Chapter 3
Creative Genii: Creative Intelligence, Insight and the Six Ps

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Abstract The brain is the central engine in the creativity machine. It drives all the competencies necessary for creative intelligence (CiQ). Different brains lead to different forms of creativity, and creativity is central to human life. Although CiQ is closely linked to general intelligence, imagination, adaptability, empathy and innovation, creativity is quite distinct from these intelligences. This chapter discusses the various types of minds or intelligences, and how decisions to be creative can offer incremental and disruptive contributions to innovation.

Keywords 4P-theory · Creative intelligence (CiQ) · Decision stages · Domain expertise · Focus · General intelligence (*g* or IQ) · Insight · Six Ps · Theory of cognition · Threshold theory

Learning Objectives
On completion of this chapter, the readers will be able to:

- Record the role of various neurological processes in convergent and divergent thinking.
- Describe the various attributes of creative persons.
- List and contrast the factors used to describe and assess creative output/product.
- Describe how deep knowledge reservoirs can be accessed to ignite insight.
- Apply propulsion theory and suggest ways to implement its eight different contributions to the Creativity Space.

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3.1 Introduction

The brain provides the competencies required to be creative, and to exhibit creative intelligence (CiQ). Although there is much debate amongst scholars and scientists about the role of consciousness, unconsciousness, emotion and neuroanatomical differences in creative brains, research supports two tenets: (1) "the human brain supports different kinds of creativity, and (2) different human brains lead to different kinds of creativity" ([1], p. 113).

The theory of cognition postulates that being creative is an essential part of human life. Creativity is as much a part of being a human being as thinking [2], observing, analysing, sensing, judging and feeling. Along with the evolution of *Homo sapiens* as thinking creatures, a distinct capability called creativity has also developed. Just as actions, thoughts and feelings are the products of our brains, so is creativity. Therefore, an important question about thinking capabilities arises: Is creative intelligence different from traditional cognitive intelligence (iQ)? Originally (before 1950) scholars, educators and psychologists considered iQ and creativity as the same ability. Guilford [3] is credited for distinguishing creative intelligence as a natural resource, separate from general intelligence or intellect. Guildford [4, 5] studied both the general intellect (g, IQ or iQ or *g* in various sources) and the creative intelligence (CiQ) of individuals, and conceptualized distinctly different thinking styles: convergent (finding or remembering one correct answer) and divergent (generating many alternative answers).

Later, rigorous research by Wallach and Kogan [6] indicated that divergent thinking (numerous ideas and a wide range of responses, rather than one correct answer) within a permissive environment (involving thinking games or play, where new connections, divergent thinking and original answers are encouraged), cannot be predicted from traditional measures of intelligence (IQ). Researchers of creative capabilities and competencies have found predictive validity in divergent thinking tests, meaning that such tests can provide information about future behaviour. Researchers can thus predict how creative individuals are likely to be, based on students' extracurricular activities and achievements. In contrast, traditional IQ measures have little predictive value. This implies that "creative thinking, as estimated from tests of divergent thinking, is more important in the natural environment than tests of IQ or academic tests" ([1], p. 5). As an entrepreneur, employer or designer, would you not like to perform better in the real world than in GPA tests or formal examinations? This important finding, repeated in several disciplines, indicates that when we invest in developing convergent thinking and IQ (recall, memorizing, linear thinking) we may not be improving our creative intelligence. Creative intelligence is labelled CiQ from here on: it represents an ideation and innovation coefficient, indicating divergent thinking, the ability to make connections and engage in lateral thinking. It must be noted that creativity tests are mere indicators of potential, and do not indicate how motivated or interested an individual is, or how much the individual intends to apply him/herself in the real world (Fig. 3.1).

The Disciplined Mind
The Synthesizing Mind
The Creating Mind
The Respectful Mind
The Ethical Mind

Fig. 3.1 Five minds for the future

Although closely linked to intelligence, imagination, adaptability, empathy and innovation, creativity is quite distinct from these intelligences. In his book *5 Minds for the Future*, Howard Gardner [7] describes five "minds" or futureproof intelligences, that humans will need to navigate turbulent times, a complex and unpredictable environment, and the ever-increasing speed of change. He summarizes these five minds as follows:

> In the future, individuals who wish to thrive will need to be experts in a least one area – they will need a discipline… mastery of major schools of thought (including science, mathematics and history) and at least one professional craft.

> As synthesizers, they will need to be able to gather together information from disparate sources and put it together in ways that work for themselves and can be communicated to other persons. …[synthesis] gains power when it provides a sense of meaning, significance and connectedness that so many seek today (p. xix). …The ability to integrate ideas from different disciplines and spheres into a coherent whole and to communicate that integration to others.

> Because almost anything that can be formulated as rules will be done well by computers, rewards will go to creators – those who have constructed a box but can think outside it. Creative minds have the capacity to uncover and clarify new problems, questions and phenomena.

> The world of today and tomorrow is becoming increasingly diverse, and there is no way to cordon oneself off from diversity. Accordingly, we must respect those who differ from us as well as those with whom we have similarities. The respectful mind has an awareness of and appreciation for the differences among human beings and human groups.

> Finally, as workers and as citizens, we need to be able to act ethically – to think beyond our own self-interest and to do what is right under the circumstances ([7], p.xiii). Ethical minds fulfil their responsibilities as workers and citizens [8].

From the field of cognition and learning, Malcolm Gladwell [9] reports that it takes roughly 10,000 hours (20 hours per week for 10 years) to become an expert in a field. Although this long period of mastery has been questioned by later studies, Howard Gardner points out that this long journey not likely to allow multiple areas of mastery in one's lifetime. Given the proliferation of online courses and technology aided forms of learning (e.g., DuoLingo and YouTube tutorials), it is likely that

learners can attain a respectable level of expertise in a shorter, more contracted period of time. In addition, the guidance of mentors and other forms of developmental support may allow those who are competent, but perhaps not yet fully masterful, to excel and participate in creating the future of mankind.

Creativity is difficult to define, due to its diverse forms over various disciplines and diverse expressions over decades, over different cultures and over multiple subject domains. But, although difficult to define, Marc Runco [1] states that creativity is "a vital form of human capital, [it] both contributes to the information explosion and helps each of us to copy and adapt to it" ([1], p. ix).

There are many published definitions for creativity, both in academic and popular literature. Since the focus of this book is on business creativity and innovation, we apply the definition offered by De Jager [37], who describes creativity in the business context as: "the accomplishment of new developments as a result of the interaction between the individual and his/her environment or groups and their environment, with commercial intent".

