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# Why Grand Theories of Creativity Distort, Distract, and Disappoint

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The success of physics and other sciences is in many ways attributable to unifying theories that bring seemingly disparate phenomena together under a single conceptual framework. This model is inviting for creativity theorists because grand theories have great power, but there is no guarantee that any large theory can describe the many very different kinds of cognitive processes that underlie creativity in diverse domains. Trying to force creativity into an ill-fitting Procrustean bed can distort both theory and practice (such as in creativity-training programs and in creativity assessment) and in doing so cause us to misunderstand what we observe and to promote activities that may be counter-productive. Domain specificity, which argues that the skills and other factors leading to creative performance vary across domains, cautions against seeking grand, domain-general theories. Although there has been increasing interest in domain specificity in recent years, creativity researchers remain divided regarding the extent to which creativity is domain specific and the likelihood that there may be any significant domain-general factors in creative performance. Because this question is unlikely to be resolved soon and domain-specific theories of creativity are less likely to mislead us, practitioners should resist the allure of grand theories and try to understand and promote creativity on a smaller, domain-by-domain scale. Some limited general creativity meta-theories can be useful as heuristic devices to point us toward possibly productive domain-specific theories of creativity, however, if their limitations are clearly recognized and understood.

## PREFATORY NOTE

Based on the responses of prepublication readers of this manuscript, it will be useful to briefly delineate the primary goal of this paper. Domain specificity is a significant theory regarding the nature of creativity, but also a highly controversial one. The only set of Point-Counterpoint articles ever published by the *Creativity Research Journal* were about the question of domain specificity v. domain generality (Baer, 1998b; Plucker, 1998). The issue remains a controversial one (see,. e.g., Baer, 2010; Kaufman & Baer, 2005b; Sternberg, Grigorenko, & Singer, 2004)

The debate has of course not yet been settled — evidence and arguments for both sides continue to be produced — and it will not be settled by anything in this paper. The primary goal of this paper is *not* to defend or promote the claim that creativity is largely domain specific, but rather to show what domain specificity implies for

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creativity theories in general. I will briefly present some of the evidence and arguments for domain specificity so that readers who have not followed this debate closely will understand the context in which I am presenting this argument, but there is far too much evidence regarding domain specificity to allow a thorough review here. That has already been done elsewhere, and I will refer readers to that literature. For the purposes of the main argument I am advancing — the argument that to the extent that domain specificity is true, grand theories of creativity are doomed to failure — I will simply assume that domain specificity is largely true and proceed to spell out the implications of domain specificity for creativity theory, research, and practice.

## INTRODUCTION

Particle physics has been revolutionized by grand unified theories (GUTs). Having found ways to bring together under one theoretical umbrella their already powerful theories of the strong force, the weak force, and electromagnetism via these theories, physicists have for the past century been seeking a Theory of Everything that will bring the universe's fourth and final major force, gravity, into the fold. Large-scale theories like GUTs are attractive for many reasons, including their power and their theoretical economy (and, many would also argue, because they are simply more beautiful than smaller, more ad hoc theories). A theory that can explain everything (or at least very many things) deepens our understanding of the most fundamental forces. It is natural that such a theory would be preferred to a hodgepodge of theories that can explain only more discrete and isolated phenomena.

That does not mean that a broader theory is always more practical or useful, however, even in a field like physics where grand theories have become the norm. For many purposes it is far more economical to continue to pretend that we live in a Newtonian universe than the relativistic one Einstein has shown us, which requires us to consider complex relationships that for most purposes we can safely ignore. And to explain macroscopic events with a GUT that requires one to describe action at the quark level is for the most part neither efficient nor edifying.

Psychology has had its own grand theories. Although they don't approach the scope of GUTs, psychoanalysis and behaviorism come readily to mind as large-scale theories that have attempted to explain wide ranges of very diverse phenomena. We have certainly learned much from the bold claims of psychoanalysis and behaviorism, but it's also clear that they both over-reached. One can argue about how much human behavior may be influenced by unconscious motivations or reinforcement histories, but few psychologists today believe that any one theory can explain everything about human psychology, or even most of it. It now seems unlikely that any single theory will be able to account for more than a very limited slice of human behavior[1]

[1] Even going down to the level of neural substrates will probably not yield unified theories of human behavior. Recent research suggests that even brain wiring in what would seem to be relatively culture-free areas such as carrying out basic numerical tasks is apparently determined partly by culture (Ambady & Bharucha, 2009). Of course one can dig down further still, but discovering (for example) that "humans and fruit flies, Drosophila, are remarkably similar at the molecular level" (Ruse, 2010), while both important and interesting, will not help much in developing a psychological theory of problem-solving insightfulness, aesthetic appreciation, or openness to experience (to name just a few things that psychologists — especially those who study creativity — might want to understand).

