic more widely. Adaptive flexibility is the ability to switch strategies or idea categories when required for task performance. Spontaneous flexibility is the ability to move from one line of thought to another in the absence of external pressure. Thus, flexibility is related to cognitive mobility, which is by definition one of the keys to adopting new approaches to a problem or task.

### (d) Associative thinking

Associative thinking is a fundamental ability to bring together ideas, to make connections (e.g., Mednick, 1962). Being able to find possible associates, in particular ones involving elements that are not commonly connected is facilitated by a rich knowledge base. From this perspective, associations based on personal experiences or emotional traces are particularly relevant for creativity because they are idiosyncratic, unlikely to be suggested by other people (Lubart & Getz, 1997). In contrast, associations based on common, shared-world knowledge have less probability to lead to new ideas.

#### (e) Selective combination

This capacity refers to the synthesis of disparate elements in new ways. According to Koestler (1964), bringing together two incongruent thought "matrices" is the hallmark of creativity; he used the term "bisociation". For Rothenberg (1979, 2011), Janusian thinking , homospatial thinking and Sepconic processing (connecting separate elements) are essential abilities evidenced in case studies of eminent creators, allowing multiple views to be simultaneously considered and then combined to form a new totality, a new concept, a new approach to a topic.

## Conative resources

Conation refers to preferred ways of behaving as expressed through personality traits, cognitive styles, and motivation. Five components can be highlighted.

### (a) *Tolerance of ambiguity*

This trait is defined as a tendency to support and perhaps even be attracted to ambiguous situations. Ambiguity occurs when a problem, task, or situation is characterized by missing, unclear, or contradictory information. A natural tendency in problem solving is to seek closure, to find a solution as quickly as possible and "resolve" the issue; however, this closure may come at the price of deep, high quality processing that often is needed for complex problems. Tolerating ambiguity facilitates keeping a problem active and this prolonged treatment is favourable to the emergence of novel thinking (Zenasni, Besançon, Lubart, 2008).

### (b) *Risk taking*

Risk taking is central to creative work because originality involves breaking from habitual ideas (Prabhu, 2011). Risk taking, as a psychological trait, has been found to be relatively domain- specific with an individual showing various, different levels of risk-proclivity across situations (Slovic, 1987). Thus, specific measures based on situational details have been developed. To engage in creative behaviour, one must risk the use of personal resources (time, money, energy), and risk social criticism (new ideas are often met with resistance and rejection). In this line of work, Lubart & Sternberg (1995) observed that adults who expressed a willingness to take risks in a content domain of creative activity (such as an artistic or literary domain of work), as they envisioned their behaviour in hypothetical situations, tended also to produce more creative productions in the sector.

### (c) *Openness*

Reflected in features such as a general appreciation for art, emotion, adventure, unusual ideas, imagination, curiosity, and variety of experience, this trait has consistently been associated with

creativity (see Feist, 1998). A high-level of openness is thought to facilitate the exploration of alternative solutions in the divergent thinking production (e.g., McCrae, 1987). Individuals with low openness tend to have more conventional or traditional interests as well as being more dogmatic.

### (d) *Intuitive thinking*

Intuition is conceived as a preferred information-processing style. It can be contrasted with the preference for rational thinking (Epstein, 1994). Style preferences are distinct from processing ability. Preference for intuition is characterized by focusing on one's own experience and emotional reactions. This style of thinking accentuates idiosyncratic, personal experience-based processing as opposed to a more logical, rational type of processing. It is expected that logical, rational processing is a more standardized, commonly shared mode that leads to shared ideas. Empirical research suggests that preference for intuitive-thinking style is associated with creative productions (for a review, see Raidl & Lubart, 2001).