3.2 Focused and Unfocused Minds

3.2.1 Too Much Focus Is Not Always a Good Thing

"Our addiction to the familiar makes it hard to break habits of action, thinking and feeling"

You must have heard the shouts and urges of eager, pushy coaches: "Focus!" It seems to be the war cry of a multitude of sales managers, sports coaches and entrepreneurs. Similarly, a chorus of laments rises up from businesspeople: "What I need more of is some focused time"; "If only I had more time to focus on my job and fewer distractions from home, family and the internet"; "I want to focus on my marriage, but I am constantly distracted by work obligations and crises". As humans and business people we get stuck in ruts of our own making – eating too much, doing too little exercise, wasting time by binge-watching Netflix or playing computer games; going down the rabbit hole of social media; and generally making poor lifestyle and time management choices. People often try refocusing by making concerted efforts to escape this "stuckness". These efforts might include changing jobs, introducing date nights at home, taking up a hobby to create variety, or limiting overtime. Sometimes these attempts work, but often only for a short time, since humans easily fall back into well-set habits or get mentally and psychologically exhausted from constant attempts to (re)focus. According to Srini Pillay [10] "attempts at steadfast focus usually don't last..[as] you're trying to change using conscious strategies against a far stronger unconscious pull."(p. 124). In his book *Unlock the power of the unfocused mind*, Pillay explains how changes might not bring lasting changes due to mental baggage that may mean static solutions (like recalibrating duties, hunkering down or reprioritizing) for ever-changing problems simply cause mental exhaustion and a return to easy-to-follow habits. Small but

impactful psychological and neurological shifts are needed to empower your mind so you can get unstuck. A Chinese proverb illustrates this particular mental habit and human's addiction to the familiar and habits of action and feeling that are hard to break: "Last night I thought over a thousand plans, but this morning I went my old way".

It is very common to experience a sense of 'mind-freeze'. Almost everyone is familiar with the inability to remember a name when introducing someone or running into someone unexpectedly. Another common experience is being unable to find a word, which seems right there on the tip of your tongue, but in the moment, mid-sentence, you are unable to bring it to the forefront of your mind. Trying desperately to focus on retrieving the name or word seems to push it further out of reach. Then, minutes later, unasked, the word jumps to mind! Your brain unconsciously made the necessary psychological and neurological shifts to unlock the vault of vocabulary and prior learning. The key to this vault is un-focusing your mental process. To un-focus the mind, we need to remove the anxiety, anger, sadness, fatigue and other emotional barriers, blocks and limitations, to get to a point of neutral emotion. This allows a shift from what seems impossible to "a possibility mindset" ([10], p. 125). As you enter the realm of possibilities, you allow the brain to release opioids that relax and reward the brain, making it possible to retrieve information, make new connections and jump the twin hurdles of resistance and impossibility. This "defocus" serves a "sophisticated purpose: it is effective at putting up a barrier between your brain's anxiety center, the amygdala, and your thinking brain, the prefrontal cortex" ([10], p. 127).

Dr. Srini Pillay [10] suggests a range of formal and informal tools to defocus the mind. The informal, somewhat relaxed states include taking time to do less cognitively demanding activities such as fishing, relaxing in a hammock, gardening, knitting or generally finding joyful activities that defocus and relax the mind. Some more formal and useful ways to achieve defocus are reverie (speaking freely about fantasies, imaginary or hypothetical ideas), mind-wandering (allowing your mind to wander with no particular focus), using the imagination (visualize the "what-if's" of the future), daydreaming (stress-less and effortless tasks that you can do on autopilot like driving), self-talk (speaking to yourself in the second person), and meditation in many forms.

An early study by McKinnon [11] (1965) reports on the ability of highly talented architects to turn their attention, at least for a period of time, to another creative outlet when they are seriously blocked – returning to the problem later, when they are refreshed and reinvigorated. Less talented architects more often report stubbornly focusing on a problem when blocked in their attempts to reach solutions (p. 262). In McKinnon's own words: "endurance as tested in the Adjective Check List involves working uninterruptedly at a task until finished, sticking to a problem even though one is not making progress, and working steadily at a single job before undertaking others…"(p. 262). In more recent studies [1] the ability to work on several things at once is called the network of enterprise, or the systems approach to creative work [12].

Pillay [10] writes about conjuring creativity and advises detaching from the external world in order to "turn to your internal stream of attention" (p. 38). Inspiration can come from anywhere, so if we shut our minds by relentless pursuit of meaning and understanding, we might miss opportunities that would be, at another point, useful to the creative process. Motivation, or the desire to act on an inspiration, is an essential part of being inspired – the desire to make it real or make it happen. This is where ideas, mental pictures and dreams are combined with common sense, practical understanding and knowledge.

The Art of Creative Thinking, by Rod Judkins [13] cites the examples of stories by Hans Christian Andersen. Andersen took exotic, weird, mind-wandering, stream-of consciousness stories from the wacky narrations of lunatics in an asylum, along with long-standing folk tales, combined them with his knowledge of plot writing, and turned them into world-famous stories still told and re-told (by Disney amongst others) today. Stories like "The Ugly Duckling" and "Princess and the Pea", based on the improvised tales of mad women in the local lunatic asylum, became magical and palatable through Andersen's structured plots, by the linguistic talents and literary skills. Similarly, the imagineers© at Disney™ take musical scores (e.g. a Mozart Symphony) and well-known story lines (Hansel & Gretel, Tarzan, The Jungle Book) and turn them into magical, novel experiences for viewers all over the world, using a combination of visual experiences and engaging storylines to enthral young and old, worldwide. This brings us quite logically to the concept of insight.

3.3   Insight

This section addresses the role of "insight" (known colloquially as the "Aha moment") in the creative thinking process. Insight is an interesting phenomenon that almost everyone experiences at some point or another in their lives: you suddenly come up with a seemingly brilliant idea, only to wonder where it came from. Sternberg reports that "[an] understanding of insight helps provide a key to the gateway of imagination, fantasy, and creativity" ([14], p. 59). Sternberg [15, 16] defines insight as "a distinctive and apparently sudden realization of a strategy that aids in solving a problem, which is usually preceded by a great deal of prior thought and hard work; often involves reconceptualizing a problem or a strategy for its solution in a totally new way; frequently emerges by detecting and combining relevant old and new information to gain a novel view of the problem or of its solution; often associated with finding solutions to ill-structured problems" [i.e. problems for which a clear path to a solution is not known].

Howard E. Gruber [17], as early as 1981, indicated that unfocused thought and incubation are frequently mental processes that precede insight and require preconscious activity, indicating that creatives benefit from a process that allows uncensored thought and periods of incubation. Incubation allows ideas to percolate below

the level of active, engaged consciousness. Gruber saw this as a prolonged process, preceding conscious creative cognitive processing. Dietrich [18] sees unconscious and conscious creative processing as occurring in parallel over some processing stages, but agrees with Gruber that some unconscious processing occurs before conscious processes. According to Dietrich [18] the very definition of creative insight indicates that the Aha moment occurs in consciousness. "Creativity results from the factorial combination of four kinds of mechanisms. Neural computations that generate novelty can occur during two modes of thought (deliberate and spontaneous) and for two types of information (emotional and cognitive). Regardless of how novelty is generated initially, circuits in the prefrontal cortex perform the computation that transforms the novelty into creative behaviour. To that end, circuits are involved in making novelty fully conscious, evaluating its appropriateness, and ultimately implementing its creative expression" ([18], p. 1023). So, there is no insight unless an idea makes it all the way into consciousness. Davidson and Sternberg [19] describe six different views of insight: the mystical view, the nothing-special view; the evolutionary view, the opportunistic assimilation view; the three-process view; and the special-process view. Table 3.1 provides a summary of each view.