It has been argued that the modern psychological study of creativity began with Guilford's 1950 presidential address to the American Psychological Association (the *Creativity Research Journal* acknowledged the importance of that speech by issuing a special issue commemorating it; Plucker, 2001). Guilford's Structure of the Intellect model (Guilford, 1967) was at once a large-scale model of the entire human intellectual apparatus and a domain-specific theory of human intelligence boasting 150 discrete abilities. It is best remembered for what Guilford termed "divergent production" (more commonly referred to as "divergent thinking" today). Divergent production included 16 factors that Guilford grouped into four categories:

1. Fluency (which includes word fluency, ideational fluency, associationistic fluency, and expressional fluency) is the ability to produce a large number of ideas.
2. Flexibility is the ability to produce a wide variety of ideas.
3. Originality is the ability to produce unusual ideas.
4. Elaboration is the ability to develop or embellish ideas and to produce many details to "flesh out" an idea.

Guilford's theory was so successful that, for better or worse, creativity gradually came to *mean* divergent thinking in much research in, assessment of, and theorizing about creativity (Baer, 1993; Crockenberg, 1972; Heausler & Thompson, 1988; Kagan, 1988; Kogan, 1983; Mayer, 1983; McCrae, Arenberg, & Costa, 1987; Rose & Lin, 1984; Runco, 1986; Treffinger, 1986; Torrance, 1972, 1984, 1988. 1990; Torrance & Presbury, 1984; Wallach, 1970). Divergent thinking thus became one of the most influential theories of creativity — arguably the *most* influential — even though often not in the form Guilford envisioned (Baer, 1993, 2009, 2010). It remains fundamental to both creativity training (Baer, 1997a; Isaksen &Trefflinger, 1985; Micklus, 2006; Parnes, 1992; Talents Unlimited, 2010) and creativity assessment (Baer, 2009, in press-a, in press-b; Kim, 2009, in press; Torrance & Presbury, 1984).

Divergent thinking is not the only attempt at a grand theory of creativity. I have singled it out here because it is the best known theory of its kind, it has had such an extended shelf life, and it demonstrates the harm that a large-sale theory of creativity can do. My goal in this essay is not to challenge particular large-scale theories of creativity or to review in detail the evidence for domain specificity that limits the possibilities for such broad theories. I have made that case elsewhere (e.g., Baer, 1993, 1994a, 1996, 1998b, 2010) and will only summarize it very briefly here. This essay has two primary objectives:

- to argue that to the extent that creativity is domain specific (a) claims made by any large-scale theories of creativity necessarily promise far more than they can deliver regarding how creativity works and (b) such grand theories can be, at best, of primarily heuristic value, pointing us in directions that might help us recognize many smaller, domain-limited influences on creativity; and
- to explain why, lacking a compelling grand theory of creativity, practitioners who assume that such a theory exists take a very large and totally unnecessary risk.

In order to achieve these objectives, I will also explain how what are really small-scale, domain-specific theories of both creativity and methods of promoting creativity

can sometimes *appear* to be grand theories, or to be based on a grand theory, even though what is in reality doing the work in such cases are much smaller, domain-specific theories. I will show that these hard-working but disguised small-scale theories of creativity may sometimes come dressed in the trappings of grand theories, even though all that is "grand" about them is actually an illusion.

I'll start by making parallel arguments about teaching a different kind of thinking (critical thinking) and about learning skills necessary for skillful athletic performance in different sports. These will serve as a template for the kinds of creative-thinking skills commonly taught, which I will argue are very domain-specific, even though they may initially appear otherwise. This is not to suggest broad commonalities among creative thinking, sports, and critical thinking, only to show in domains somewhat remote from creativity how skills can *appear* to be related when in fact they have only the most superficial kind of connection. I will then show how a misguided assumption of domain generality has hurt many creativity training efforts and explain why the success of intelligence testing provides a poor (albeit seductive) model for creativity theory.

I will then turn to what this means for creativity theory and research more generally. In this final section I will argue that the evidence for domain specificity makes grand theorizing about creativity of limited value and show how some existing large-scale theories either fail or simply do far less work than they claim to do.

This paper is not an argument for domain specificity, an argument that I have made elsewhere (see, e.g., Baer, 1993, 1994a, 1996, 1998b, 2010). Domain specificity is more like an anti-theory than a theory, an argument with very real implications for other all theories of creativity. I accept domain specific of creativity here as a premise and explore its implications, recognizing that not all readers may accept that premise. If creativity theorists take the case for domain specificity seriously, however, they must recognize that it changes the ways we can think about creativity and asserts that our theoretical goals must be modest ones. This paper focuses on the constraints that domain specificity puts on creativity theory, and especially on the limitations for any grand, large-scale theories of creativity.

## TEACHING CRITICAL THINKING, TENNIS, AND GOLF

In teaching both critical and creative thinking, a lot of what teachers do is very similar — or at least looks very similar — across disciplines, even though what's happening inside students' heads is often totally different. For example, one might assume that analysis is analysis wherever one might encounter it and it doesn't matter the content being analyzed, but in fact much of what is called "analysis" really depends on domain-based knowledge. It isn't simply that the content is different; the analytical skills employed in different domains are themselves also quite different. The critical and analytical thinking skills that help one dissect a sonnet are of little use when dissecting a logical argument, or a polygon, or a frog. They aren't even that much use in analyzing a haiku, although there is probably some overlap in that case. Skills that might seem the same when viewed from the outside — from an observer's perspective — may be totally different when viewed from the inside, at the level of actual cognitive operations.