### (e) *Motivation to create*

Motivation to engage in creative work, to invest one's energy and time, may come from several sources (Barbot, Besançon, & Lubart, 2011). Both, intrinsic motivational orientation (e.g., task-oriented, personal desire to accomplish a creative work) and extrinsic motivation (reward-oriented motivation) contribute to an individual's desire to create. Intrinsic motivation is regularly viewed as a good predictor of an individual's likelihood to engage with a creative work and is associated with related traits such as perseverance and commitment to the task. Long viewed as "detrimental" for creativity (e.g., Amabile, 1983), the importance of extrinsic motivational orientation is increasingly acknowledged as relevant and potentially beneficial as well, at least for certain parts of creative work. It is indeed likely that extrinsic motivators, such as monetary rewards or prizes, may encourage an individual to commit effort to overcome obstacles or to complete their work. Correspondingly, Baer, McKool, and Schreiner (2009) suggest that under some conditions, extrinsic motivation can help individuals get through difficult creative assignments (see also Crooker, 2006), and in some cases, might "compensate" for a lack of intrinsic motivation. The contribution of both intrinsic and extrinsic motivational orientations may depend on the domain and the creative task to accomplish. In creative writing, for example, authors may be intrinsically motivated to write as a way of expressing their emotions, but also as a way to seek public recognition from readers, illustrating the engagement of both intrinsic and extrinsic motivational orientations in this domain (see e.g., Magnifico, 2010).

## Putting the components together

Because each of the key creative profiler's components do not have the same importance as a function of the creative work or domain of creative expression under consideration (per the multivariate approach of creativity), it is not conceptually and empirically relevant to summarize an individual's potential for creativity with a single, unitary composite score (such as a total IQ score, for example). Rather, the creative profiler approach consists of measuring the likelihood that an individual's profile is similar to an "optimal" creative profile for a given kind of creative work. To do so, the creative profiler capitalizes on modelling individuals who are recognized for their high creative potential in a given domain (or a specific creative task). After obtaining a measure of these individuals on the ten key components of the creative profiler, we obtain an average "optimal" creative profile for a specific creative task. This average profile becomes a "target" profile against which additional individuals, who are screened with the creative profiler can be compared, using classic statistical measures of distance (squared Mahalanobis distance, $D^2$) between an individual's multivariate profile, to the centroid of the "expert" group profile (for additional details on this approach, see Barbot et al., 2012). The squared Mahalanobis distance is a standardized distance adjusted for the variance in the target profile (based on the individual differences in the sample of individuals who contributed to derive this target profile), and the correlation between the creative profiler's components within the sample of individuals who contributed to derive the target profile (see e.g., Rencher, 1995). This approach is illustrated in Figure 1.