Table 3.1 Six different views on insight

Type of view on insight	Brief explanation to allow implementation	Examples to demonstrate
Mystical view	People are inspired by a "muse" or mystical force to create. It's also called the wizard Merlin perspective. Scientists dismiss this view as it provides no guidelines or clear understanding of the phenomenon.	Plato & Greek mythology The wizard Merlin A demon that lives in writers' pens
Nothing-special view	We learn things by associating new ideas with old ideas or by re-associating ideas that might not have been associated formerly.	A child sees an unknown animal in the woods and because of her experience with fierce dogs, deems the animal (later identified as a wolf) dangerous, thereby saving herself from harm.
Special-process view	Insights are derived from special extended unconscious leaps in thinking or from greatly accelerated leaps in thinking or mental processes. Sternberg and Davidson [18] suggest that insight happens when the mind finds a gap in a schema and fills the gap by reorganizing the visual or other information.	Using x-rays to treat cancer meant oncologists had to find a way to irradiate a tumour, but not the healthy tissue around it. Doctors had to reformulate the problem and the goal to focusing many weak rays on one point, so that healthy tissue only receives low doses, while the converging rays focus primarily on diseased tissue.

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Table 3.1 (continued)

Type of view on insight	Brief explanation to allow implementation	Examples to demonstrate
Three-process view	Theorists suggest three distinct processes that lead to insight: Selective encoding (sifting relevant from irrelevant information); selective combination (combining seemingly isolated pieces into a whole) and selective comparison (relating new and past information).	What is the shortest time to grill 3 steaks, when it takes 2 minutes per side to grill a steak and the grill takes only 2 steaks at a time? How many creatures are there if there are giraffes and ostriches and there is a total of 44 legs and 32 eyes?* **Answer below
Opportunistic assimilation view	Problem solvers recognize a new problem as unsolved and go into incubation mode when their memory marks the problem as unsolved. During unconscious thinking, the mind highlights special areas in the contextual environment that were not noticed before. Features that are relevant will highlight a possible path to a likely solution as thinkers return to active thinking and hone in on specific elements of the environment.	Seifert et al. [20] offer the example of two travellers who find a dead man in the desert with untouched food and water in his backpack, and a large ring on his index finger. They could not explain his death, until later, one traveller dropped his handkerchief, only to have the insight that the dead man's parachute had become detached.
Evolution view	This view applies the theory of evolution of organisms to the evolution of ideas – Claiming that ideas undergo haphazard recombination in the mind, called "blind variation", much like the mutation of genes in different species. Blind variations are then passed through a selective filter: Cognitive processing retains some and rejects others. The selective retention of ideas is later recognized as "insight".	Writers often listen to bits of conversation and make no special connections, or they fail to conjure up special stories. However, in the case of Henry James, one chance comment by a dinner guest led to an insight, which resulted in his story *The Spoils of Poynton*. **Answer to BBQ problem: 8 min Answer to creatures: 32/2 = 16 pairs of eyes so 16 animals.

Adapted from [14]

According to Metcalfe [21]: "The persistent lack of a mechanism for insight, linked with the charge that the notion of insight is somehow supernatural, has shackled researchers who would explore this most important of cognitive processes....We do not yet understand insight." Melissa Schilling considers this age-old quest to understand insight, and uses the concept of "small world networks in the brain" to illuminate this peculiar moment of insight, normally accompanied by the affective "Aha!" experience ([22], p. 5). Schilling integrates graph theory, cognition and prior research on neural networks to build a theory that explains how insight occurs. The small world neural network theory (SWoNN) links with the work of Gick and Lockard [23] who propose that the "Aha!" is an affective response that arises because the solution not only appears quickly and unexpectedly, but also appears disconnected from previous solutions and representation attempts [24].

Sternberg [25] proposes the propulsion theory of creative contributions and metaphorically compares creative insights to trajectories in space: "theories in
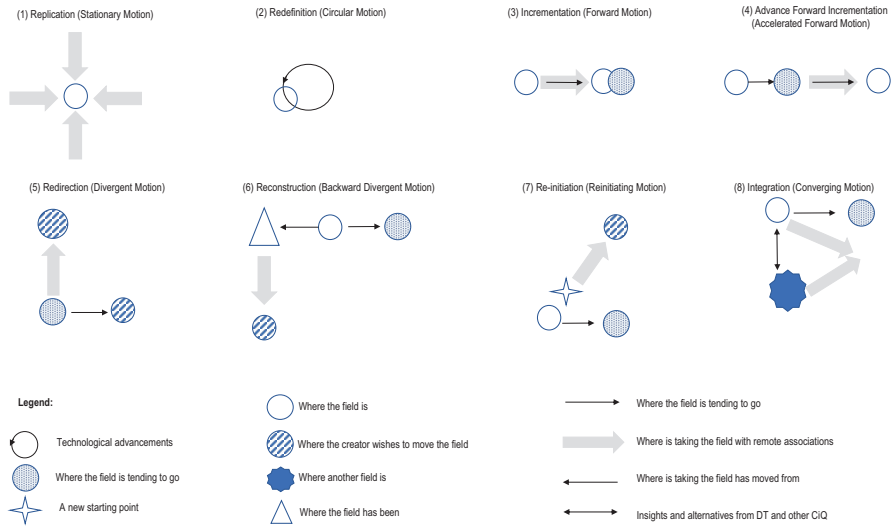
Fig. 3.2 Eight contributions to the creativity space (propulsion theory) [25]

creativity are searching space"([25], pp. 90–91). Sternberg offers eight ways to achieve insight, when creativity is considered "a decision to be creative".

As shown in Fig. 3.2 Sternberg graphically demonstrates the eight contributions of insight to progress and innovation. The eight contributions are:

Replication: Confirms, solidifies, keep the field where it is;

Redefinition: Changes perceptions about where the field is and redefines it from a new vantage point;

Incrementation: Small forward movement in the same direction as it is already moving;

Advance Forward Incrementation: The idea is ahead of its time and moves the field rapidly forward (higher rate than expected, but same direction);

Redirection: Moves the field forward but in a different direction than it is currently moving;

Reconstruction: Moves the field back to a past state (real or imagined), with the intention to move it in another direction from where it currently finds itself;

Re-initiation: Starts from scratch (moves the field or sub-field in another direction either due to exhaustion of that direction or having reached an undesired point in the development of the field);

Integration: Combines ideas from formerly distinct or unrelated ways of thinking ([25], pp. 90–91).