Skills that share a name often share very little when it comes to actually performing the acts that those skill names describe. A computer programming metaphor of calling

up subroutines — which can often be applied in multiple unrelated contexts — is misleading. There is no "analysis" or "dissection" subroutine in our minds, just a large array of essentially unrelated sets of operations that have come to be known by a shared name. They may look similar from the outside (and it may be in many ways useful for psychologists and other observers to call them by the same name) and yet be totally different on the inside (in terms of the actual cognitive operations and/or skills that are required to perform them) — just as the single word "dissecting" can seem to link many totally different and unrelated physical and cognitive operations (Willingham, 2007).

And this is just scratching the surface of the problem. Not only are critical thinking skills different and essentially unrelated cognitive skills when looked at across disciplines[2], but even within the same discipline there is limited transfer. Evaluating an argument for punctuated equilibrium is very different than evaluating arguments about likely eutrophic effects of nonpoint source pollution on a particular estuarine environment, and neither is much like evaluating arguments about modularity of brain functions, even though these issues might arise in courses — albeit probably different courses — in the same field. Unless one has a rather substantial body of knowledge related to each of the other two tasks, the fact that one knows enough to be able to do one of these tasks would be of little help in performing either of the other two "evaluating arguments" tasks (and a student who does have the requisite content knowledge to do one of these argument evaluation tasks is not much further aided in performing it by the fact that he may at some point have evaluated arguments of an entirely different kind involving radically different content). These three argument evaluation tasks call on discrete skills that are dependent on very different bodies of

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[2] An anonymous reviewer of an earlier draft of this paper argued that there are some domain-general critical thinking skills, but he then actually made the case for domain specificity in the example he chose to demonstrate this:

> I would claim there are *some* domain general critical thinking skills; if I know that evidence needs to be sound (based on the methods used to collect it) and that general principles of soundness apply (largeness of sample size, reliability and validity of measurement, etc.) then I can critically evaluate claims across all kinds of domains. So I don't completely agree with the author's assumption here. Of course the content of my evaluation (psychology, politics, neuroscience, physics, etc) may vary, but if I know these principles I can apply them to these different domains—not as an expert of course, but as a generally well-educated critical thinker.

The "general principles of soundness" offered here are in fact very domain specific, not domain general as claimed; "largeness of sample size, reliability and validity of measurement" may be principles of soundness of evidence in some fields (such as psychology), but not in many others (such as history or literature or law). These principles may be similar in similar domains, but even there we can easily be misled; in physics or neuroscience, two of the examples given by the reviewer, sample size is often not an issue at all and reliability and validity of measurement have such different meanings that what I know about reliability and validity of measurement as a psychologist is largely irrelevant. And that is exactly the point. The things that often seem to us to be domain-general critical thinking skills only seem that way because at a very high level of abstraction we may call them by the same name, even though the actual skills involved vary from domain to domain. Unlike some computer subroutines, thinking skills vary not only in the contents those thinking skills manipulate, but in the actual skills themselves. One cannot take one's skill at evaluating soundness of evidence in psychology (such as the "largeness of sample size, reliability and validity of measurement" heuristics) and apply them to content in other domains that have their own very different ways of establishing the soundness of evidence.

content knowledge[3]. This is not to say there would be no overlap — they may not be quite so disconnected from one another as they are from analyzing an argument favoring one teaching approach over another, or from analyzing an argument about the roles of kanji, hiragana, and katakana in the development of word processing technology in Japan — but they are hardly the same skill, or even closely similar skills, even though they come from the same discipline and might be studied by students in the same major. As Willingham (2007) argued:

> After more than 20 years of lamentation, exhortation, and little improvement, maybe it's time to ask a fundamental question: Can critical thinking actually be taught? Decades of cognitive research point to a disappointing answer: not really. People who have sought to teach critical thinking have assumed that it is a skill, like riding a bicycle, and that, like other skills, once you learn it, you can apply it in any situation. Research from cognitive science shows that thinking is not that sort of skill. The processes of thinking are intertwined with the content of thought (that is, domain knowledge). (p. 8)

Moving even farther afield from creativity, there's a similar parallel in coaching sports, where things like "keep your eye on the ball" and "accelerate through the swing" are instructions that both a golf coach and a tennis coach might give (and many other kinds of coaches as well). From the outside, "keeping your eye on the ball" might seem like the same thing in tennis and golf, but it's not (and practicing to do it well as a golfer won't do much for a golfer's tennis game, or vice versa). This "eye on the ball" skill might appear transferable, but it's actually totally different. In golf, the ball isn't coming at you at high speed. A golf ball just sits there and waits for you to do something. "Keeping your eye on the ball" in golf is mostly about keeping your head still, not about watching to see what the ball does. Conversely, watching to see what the ball does matters quite a lot in tennis, where the ball is coming at you at high speed and with considerable spin, and where you are running around yourself, so keeping your head from moving is not an issue (Syed, 2010)[4].