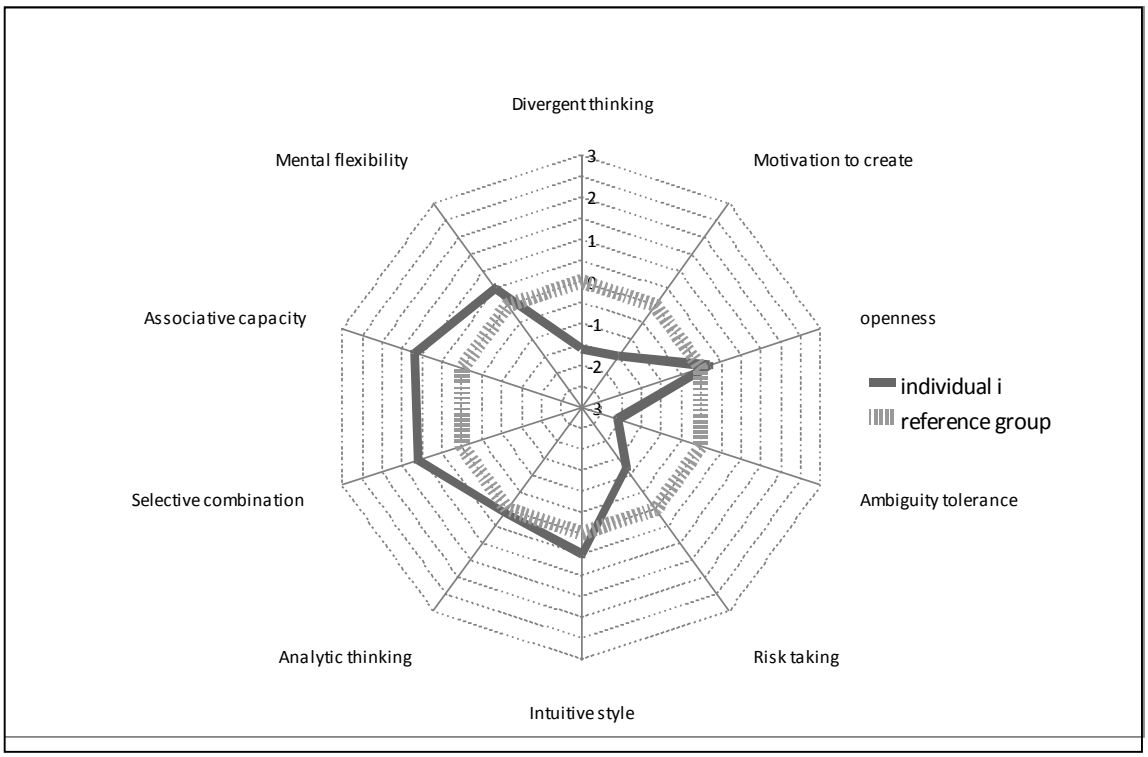


**Figure 1**: Individual profile compared to a group's average profile.

In an extended version of this approach, an individual's multivariate profile can be compared to several optimal, or "target" profiles, representing high potential in a wide range of creative works or domains. This possibility is illustrated in Figure 2. An individual "candidate" is shown with respect to the several other people who are creative in three different fields (artists, designers, managers); however, the graphic representation does not reflect the fact that the distance from the individual (candidate) to each group is actually measured over the ten dimensions that form the creative profiler. It is shown in the example (Figure 2) that the smallest distance occurs between the individual (candidate) and the creative manager group. This suggests that the candidate has the most creative potential with respect to this group; however, the fit is not perfect and the candidate cannot be expected to show the highest level of creativity as the person's profile deviates to some extent from the creative manager's collective profile (represented as the centre of the cloud, with only 55 % similarity to the ideal profile). The distance to the designer (45% similarity) and artist (25% similarity) "clouds" is even greater, suggesting lower potential for these sectors. These differences can however be reduced, at least to some extent, through training, which will be described in the next section.

## Towards talent development

Measuring creative potential leads to the possibility to help individuals to identify the tasks and domains in which they may have the greatest creative potential. This information can be valuable for career counselling. For children and adolescents, EPoC offers some initial indicators of strengths and weaknesses; for adults, the profiler approach pinpoints the resources that may be developed to complete a person's profile with regard to a specific task, and an "ideal" reference group's profile.