One of the key findings of Schilling's investigation into insight confirms the benefit and cost of "deep knowledge reservoirs ", as identified by scholarly studies by the work of Simonton [26], and, Gladwell [9] and Gardner [9]. Both Gardner and Simonton [9] argue that insight first requires preparation within a discipline, so as a first step, insightful people build huge reservoirs of discipline-relevant information

[26]. In contrast, various research authors report on the limitations that years of experience in a discipline might have due to mental set fixation, functional fixedness,[1] mechanized problem-solving using existing paradigms, and institutional pressures to conform. We can go as far as reporting that both Einstein and Piaget claimed that formal schooling detracted from their intellectual development, impeding their cognitive insight [27]. Various scholars report than marginal intellectuals (who are not central to a particular domain but participate in multiple disciplines) are more likely to introduce creative breakthrough insights than well-established domain experts. So, we can deduce that there is a curvilinear relationship between experience (problem-solvingexpertise in a domain) and creativity. A tendency to rely on one's prior experience(s) is likely the cause of this curvilinear relationship (e.g., [28, 29]). The inverted U-shape of a curvilinear graph (see Fig. 3.3), indicates that up a certain point, an increase in experience leads to an increase in creativity or creative output, but after a certain point, a further increase in experience within a domain/discipline will lead to a decline in the level of creativity. Scholars attribute the early creativity to people's natural tendency to seek solutions to problems, and blame mental set or functional fixation for the decline in creativity of highly focused experts.
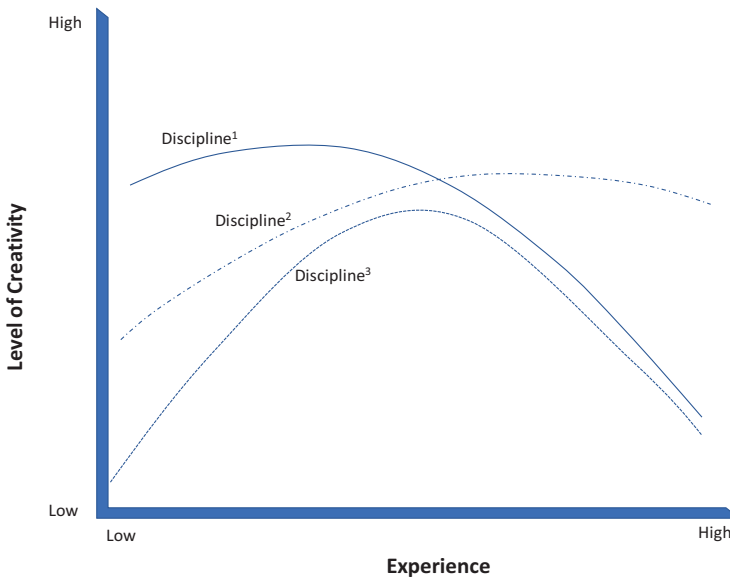
Fig. 3.3 Curvilinear relationship between experience and insight

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[1] "Functional fixedness" refers to a situation whereby an individual can only think of using an object for its most common use; e.g., a paper clip can only be used to keep papers together.

It is clear that scientists from various disciplines agree that creative thinking does not result from cognitive thinking alone. Creativity is complex; dependent upon IQ (also called *g or iQ)* and emotional components like interest and attitude. The emotional components of creativity have received attention over many decades from both neuroscientists and in non-biological studies of creativity. Studies report that affect or emotion not only regulates thinking preferences and cognitive demands, but affect also acts as a source of drive, motivation, persistence and energy, courage and interest to explore, wonder and curiosity and finally, as an interpreter of logical facts, information and knowledge [1, 18, 30–32]. Mark Runco [1] points out that readers must keep in mind that it is thinking style dominance, not left vs right hemisphericity, that is important. "The dominant hemisphere …houses the interpreter and the non-dominant hemisphere deals with problem in a simple, uncomplicated fashion" ([1], p. 91).

Damasio [32] offers a list mainly concentrated on affective and extra-cognitive process requirements for creativity, listing courage and motivation at the top of his list. Next on the list is extensive experience in a particular field. Damasio then links emotional elements like insight into one's own mind and the minds of others. He particularly refers to the importance of a large working memory that allows individuals to store and manipulate representations and to recombine and rearrange them to make novel combinations of entities and images. Damasio highlights several emotional/affective requirements for creative intelligence, listing the cognitive abilities of decision-making last. Although the emotional brain plays a significant role in creative efforts, it does its work through interactions and systems among neuroanatomical structures ([1], p. 93).

3.4 Definitions Relating to the 4Ps: Person, Product, Problem, Process

It is not easy to find a comprehensive or single definition of creativity, as there are multiple perspectives: creativity can be seen as a natural talent or skill, a neurological functionality or cognitive ability, a personality type, or the product of an individual's or group's efforts. Further, it is often hard to distinguish creativity from its products, for example in art, craft, dance, poetry, architecture, design, advertising and various other forms of creative output, both formal and informal. Hundreds of definitions exist when all perspectives are considered.

Author Ruth Richards [33] views the 4 P Framework of Creativity (originally proposed by Mel Rhodes in 1961) as Person, Process, Product and Press. This book expands this model to six Ps, to include Possibilities and Partnerships (see the six Ps in Fig. 3.4). Since this is a new model that will be further elucidated in this book, in this section we will focus on the definitions from extant literature that cover the 4 Ps.

While 'Person' captures the state and traits characteristics of the creative individual, including cognitive style, attitudes, intentions, values and other aspects

**Six Ps of
Creativity**

Product

Person   Process

Press

Possibilities   Partnerships
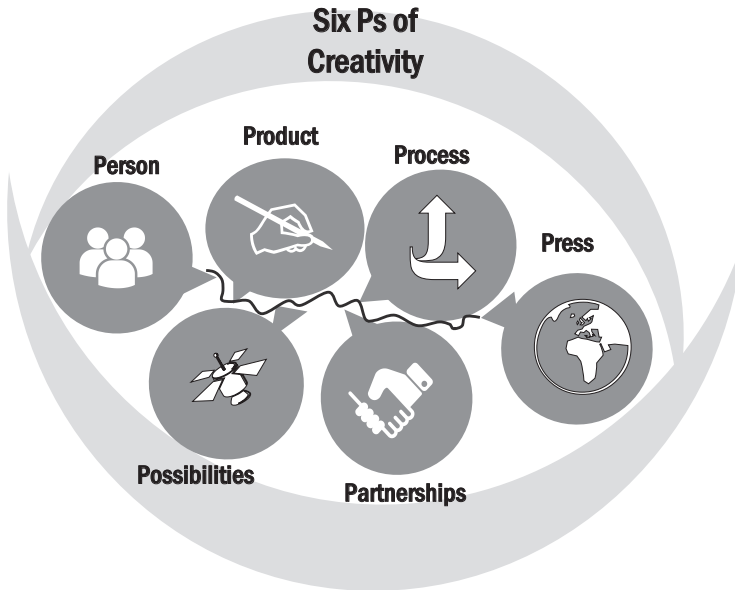
Fig. 3.4 Extended multi-factor model of creativity: 6Ps

discussed in more detail in following sections, the 'Process' factors consider the
ways in which creatives think, feel, experience, motivate and direct themselves and
others. This includes developing continuous learning strategies to adapt to the
changing world. 'Product' is concerned with the outcome or result of creative efforts
and may range from pure ideas to tangible products and inventions. The final of the
4Ps, 'Press' refers to the creative environment around creative individuals and
groups that either facilitates or restrains creators' capabilities. Within organizations
the creative environment includes the culture and subcultures that shape and reward
(or punish) the creative person's attributes, perceptions and attitudes (see Chapter
13 for additional details.)