Does this matter? Only if one believes that "keeping your eye on the ball" and "evaluating arguments" are domain-general, easily transferable skills. I doubt that any tennis coach assumes that practicing keeping one's one on the ball while playing golf will help one's tennis game much. Coaches don't generally assume such skills are readily transferable, even if they share a name (Syed, 2010). But what about "evaluating arguments?" Imagine that a teacher knows that a student has learned (probably after much study) to evaluate an argument about modularity of brain functions. Should the teacher then assume that the student will have little trouble evaluating

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[3] A similar case has been made for reading, where it has been argued that once a student can decode words, reading depends more than anything on content knowledge (see, e.g., Hirsch & Pondiscio, 2010), but there is far less of a consensus on that claim than on the claim that critical thinking depends critically on domain knowledge.

[4] This is not to deny that there are some domain-general abilities that influence performance across domains. There may well be some general coordination abilities (similar to the *g* of intelligence) that influence performance across sports (just as *g* is related to performance in many intellectual domains). The important point here, however, is that many skills that seem or sound the same are often totally unrelated in terms of the actual cognitive or physical operations involved, and training in one may have no influence on the others.

arguments about the roles of kanji, hiragana, and katakana in the development of word processing technology in Japan? I doubt few professors would make that mistake. But might a fifth-grade teacher think that by practicing making predictions about what might happen next in a story students will now be better able to predict the outcome of a chemistry experiment? I believe a teacher might make that leap (see, e.g., Drapeau, 2008), and in believing this might neglect to teach and nurture the very different kinds of knowledge and skills a student needs to predict what will happen in a chemistry experiment.

This analysis of the domain specificity of many critical thinking and athletic skills leads us to the issues of creativity training and the teaching of creative-thinking skills.

## CREATIVITY TRAINING

A case that closely parallels those of teaching critical thinking and of teaching tennis and golf can be made for creativity. The most widely taught creative-thinking skill is divergent thinking (see, e.g., Baer, 1997a; Eberle & Stanish, 1980; Gordon, 1961; Isaksen &Trefflinger, 1985; Micklus, 2006; Newman, 2008; Parnes, 1992; Runco, 1999; Talents Unlimited , 2006; Torrance & Presbury, 1984), which can be (and generally is) conceptualized as a single, domain-general cognitive skill (Plucker, 1999; Runco, 1999; Yamada & Tam, 1996). The most widely used assessments of divergent thinking are the Torrance Tests of Creative Thinking, which were originally based on Guilford's four divergent-production categories — fluency, flexibility, originality, and elaboration. The tests and their scoring systems have been revised several times in their half-century history (Davis, 1997; Kim, 2006), but divergent thinking training still often follows Guilford's model and Torrance's original tests by teaching fluency, flexibility, originality, and elaboration[5] (Baer, 1997a).

Whatever one's theory of divergent thinking (or creativity), one cannot practice divergent thinking — or any kind of thinking one believes might be associated with creativity — without some kind of content. It is in choosing the content of creativity training exercises that it matters whether creative thinking is a domain-general or a domain-specific skill. If it is a domain-general skill, then it really doesn't matter what content one chooses because any increase in domain-general creative thinking skills acquired working in one domain will, because the skills being practiced are generic, automatically transfer to activities in all other domains.

In the same way that an increase in general intelligence is correlated with better performance in all activities that require general intelligence, an increase in domain-general divergent thinking skills should improve creativity across all task domains (Baer & Kaufman, 2005; Kaufman & Baer, 2005a). Here's how one creativity researcher summarized how the predictions of domain generality and domain specificity should differ:

> Domain generality would be supported by high intercorrelations among different creative behaviors and a common set of psychological descriptors for those behaviors, while domain specificity would be

[5] Torrance recommended that the subscales be interpreted in relation to one another to get a picture of an individual's skills. As Kim, Crammond, and Bandalos (2006) explained, "Torrance has discouraged the use of composite scores for the TTCT. He warned that using a single score like a composite score may be misleading because each subscale score has an independent meaning." (p. 461).

> supported by relatively low correlations among different behaviors, and a diverging set of psychological descriptors of those behaviors. (Ivcevic, 2007, p. 272)

On the other hand, if creative-thinking skills are domain-specific skills, then improvements in one's poetry-writing creative-thinking skills will have little if any impact on one's creative-thinking skills in other areas (e.g., creativity in cooking, teaching, physics, sculpture, dance, music, mathematical problem solving, engineering, etc.; and in fact, Baer, 1996, demonstrated exactly this in a series of classroom-based training studies). In this case a parallel might be drawn to expertise, which is highly domain specific. Increasing one's expertise in cooking would not be expected in increase one's tap dancing, algebra, map-making, or badminton skills. Expertise is not fungible the way (for example) money is. You can earn and save money for one purpose but later use that money instead for a totally different and unrelated purpose. Expertise, sadly, doesn't work that way. All the studying one may have done for a history exam will be of little use if applied during a calculus exam (and vice versa).