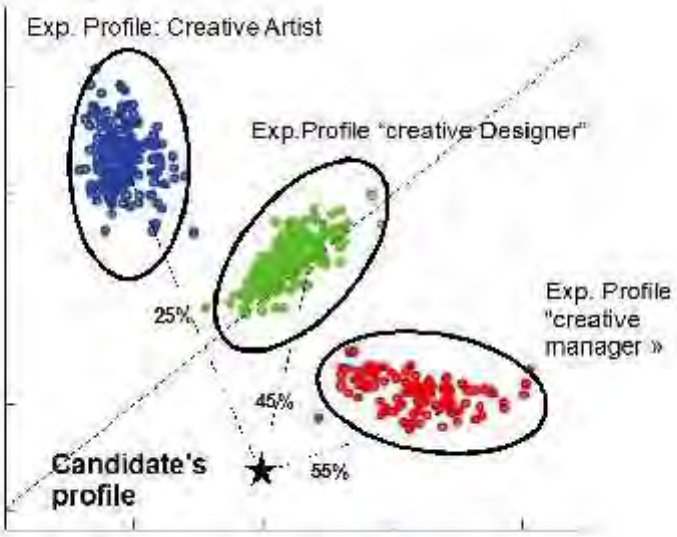


**Figure 2**: Individual (candidate) profile and profiles for several creative groups.

EPoC offers an opportunity to estimate creative potential in children and adolescents. It provides scores by creative activity sector (e.g., graphic-artistic, verbal-literary). Within each activity sector, detailed scores on divergent-exploratory and convergent-integrative thinking are available. It is possible to situate a child or adolescent with respect to others of the same age or school level. This allows the inter-individual differences in potential to be scored. Thus, children can be oriented in various activities, or tracks to build either on their existing potential or to offer enrichment and discovery for new areas in which the child or adolescent does not yet have strong potential. In addition to the inter-individual differences, the same scores by activity sector and type of creative thinking allow an intra-individual pattern of personal strengths and weaknesses to be seen. This intra-individual variability is valuable to examine because it is possible that within a domain, such as the verbal-literary one, a child is strong in one aspect of creative processing, such as convergent-integrative thinking, but relatively weak in the other aspect, divergent-exploratory thinking.

Thus, a child may have a restricted potential in a domain, in general, because he or she is "missing" part of the creative process. Selected activities, such as verbal-literary, divergent-exploratory activities, can be offered to the child to develop creativity in an efficient way through this kind of analysis. For example, a child can be given a concept such as "dog" , asked to find many idiomatic expressions that involve this concept (such as it's a "dog-eat-dog world", "it's raining cats and dogs"), and then use associative thinking to suggest new expressions.

The Creative Profiler offers a different angle on talent development. The comparison between an individual's profile and the ideal profile of highly creative people in a given task or domain allows the specific cognitive and conative factors to be compared. Thus, the distance between an individual's scores on these factors and a criterion group's scores indicates the most important aspects to be developed for creativity. Based on Figure 1, the most important aspects to be developed for the individual concerned are divergent thinking, motivation to create, ambiguity tolerance, and risk taking. In the example in Figure 3, the individual's profile is shown with respect to the needed values for two tasks. Training on divergent thinking could help enhance the individual's potential for Task 2; however, training on ambiguity tolerance could enhance the person's potential on Task 1. Thus, this profile approach allows individual training programs to be developed.

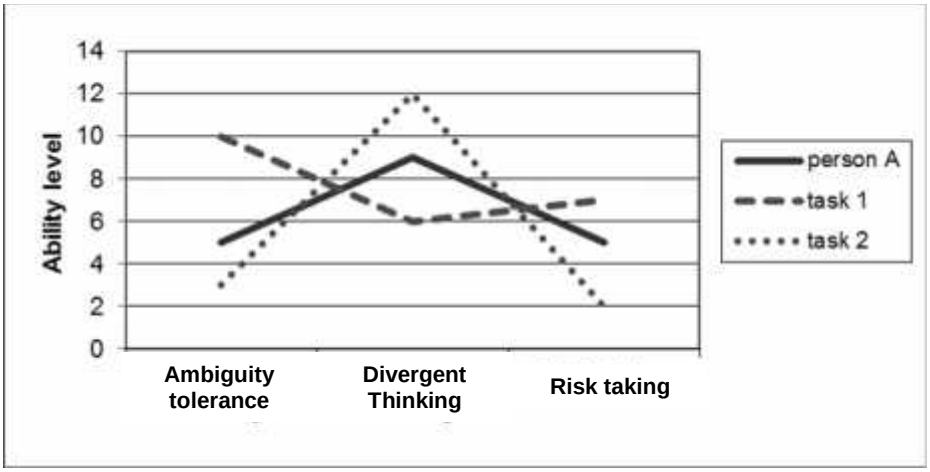


**Figure 3**: Hypothetical example of individual profile and ideal task profiles.

## Conclusion

Recent advances suggest that creative potential can be defined and measured. In children and adolescents, creative thinking tasks can be used, as in EPoC, to assess the extent to which a person is able to engage in creative work. The productions are indicative of creative potential. For adults, creative potential can be measured differently, focusing on the "ingredients" or factors underlying creativity. Through a set of cognitive and conative measures, it is possible to obtain a multivariate profile. This profile can be compared to known profiles of people considered creative in specific job settings and thereby identify proximity, or on the contrary distances, between individual profiles and ideal ones in a task situation. Its use may help to identify individuals with characteristics allowing them to be highly creative in specific domains or tasks, which is useful for career counselling. It can also be used to identify those who may benefit from training programs that develop specific cognitive or conative factors relevant to creativity.

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