3.4.1 Definitions Related to the Person (Genii)

According to Mihaly Csikszentmihalyi [34] and Dean Keith Simonton [26] creativ-
ity happens when a problem solver, creator, innovator, inventor or ideator does
something novel or unexpected that solves a problem, leads to other solutions and
changes how people think or behave. Stokes ([35], p. 1) provides an example to
illustrate the influential and generative nature of creativity in the form of Pablo
Picasso's art (in the early 1900s). The new artform was called cubism [36], which
provided artists with new ideas on seeing and representing the world. Cubism was
useful in generating other variations of the solution it provided. Picasso's art was

highly influential as it changed the way others saw and produced paintings, and how artists interpreted their realities.

Dean Simonton [26] claims that creativity is best understood by considering a Darwinian process of variation and selection. In his book, *Origins of Genius*, Simonton argues convincingly that creative artists and scientists create a wealth of ideas, later subjected to judgement—whether aesthetic or scientific. Only the best few are eventually selected to further develop, reproduce or expand. This is quite similar to the process described by Charles Darwin [37] in *On The Origin of Species by Means of Natural Selection*.

Let us, as students of creativity and expansive thinking, consider Plato's question: "From what sources do excellence in human thought, action, or performance arise?" Aristotle's answer to this fundamental, defining question offers three distinct kinds of human activity, each requiring some form of intelligence, each with its own characteristics. These activities and their distinctive varieties of intelligence may be defined in terms of their ends or aims: (a) understanding or "knowing", (b) action or "doing," and (c) production or "making", giving us the designations of theoretical, practical, and productive intelligence. In 1984, Arthur Sternberg developed the Triarchic Theory of Human Intelligence [38]. Sternberg's triarchy in its most recent manifestation has three general headings: analytical, practical, and creative intelligence.

Sternberg's creative intelligence is important both when humans encounter novel situations and when we deal with recurring circumstances. Novel situations require skills that may be only loosely based on past experience, and some people are more skilled than others at this kind of coping. Recurring situations, on the other hand, benefit from automatization that frees up attention for use elsewhere. Creative intelligence is thus closely linked to the experience of the individual.

"People with creative intelligence are able to produce novel and interesting ideas and are willing to develop these ideas in the face of widespread resistance that often accompanies innovation. Successful inventors and designers must possess this type of ability. Unlike analytical and practical intelligence, creative intelligence is best expressed in situations with minimal structure or constraint." ([39], p. 176) Both Sternberg and Aristotle confirm that creative intelligence can be learnt by observing others, learning risk-tolerance and risk-taking from peers and mentors and educators who tolerate, allow and pursue mistakes to learn from [39].

In her book *Creative Intelligence: CQ@Play,* Cherylene de Jager [40] defines creative intelligence as the ability to be creative. But this ability goes beyond cognitive processes such as thinking, knowing, remembering, judging, solving problems, and includes psychological factors such as willingness to take risks, intrinsic motivation, open-mindedness and willingness to be in touch with one's own and other people's feelings. Other authors highlight a constellation of personality traits such as flexibility, ego-strength, empathetic sensitivity to others, and a high level of intuition. Psychology researcher Mark Runco ([41], p. 521) highlights the paradoxical nature of creatives' personalities by summarizing a wide range of studies of creative intelligence:

> Creativity requires possession of…openness combined with a drive to close incomplete gestalts; acceptance of fantasy combined with maintenance of a strong sense of reality; critical and destructive attitudes together with constructive problem solving; cool neutrality combined with passionate engagement; self-centeredness coexisting with altruism; self-criticism and self-doubt together with self-confidence; and tension and concentration side by side with relaxedness.

For more detailed discussions about the psychological aspects of creatives, such as drive, characteristics, traits and thinking habits, see Chapter 8 of this book.)

A study by scholars from the University of Vienna and the Max Planck Institute for Human Development in Berlin asked 111 creatives (64 creatives, graphic designers and "fine" artists, and 47 psychology and art students) to provide personal definitions of creativity and list the attributes of creative persons [42]. In Table 3.2 the salient factors to identify creative persons are listed, but are neither ranked, nor address the differences in opinion between the different groups (identified as "free" artists, "constrained" artists and "psychology" students in the study). This study shows that although may be some differences in ranking between practitioner experts' and students' opinions (as lay-people) about what creativity is and how it should be defined, they all agreed on richness of ideas (inventiveness). Although artists assigned great importance to assertiveness and cultural competence, students did not. These differences may be attributed to differences not only in experience, but also in age and life experience.

Creativity is also a social phenomenon, as creatives normally defy rules in pursuit of novel, unusual results, defying the norms of society and sometimes engaging in contrarianism. Mark Runco ([41], p. 518) sees creativity in part as "the failure to confirm to norms of society". As humans grow up, societal norms narrow, defining acceptable and expected behaviours and choices. These restrictions narrow the range of options for solving problems, teaching young learners to try to find "the one right answer" or "the single and only acceptable answer" to satisfy societal expectations. These societal rules discourage the rare, the unique, the unusual. Obviously, societies tolerate small deviations from the rules, but if the deviation goes beyond acceptable limits, rule breakers are regarded as eccentric, weird, immoral, criminal or mentally disturbed. Different societies and cultures have

Table 3.2 Five factors of person attributes (Definitions of Creativity Questionnaire by Glück, Ernst and Unger, [42], p. 60)

Factor 1 Assertiveness	Factor 2 Cultural competencies	Factor 3 Richness of ideas
Assertiveness Self-confidence Ability to decide Self-control	Intelligence Knowledge Taste/style	Inventiveness Imagination
Factor 4 Intrinsic motivation	Factor 5 Artistic personality	
Tolerance of frustration Diligence Love of one's work	Artistic talent Unconventionality Readiness to take risks	

Fig. 3.5 Graffiti: art or contrarianism? (Photo taken by the author in June 2019, in Verona, Italy)

different rules about the acceptable limits for breaking the rules. A modern example is graffiti. Is it art or some type of creative output; perhaps even a service to society to brighten drab concrete walls? Or is it merely self-expression or even vandalism and criminal damage to public or private property? (See Fig. 3.5 for an Italian artist's graffiti.) We cover the issue of "Press" (conditions within which creativity blooms) in Chapters 15 and 17 and corporate culture (how organizations can establish innovative cultures) in Chapter 16.

3.4.2   Creativity as It Relates to the Problem

When considering the first part of the definition by Simonton – solving a problem – one has to look into the types of problems, to determine whether the solution is creative or not. If it is a well-defined problem, where all information is known or given and the sequences to move from the problem to the solution (or goal state) are fairly structured, then a creative solution is unlikely. An example provided by Stokes ([35], p. 4) is the "paint-by-numbers" canvas set. Here the canvas has a pre-printed picture, the paint box has numbered colour blocks and the desired goal is printed on the box as a completed painting. This entire problem statement precludes creativity. Learning and development is possible, but according to the definition of creativity, the very well-defined problem makes creativity not only unlikely, but even somewhat undesirable for such projects. In contrast, ill-structured problems prompt creativity. The very nature of ill-defined problems allows for various ways to redefine the problem, consider and pursue alternative goal states, and restructure the problem space to preclude or limit the familiar and promote novel, unique, unusual solutions and solution processes (paths to possibly surprising new solutions). Creative problems tend to be ill-defined and at least somewhat poorly structured. In addition, the

problem is normally a novel one, for which rote extrapolation from past experiences is not likely to result in useful, appropriate or effective solutions ([43], p. 807). Lastly, these creativity-generating problems require thinkers to "reshape or reform existing knowledge to generate the new ideas and new approaches" ([43], p. 808).