If one's goal is to nurture creative thinking in a single domain, exercises that relate to that domain are the most obvious choice (even though, under domain generality, it really wouldn't matter; one could, for example, use poetry-relevant divergent-thinking exercises to improve one's engineering creativity). If the goal is to improve creative-thinking skill more generally, however, one's choice of activities is very problematic. Using all one kind of exercise (such as the common "Think of as many uses as you can for X" brainstorming activity) would work just as well under domain generality as exercises that use content from a wide variety of domains, whereas if domain specificity is correct — and if there is therefore no possible grand unifying theory of creativity, or even of divergent thinking — then using many of the same kind of exercises (from a single domain) would increase only one limited kind of creativity. To improve creative thinking in many areas, one would need to do many different kinds of creative-thinking exercises using content from a wide range of domains.

Even if one chooses to use exercises and content from many domains, these activities might still look very much the same from the outside. Just as "keeping one's eye on the ball" or "accelerating through the swing" may be good coaching advice in different sports — and actually lead athletes to practice and develop many completely different and unrelated skills as they follow this advice in their respective sports — so might advice to think of "many, varied, and unusual ideas" (from the Talents Unlimited model; Newman, 2008, p. 36) be a useful creative-thinking prompt that would work in many domains. Thinking of many, varied, and unusual ideas about X could be a helpful heuristic even though the creative-thinking skills thus developed when the domain of X is changed might be as distinct, unrelated, and nonfungible as the skills developed by keeping one's eye on the ball in tennis and in golf.

Similarly, brainstorming exercises (or any activities aimed at improving divergent-thinking skills) using diverse content might look the same from the outside — they might follow exactly the same brainstorming rules, for example — and yet these activities might train very different (and unrelated) sets of divergent-thinking skills. To increase one's physical strength, no coach would suggest doing only pull-ups, or only push-ups, or only sit-ups. Doing nothing but weight-lifting curls probably won't do much for one's thigh muscles, because to increase overall strength one must do many *different kinds* of exercises that strengthen different muscles. Exercising one

muscle will strengthen that muscle, not all of one's muscles. If creativity is domain-specific, then the same will be true of creativity training: one must do many different kinds of exercises if one wishes to strengthen many different creative-thinking "muscles." Under domain generality, there is essentially a single creative-thinking muscle (or a single set of muscles) that one uses no matter what problem or task one faces. If this were true of actual muscles, it could certainly shorten our time in the gym. This is perhaps the great attraction of grand theories of creativity: they allow shortcuts. A single, domain-transcending theory would make both creativity training and creativity research much easier. If creativity is domain specific, however, then training creativity would be more like building muscles or developing expertise. Creativity-training exercises would need to come from a wide variety of domains — unless, of course, one only wanted to increase creativity in a limited domain (as one might want to do in a gifted program focusing on a single domain — e.g., poetry-writing, mathematical problem-solving, sculpting, or mechanical engineering — in which case the creativity-training exercises would appropriately come from the particular area of special interest),

As suggested above, the acquisition of expertise provides a useful parallel. Although we may use the term "expertise" without reference to a specific type of expertise, expertise is in fact very much domain specific. No one is an all-around expert. A person may have no expertise in any area, expertise in one or a few areas, or even expertise in several areas, but no one assumes that acquiring expertise in one field will give one expertise in all fields (or in *any* other field, for that matter)[6]. We don't assume that if a person studies and practices playing the guitar she will, as a result, gain expertise in economics, cooking, biology, or weather forecasting. We expect there may be gains in closely related areas; e.g., after years of study and practice on the guitar, it may be easier to learn to play the piano. But if we want to gain expertise in one (or several) domains, we don't assume it is irrelevant what topics we study. We know we must study topics in the domains where we wish to gain expertise.

## WHY THE SUCCESS OF INTELLIGENCE TESTING SEDUCES CREATIVITY THEORISTS

Intelligence testing has been remarkably successful in predicting performance across many domains. It is certainly not the only thing that matters in such areas as school performance across subject areas and job performance across a wide range of occupa-

[6] According to domain specificity theory, this is also true of creativity. A person may have no creativity in any area, creativity in one or a few areas, or even creativity in several areas (and of course one may have varying degrees of creativity in different domains). The unfortunately common misconception that the existence of polymaths is evidence against domain specificity theory is therefore a complete red herring; in fact, domain specificity theory *predicts* the existence of polymaths. Domain specificity theory does not argue that a person may be creative in only one area. Domain specificity theory simply says that the skills that underlie creativity vary by domain and the presence or absence of creativity-relevant skills in one domain does not predict one way or the other the existence of creativity-relevant skills in other domains. The theory thus predicts exactly what most of us observe: a few people will exhibit little if any creativity in any domain; many people will have developed modest amounts of creativity in several domains; some will have a developed a great deal of creativity in one or more domains; and a few will exhibit very high creativity in two or more domains (Kaufman, Baghetto, & Baer, in press; Kaufman, Beghetto, Baer, & Ivcevic, 2010).

tions, but it is significantly correlated with such a wide range of achievements that it is hard to argue that there isn't a least some of what psychologists label *g* at work. IQ testing has many flaws and many critics, but for a century it has successfully predicted such a wide variety of outcomes that it is hard to argue that there is not some degree — and a fairly significant amount, it would appear — of domain generality to intelligence (Neisser, Boodoo, Bouchard, , Boykin, , Brody, Ceci, , Halpern, Loehlin, Perloff, Sternberg, & Urbina, 1996). It doesn't qualify as a grand unifying theory that subsumes and explains *all* cognitive abilities, but it is certainly a large-scale, domain-general theory that encompasses many diverse kinds of performance[7].

It would, perhaps, make creativity research easier if there were a CQ with the power of IQ to make predictions across many domains. Looking at problem-solving from an evolutionary perspective, Confer, Easton, Fleischman, Goetz, Lewis, Perilloux, and Buss (2010) ask, "Wouldn't one domain-general rationality mechanism be more parsimonious than postulating many domain-specific mechanisms?" (p. 114). Confer et al remind us, however, that this is not how evolution works, and its gradual and opportunistic adaptive processes more often create separate modules for different tasks in different domains. Even "evolved memory systems," seemingly a good candidate for a unified, domain-general system, are in many ways "domain-specific, sensitive to certain kinds of content or information" (p. 112).

The evidence for a creativity measure with the power and domain generality of IQ is, at best, very limited. Even Torrance himself found that the two different forms of his own tests — the verbal and figural forms of the TTCT — were essentially orthogonal, with almost no shared variance at all (Crammond, Matthews-Morgan, Bandalos, & Zuo, 2005). And in his recent re-analysis of Torrance's longitudinal data, Plucker (1999) found verbal divergent thinking was a powerful predictor of the (verbal) self-report data he was looking at, but figural divergent thinking was not. These two forms of the TTCT — the most widely used creativity test — make different predictions and are essentially uncorrelated with one another. It is hard to escape the conclusion that either the tests are invalid or the construct (of domain-general creativity) is invalid — and of course if the construct is invalid, then trying to assess a nonexistent construct by any means makes no sense. (See Baer, 2009, in press-a, and Kim, 2009, in press, for a recent debate sponsored by the American Psychological Association's Division 10 on the success of the most commonly proposed measures of domain-general creativity.) I will discuss the evidence for domain generality and specificity of creativity very briefly in the next section — this paper's goal is not to rehash those arguments in any detail — but suffice it here to say that even the most ardent supporters of domain generality acknowledge that it is at least an open question (see, e.g., Plucker, 1998).

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[7] This includes creativity, and to the extent that there is a domain-general factor influencing creativity across most fields of endeavor, it is probably intelligence. But domain-general theories of creativity aren't about *g*. They claim there is something (call it *c*) that is not *g* that contributes to creativity in significant and at least moderately powerful ways across all (or at least virtually all) domains. I have (along with my colleague James C. Kaufman) argued for domain-general as well as domain-specific factors in our APT Model (Baer & Kaufman, 2005; Kaufman & Baer, 2005), in which we identified intelligence as the primary domain-general skill that influences creativity across most domains. I have no quarrel with theorists who might posit *g* as a domain-general, creativity-relevant skill, but that is not the case that domain generality theorists are making (Plucker, 1998).

Like the strong attraction of grand unifying theories in physics, the success of intelligence testing tends to pull creativity assessment in the direction of domain generality. It would certainly be useful if there were a CQ test with the extremely broad predictive power of IQ testing, and I suspect that the success of IQ testing at least subconsciously suggests that something similar — some kind of domain-general creative-thinking skills — must underlie creativity the way it does intelligence. This is why I offered the contrasting metaphors of muscle-building and the acquisition of expertise in the previous sections. It is not clear whether the domain generality of intelligence or the domain specificity of muscle-building and expertise will prove to be the better analogy, but in the absence of more convincing evidence, we should at least accept that the question of the domain specificity/generality of creativity is an open one. If it is, then it is easy to show — as I will do below — that there is a dissymmetry in the impacts of assuming one conclusion or the other. Assuming domain generality is simply far riskier, even if at this point the likelihood of either conclusion being true were equal.

## WHAT WE KNOW ABOUT THE DOMAIN GENERALITY OF CREATIVITY

The evidence for the domain specificity of creativity is based primarily on the actual creative performance of individuals, not on divergent thinking test scores that may or may not be correlated with actual creativity (Baer, 2009, in press-a; Kim, 2009, in press) or unreliable self-report data about what people say regarding their own creative accomplishments (Baer, 1993, 2010). The two competing theories — domain generality and domain specificity — make very different predictions regarding actual creative performance, and this has allowed researchers to test those theories. Recall how these predictions should differ: "Domain generality would be supported by high intercorrelations among different creative behaviors. . . while domain specificity would be supported by relatively low correlations among different behaviors" (Ivcevic, 2007, p. 272).

The primary empirical evidence for domain specificity of creativity comes from studies showing that the actual creativity of artifacts created by subjects, regardless of age, shows little correlation across domains. Subjects who write more creative stories on one occasion are more likely to write more creative stories on a later occasion, but they are no more likely than chance to make creative collages or creative math puzzles (Baer, 1993, 1994a, 1994b, 1998b; Han, 2003, Runco, 1989). It is of course possible that as researchers explore more domains, some higher-level factors will emerge. Given the number of domains that have been explored thus far, however, it seems unlikely that any truly domain-general factors will emerge (which would require all of the domains thus far studied to be outliers).