Returning to the issues of the solution to a problem, societal tolerance of rule-breaking and novelty, true creativity – not to be confused with pseudo-creativity, blind rule-breaking and rejection of societal norms – requires an element of relevance, usefulness or efficacy. It must offer some kind of genuine solution to a problem. Arthur Cropley [44] defines creativity as the production of relevant and effective novelty. The product or output must therefore not be preposterous, far-fetched, outrageous or incomprehensible. More recent work by Mark Kilgour and Scott Koslow [45] highlights the "appropriate" novelty of creative solutions, referring to the alignment with the creative brief, problem statement, or clients' need for worth and value in creative solutions. The words appropriate and effective will have different meanings in different contexts, such as arts and business. In arts the measure of effectiveness might be whether something is aesthetically pleasing, entertaining or affectively engaging. But in business the alignment with goals may vary from being profitable, to being aligned with the corporate strategy and advertising brief, to preventing competitive take-overs for the survival of the firm. Perhaps an important note here, which will be discussed in more depth in Chapter 19, is the ethical considerations of appropriate solutions. Creatives will be asked to solve more far-reaching, wicked problems like the health of the planet, the well-being of at-risk societies and the impact of robots and AI on human life, considerations regarding the impact of inventions, particularly in science (such as cloning humans, genetic engineering of flora and fauna; bionics and augmented limbs) and technological advancements (weaponry; environmental implications). Wicked social problems are those related to the human condition (e.g., poverty, inequality); they are difficult to solve because of incomplete, contradictory and changing requirements that may be difficult to recognize and complex to address. These wicked problems are normally inter-connected at various levels of society, are ambiguous in their aims and solutions, and often carry high risk in even attempting to solve them.

3.4.3   Definitions Related to the Process of Creative Thinking

A different perspective considers the interacting components that come together to produce original and productive outcomes ([46], p. 20), called the "componential framework" [47]. The components of Theresa Amabile's framework are: (a) task motivation; (b) domain-relevant skills; and (c) creativity-relevant skills. This confluence model emphasizes abilities that collide in unique ways. Gruber and Wallace [48] proposed a different confluence model that highlights the unique ways in which ideas, knowledge, and goals interact over time to develop ideas. An example is Darwin's theory of natural selection [49], exemplifying a chain of steps, goals, interests and unique domain knowledge colliding to create Darwin's theory of

natural selection and a new evolutionary science. Another confluence model, by Sternberg and Lubart [50], proposes six interrelated factors essential to creativity: intellectual abilities, knowledge, styles of thinking, personality, motivation and environment. Sternberg and colleagues [45] call this the investment theory of creativity.

Edward de Bono and other researchers [51, 52]concentrate on thinking processes as the basis for creativity. Many terms have been coined to indicate creatives' ability to use divergent thinking, which is a capacity to think broadly and expand beyond the obvious; "lateral thinking" (taking unique perspectives on a problem); "Janusian thinking" (looking forward and backward to consider ideas); bi-phasic thinking (two phases, first free unjudged thinking, then organized and judged); "homospatial" (bringing ideas together from different domains) and "tertiary thinking" (combining primary and secondary processes).

Other theories emphasize links between domains and the process of associating ideas from a diverse range of disciplines (see Chapter 9 for further discussions about domain and discipline relevance). These are called associational theories. In the scope of normal life, people learn to make hierarchical associations between ideas, objects and actions, and these links rise in the hierarchy when they happen over and over (e.g. animals have legs, a face with two eyes and a mouth). Less likely or less common associations are described as "remote". A person who makes remote associations is seen as creative, as they make unusual or unexpected associations between domains (e.g. the shopping trolley started out as a chair on wheels, and VELCRO™ was discovered by George de Mistral in 1948, who observed leaves sticking to his dog's fur, and made the association with one piece of fabric sticking to another.)

Creativity is seen as a problem-solving process. Problem solving may involve creative thinking, but creativity is not necessarily an element of all problem solving actions/decision or activities. For example, deciding which movie to see, or which dress to buy may require almost no creative input, and the same applies to some routine problems. In contrast, intractable problems (e.g. how to escape a building where the stairs are on fire; erecting a tent in the wild when the tent pens were left at home), are likely to make creative thinking necessary. To assess the degree of creativity in problem solving, one has to divide the problem into three distinct but inter-related parts: (i) the degree of well- or ill-defined problem definition; (ii) the solvers' familiarity with the domain and problem and means of solving it; and (iii) the clarity of the criteria for measuring the effectiveness/appropriateness of the solution [44, 53, 54].

Referring to the first component, researchers think of "problem recognition", also called "problem framing", problem definition and problem finding as a major first step in creative problem solving (see Chapter 9) on the stages and importance of problem definition and redefinition). A vital step in scientific research is finding a gap in the available knowledge, and defining the research problem. In brief, the process is ordinarily described as *eight distinct activities* (not to be confused with the *4 stages*): (1) problem definition or construction; (2) information gathering and coding; (3) category selection (organizing information into concepts that might be

useful to the solution; (4) category combination or reorganizing; (5) Ideation or idea generation; (6) idea evaluation, in terms of workability, viability and effectiveness; (7) implementation planning (piloting); and (8) monitoring implementations, to improve, adjust and refine [43].

More recently in business studies, social marketing, advertising and product development, scholars have focused on the way we view the output of the creative process – the creative product – which in this case is creative ideas. Definitions of creative ideas proposed by Scott Koslow, Mark Kilgour (see Chapter 9), Michael Mumford and Dean Simonton and their colleagues [45, 55] emphasize two key aspects: novelty and appropriateness. More recent improvements add artistry or expression of the idea(s)– which link back to Mihalyi Csikszentmihalyi's [34] and Dean Simonton's [26] concepts of influence. For ideas to be considered creative, they must be both original and appropriate. Being only original may mean the idea is too weird to be useful, while too appropriate will mean that it has little novelty and is thus commonplace or unoriginal.

3.4.4 Definitions Related to the Outcome or Product of Creativity

Many authors expose their bias in their definitions of creativity as a product-producing process by defining creativity as essentially the behaviour, actions, and thinking related to an observable result. In the words of educator Reynold Bean [56] "even though creativity begins as an inner process – a feeling or idea– it must also produce an observable result… just being oneself is not being creative (p. 3).. there must be a product that expresses those thoughts and feelings" (p. 3). A succinct definition by Solomon, Powell and Gardner [57] declares that "creativity involves an original approach to a problem or product within a given domain of study", thereby focusing both on process (approach) and outcome (solution/product) (p. 273). Some scholars are far less broad-minded in their approach to defining creativity and hone in on the product or outcome of creative endeavours. Bailin [58] declares that "the only coherent way in which to view creativity is in terms of the production of valuable products"; here creativity is determined solely by its end product.