Some researchers have argued for domain generality and presented evidence of modest correlations in creative performance across domains, but even in this data, it is the within-domain correlations that are significant, whereas the cross-domain correlations tend to be miniscule. For example, Conti, Coon, and Amabile (1996) argued for both domain-general and domain-specific factors. Their data did indeed show modest intra-domain correlations among tasks in the same larger domain (they had two kinds of products, writing-related and art-related, which evidenced modest-to-strong correlations within each of the two domains). The case for domain generality

must rest on *inter*-domain correlations, however, and here they found exactly what domain-specificity theory would predict. Of 13 such inter-domains correlations, eight were positive, four were negative, and one was zero — and *none* of these correlations was statistically significant. They presented their data as evidence of both domain specificity *and* domain generality, but in fact it supported only specificity (see Baer, 2010, for details).

Some have argued that the existence of polymaths is evidence for domain generality (Root-Bernstein & Root-Bernstein, 2004), but domain specificity *predicts* occasional polymaths, so pointing out their existence isn't really an argument against domain specificity (Kaufman, Beghetto, & Baer, 2010; Kaufman, Beghetto, Baer, & Ivcevic, 2010). Domain generality also predicts polymaths; in fact, it predicts many *more* polymaths than we actually observe. If creativity were domain general, then we should have large numbers of polymaths because if one has a lot of domain-general creative ability, it should lead to high levels of creativity across the board (just as people with a lot of *g* tend to get high marks in lots of areas). Domain generality is shielded from needing to defend this failed prediction by the ten-year rule (Hayes, 1989), however, because no one has time to put ten or more years of intense work into several domains[8]. So the existence of polymaths really prove nothing either way.

The evidence for domain generality tends to come from psychometric studies. Plucker (1998), in a published debate arguing that creativity is domain general, acknowledged that "researchers approaching creativity (especially divergent thinking) from a psychometric perspective over the past 50 years have worked under the *assumption* that creativity is content general" (p. 179; italics added for emphasis). Scores on tests designed under the assumption of domain generality of creativity have indeed tended to produce single-factor solutions far more than studies that have examined actual creative products (Baer, 1993; Kaufman, Plucker, & Baer, 2008). As Plucker (1998) explained:

> A possible explanation for the apparent dichotomy in research findings is that a method effect is present in the empirical creativity literature: Performance assessments produce evidence of task specificity, and creativity checklists and other traditional assessments suggest that creativity is content general. (p. 180).

Based on this argument, whether one accepts domain generality or domain specificity would be determined by whether one put more trust in self-report checklists and tests that assume domain generality or in performance measures that assess what subjects can actually do and that make no assumption about domain generality or specificity. Brown (1989) summed up the basic problem of self-report data in creativity research when he argued that "self-report data and retrospective case histories are generally unverifiable" (p. 29). This lack of evidence of validity alone makes one hesitant to

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[8] In his analysis of the kinds of "mechanisms that mediate superior performance," Ericsson (2003) found that the underlying abilities that led to performance at the highest levels were "surprisingly complex mechanisms highly specific to the task domain" (p. 109). This is consistent with the ten-year rule's argument that years of intense domain-specific study and practice is needed before anyone can make a Big-C-level creative contribution to a domain. (Perhaps not coincidentally, the training time for high-level sports performance is similar; Syed, 2010.) It is somewhat ironic that it is the need for years of *domain-specific* preparatory work that shields domain generality from the need to explain why there are not considerably more polymaths, as domain generality would otherwise necessarily predict.

rely very heavily on such data, and there is recent research evidence that suggests self-reported creativity does not match experts' judgments of creativity. Dollinger, Burke, and Gump (2007) found that although the Creative Behavior Inventory showed strong reliability, it correlated only .16 (non-significant) with three rated creative products (a drawing,a story, and a photo essay) produced by college students. Kaufman, Evans, and Baer (2010) compared self assessments of actual products fourth-grade students had themselves created with experts' ratings of the creativity of those products and found that self-assessed creativity and expert-rated creative performance correlated -.07 in science, -.22 in writing, -.08 in art, and .07 in math. (See Kaufman, Plucker, and Baer, 2008, for a more in-depth discussion of validity issues surrounding self-reported creativity. The limitations of self-report data extend well beyond creativity research, of course; see, e.g., Rowe, 1997.)

There are also theories that include both domain generality and domain specificity (Amabile, 1983; Conti, Coon, & Amabile, 1996) and theories that argue for a hierarchy of creativity-relevant skills (Baer & Kaufman, 2005; Kaufman & Baer, 2005a; Kaufman, Cole, & Baer, 2009) that range from domain-general knowledge and skills (e.g., general intelligence), broadly domain-specific skills (e.g., artistic/verbal skills and artistic/visual skills), more narrowly defined domain-specific skills (e.g., poetry-writing or play-writing, both of which are in the same general areas of artistic/verbal skills), and finally very narrow, micro-domain-specific skills (e.g., writing haiku and writing sonnets, both in the larger poetry-writing domain). Theories of creativity run the gamut, and the only thing it is safe to conclude about creativity theory at this point is that the issue of domain specificity/generality remains an open question.