Mumford expresses this objective, observable, tangible outcome interpretation of creativity in the following way: "over the course of the last decade, we have seemed to reach a general agreement that creativity involves the production of novel, useful products" [59] In various fields (e.g., performing arts vs science), disciplines (such as business, engineering, or medicine) and even in activities within disciplines (business: advertising vs accounting) the outputs/products vary substantially both in terms of how the quality is measured (e.g., by public opinion vs expert opinion) and the tools necessary to produce a creative product (e.g. musical instruments vs test tubes vs surveys). The specific knowledge required to achieve content variability will also differ (e.g., engineering creativity might demand mastery of the laws of physics and the use of IT, whereas creative writing demands mastery of linguistic symbolism) [42].

Table 3.3 Three product factors ([42], p. 59)

Factor 1 Functioning	Factor 2 Originality	Factor 3 Impression
Technically correct	Unusual	Elegant
Useful	Radical	Understandable
Well-crafted	Surprising	Aesthetic
Functioning	Original	Logical
Fulfilling its purpose	Funny	
Elaborate	Showing individual style	

A comprehensive study of various definitions of the creative product, which involved 111 creative artists and students [42], found three sets (called factors in Table 3.3) of product attributes. These three categories of product attributes align well with the definitions offered by many researchers [60] and elsewhere in this book. The three factors are described as follows: "Functioning refers to all "technical aspects of the creative product. Persons with high scores on this factor think it is important that a creative product works and fulfils its purpose; that it is elaborate and well-crafted. Originality comprises aspects of unusualness. A high originality score indicates that a creative product must be unusual and original, perhaps also surprising, funny, radically new, and reflect the producer's individual style. In this study "Impression" refers to the view of the others who are confronted with or exposed to the creative product. The product is expected to have aesthetic qualities, and to be understandable or logical" ([42] p. 59).

In summary, the creative output space can be illustrated as a three-dimensional space with products ranging in quality from low to high. The three-dimensional space is illustrated (as well as a two-dimensional printed copy will allow) in Fig. 3.6. Imagine the axis of Impression/Artistry protruding straight up out of the page. The XY-plane (the flat area that is highlighted in grey) illustrates the novelty:usefulness* space. Products can range from low in both usefulness and novelty (useless), to a mixture of those aspects (making the products little-c outcomes), to high in novelty and high in usefulness, making the product a Big-C outcome. The mid-range outcomes are either bizarre when the product is very novel but has low usefulness ratings, or simply commonplace if the output is very useful, but lacks novelty. (See Chapter 9 for further expansion on little-c and Big-C products.)

In the next section we will move from the person, the process and the product, to definitions of CiQ – the development of creative capabilities (Fig. 3.6).

3.5 Conclusions About Creative Intelligence (CiQ)

It is not surprising that people consider creative intelligence (CiQ) to be simply another form of conventional human intelligence (labelled iQ). In the *Encyclopaedia of Creativity*, Arthur Cropley [44] reports on "six facets of creativity": knowledge, insight, intrinsic motivation, the courage of one's conviction, flexibility, a willingness to take risks, and relevance (p. 516). It is noticeable that some facets overlap
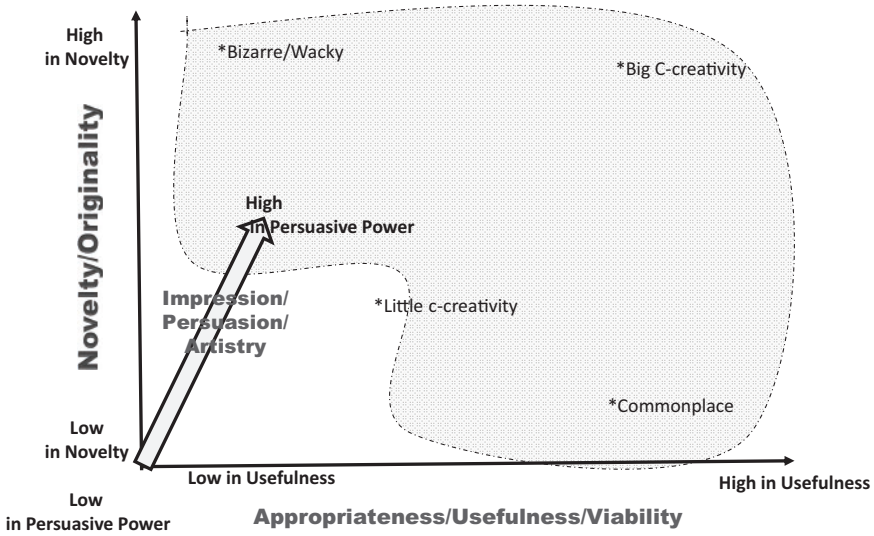
Fig. 3.6 The creative product output space: commonplace, little-c, Big-C and Bizarre Products

with intelligence, as knowledge retention and recall are essential to achieve high iQ scores. Cropley [44] summarizes his findings by reporting that "creativity and intelligence are neither identical nor completely different, but are interacting aspects of intellectual ability"(p. 516). The APA Dictionary definition of CiQ is as follows: "creative intelligence in the triarchic theory of intelligence, the set of skills used to create, invent, discover, explore, imagine, and suppose (p. 516). This set of skills is alleged to be relatively (although not wholly) distinctive with respect to analytical and practical skills" [61–63].

Once one understands that creative thinking demands the production of novel, unusual output, often associated with departing from established facts and standard thinking to new ways of inventing solutions by connecting unusual domains and acquiring insights from unexpected sources, it is clear that specialized competencies are required. Conventional intelligence (measured as iQ) is closely dependent on substantial knowledge and recall of facts, and knowledge (e.g. of language, numbers and general social knowledge). Scholars conceptualize creative intelligence, in contrast, as a set of attributes and skills and approaches to problem solving, rather than a particular level of iQ. Interestingly though, the threshold theory of creativity explains that some minimum threshold of iQ is necessary before creativity is possible. Above a particular iQ, the possibility of creativity arises. Psychologists and research academics found that humans with high iQs (above this threshold of 120) show the possibility, but not necessarily the propensity to be creative. Interestingly, creativity is not correlated above this threshold, indicating that a minimum threshold level of iQ is necessary to retain the necessary information to be creative, but does not indicate the use of this latent ability. From the above definition of

attributes, skills and problem-solving approaches, it is clear that CiQ can be developed.

Multiple books, websites, online courses and papers (at primary, secondary and tertiary education levels) not only confirm that the requisite skills and thinking habits can be developed, but offer tools, frameworks, models and advice on how to increase CiQ [64, 65].

In Chapters 5 and 6, David Kayrouz establishes the importance of metacognitive skills, not only for thinking generally, but specifically for creative thinkers and problem solvers. Metacognitive skills are a conscious understanding of 'knowing how we know' that facilitate the transfer of training and established perceptions (as well as insights from those perceptions) to new situations. Pattern recognition is also important, as skill in pattern recognition enables individuals to form an appropriate representation of the problem situation.

CREATiViTY LABORatory

Activity I: Divergent Thinking

Divergent thinking questions from Wallach & Kogan [6]:

List strong things
List square things
List uses for a coat hanger
List functions for a brick

Activity II: Domain Intelligence

Compose a list of at least five domains in which you consider yourself to have an adequate or a high level of knowledge to act as valuable team member, when those domains come into play during creative thinking activities. Think back on some brainstorming and other creativity think tanks you were a member of over the past year. Are there any other (subject/discipline) domains you would like to develop your expertise of knowledge in? Look online for some free sources or resources (see YouTube™, TedX™ talks or visit universities to peruse online courses). Look into free community colleges or interest groups that might assist you in this quest.

Activity III: Personal Development Plan

The set of skills that the American Psychological Association (APA) set out for CiQ incorporates skills to create, invent, discover, explore, imagine, and suppose. Consider the five factors in Table 3.2 and several synonyms for each of these words,
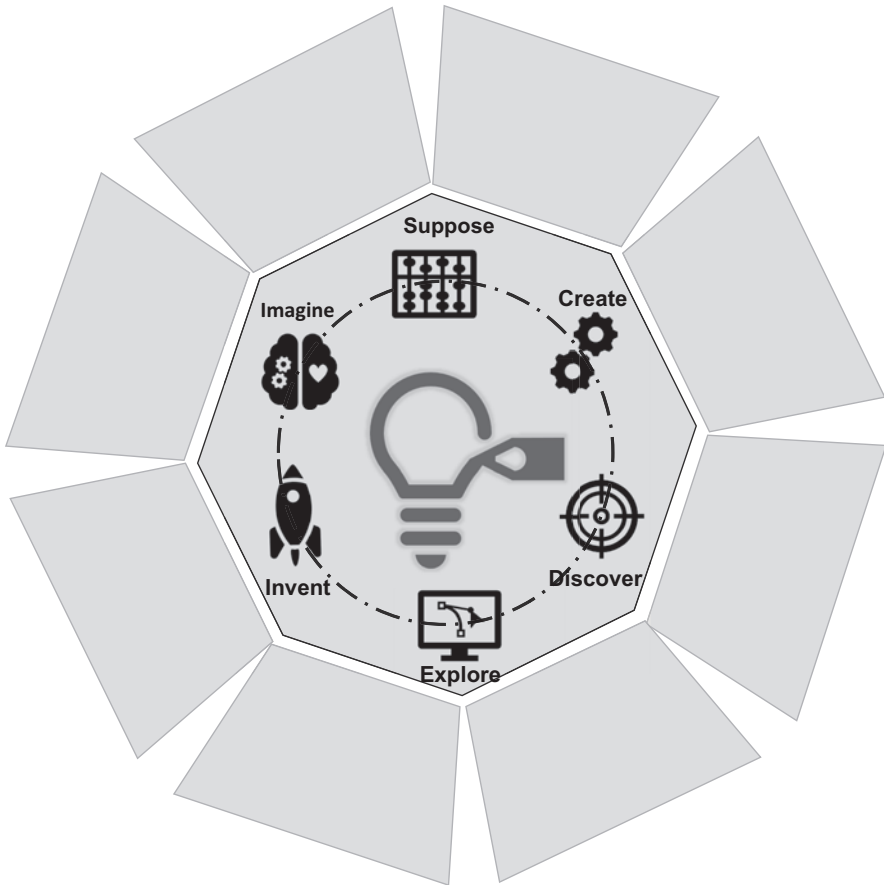
Fig. 3.7 Coaching for CiQ

as provided by online dictionaries of your choice. (e.g., the MSWord dictionary provides synonyms for suppose as: think, guess, believe, pretend, understand). Look up some words using several online sources. If you were asked to coach someone, what might you suggest as activities or tasks to develop CiQ skills. (Perhaps after reading the entire book, you might have new ideas to update/upgrade this model.) Use the figure below to design a personal development plan for your coachee or yourself (Fig. 3.7).

Activity IV: Little and Big C Idea Generation Tool

Imagine you are the creative brains of a consulting firm. You have been approached by a client to suggest new uses for two products he has found to be stuck on the shelves in his warehouse. He has millions of rolls of plastic straws (in 200 m rolls
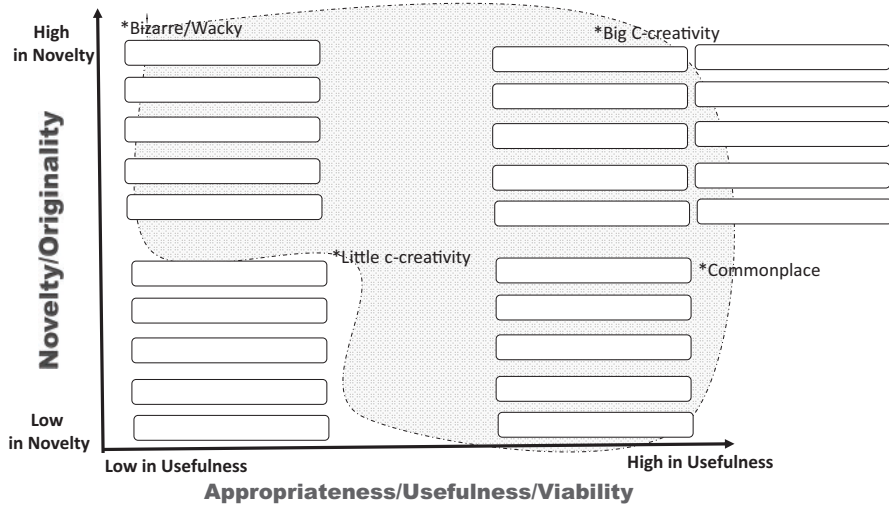
Fig. 3.8 The Creative Product Output Space: Big-C, Commonplace, Little-c, and Wacky Products

of uncut straws of 10 mm diameter) and about five million red stress balls, about the size of a cricket ball. The stress balls are not branded in any way and are soft, durable and made of memory foam – indicating that once a ball has been released from pressure, it will jump back to its original form. This will last for about 300 compressions, after which it will remain flattened, or in the form of the impression that has been made on it.

Use the Creativity Product Output Space below, to list at least 25 uses for these items (Fig. 3.8).

Activity V: Tinkertables

Dr. Pillay [10, p. 23] contrasts a timetable of frantic wall-to-wall appointments with a *tinkertable*. This tinkertable is your own self-created and self-managed series of timeslots that are off limits to any daily, compulsory, or routine tasks. These are non-negotiable slots in which to reflect, think, meditate and un-focus the mind. Find regular slots – he suggests 15 minutes – to do something that is undemanding to YOU. Something like doing a crossword, a Sudoko™ number puzzle, listening to music or taking a walk without your phone. Set aside bigger timeslots for once a week and longer time slots like a vacation or "staycation" (no travel, but no work either).

Your only two tasks right now are to (i) block out a slot of 2 hours a week for the next 10 weeks, where you can do exactly what YOU want to do: work, play, sit, think, relax, work hard, read, prepare. This can be ANYTHING YOU want and have utter control over. (ii) Find a pet name for this block like MYTIME or TRU2ME,

and select a symbol or icon to help you recall that this is not-negotiable. My symbol is α [66]. What is yours?

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