## THE ILLUSION OF DOMAIN GENERALITY

There are many theories that *seem* to be domain general (and often claim to be domain general) but actually draw all their power from domain-specific evidence. For example, Amabile's (1996) theory that intrinsic motivation promotes creativity appears to work in many domains. It therefore appears to be a domain-general factor that influences creative performance across domains, and in one sense it is. But most of the domain-general impact of intrinsic motivation on creativity is illusory. The observed effects are really the result of many discrete and unrelated motivational factors.

For the sake of argument and without trying to evaluate all the evidence for the theory, let's simply posit that in all domains, subjects who are intrinsically motivated to perform the task in question will, on average, produce more creative products [9]. That's domain generality, right? Yes — and also (very importantly) no. Just as people don't have generic expertise, they also don't have generic intrinsic motivation. If they did, anyone who had intrinsic motivation to do anything would be intrinsically motivated to do just about anything (so they could simply apply their enthusiasm for

[9] There is some dispute about these findings and how universal they may be; see, e.g., Baer, 1997b, 1998a; Eisenberger & Cameron, 1996; Eisenberger & Shanock, 2003; and Eisenberger& Rhoades, 2001. For the purposes of this paper, I will assume that intrinsic motivation regularly increases creativity and that extrinsic motivation regularly decreases it. The question of interest here is not the effects of intrinsic motivation, but rather whether intrinsic motivation, whatever its effects, is a domain-general motivational factor or if intrinsic motivation varies from domain to domain and task to task.

playing bridge, say, to doing the dishes). Intrinsic motivation is like expertise — it is extremely domain specific. One may find many activities inherently interesting or meaningful or simply enjoyable, but that motivation is specific to those particular activities. One may need to be intrinsically motivated to be creative, but motivation to write sonnets is not the same as motivation to compose symphonies or motivation to bake soufflés. Each is its own thing, discrete and generally unable to influence motivation on other tasks. A student's love of reading won't motivate that student to do some other activity that simply doesn't interest her. (We can sometimes use someone's intrinsic motivation to do one thing as an extrinsic reward for doing another, as in Premack's Principle, of course. But that is not a domain-general intrinsic motivation. It is using intrinsic motivation in one domain as an *extrinsic* motivator in another. A teacher might, for example, reward students who love to read with more time to read if they complete some less favored activity. And some extrinsic rewards [unlike their intrinsic counterparts] are quite fungible — one can use money to bribe people to do any number of things.)

Intrinsic motivation is domain-general in exactly the same way that expertise is domain-general: Domain-specific expertise and domain-specific intrinsic motivation probably contribute to creative performance in almost any domain, but the expertise and motivation that influence creative performance in one domain is unlike the expertise and motivation that will influence creative performance in another domain. Neither expertise nor intrinsic motivation transfer across domains.

This means that in a very limited and abstract sense it may be true that expertise and intrinsic motivation are correlated with creativity, but not in the sense that having expertise or intrinsic motivation in one domain predicts creativity across domains (which is the claim of domain generality). One could, perhaps, construct a test of knowledge that crossed many domains — or an assessment of levels of intrinsic motivation in many domains — and report some Expertise Index or Intrinsic Motivation Index that somehow summed those results across domains[10]. An Expertise Index might be correlated with creativity in many domains, but this would depend entirely on the domains one selected for creativity testing and for the initial expertise assessments. Ditto for a supposedly domain-general Intrinsic Motivation Index. The notion of a generic level of expertise, or of intrinsic motivation, makes no psychological sense. To show that expertise (or intrinsic motivation) in a particular domain predicts creativity in that domain, and then to do this across many diverse domains, provides no evidence for domain generality of creativity. I've argued that the same is probably true of divergent thinking (Baer, 1993, 1998b, 2009, 2010), and it may be true of other traits that have been suggested as possible domain-general factors. For example, openness to experience and risk-taking may be related to creativity in some or even many domains, but does the fact that someone is open to experiences or

[10] There is such a scale in the area of motivation, Amabile, Hill, Hennessey, and Tighe's (1994) "Work Preference Inventory." The items on the scale, such as "I enjoy tackling problems that are completely new to me," "It is important for me to have an outlet for self expression," and "The more difficult the problem, the more I enjoy trying to solve it" are not tied to particular domains. It is implausible that most people would respond in the same way to most of these items if they were attached to activities in several very different domains, however. Would most people express the same level of enjoyment in "trying to solve complex problems" (another scale item) no matter whether the domain were gardening, auto repair, economics, writing poetry, or calculus? I find that hard to believe, but I know of no research that has attempted to measure such domain-based differences in levels of intrinsic motivation.

willing to take risks when it comes to word play suggest that person would be equally open to experiences or willing to take risks when it comes to sword play? (Because domain-general intelligence is probably a factor in acquiring expertise in many domains, to the extent that IQ influences creativity in a domain, one would expect modest correlations in creativity across domains related to intelligence. Some research has disentangled IQ scores from creative performance and found what little domain generality existed disappeared when variance attributable to IQ was removed; see, e.g., Baer, 1993.)

I'll argue below that there is room for theories such as these and that they can provide a useful and productive kind of heuristic or meta-theory, even though these theories are not the kind of theories they are generally believed to be and do not tell us nearly so much about creativity as is commonly thought. For now the important point is simply that they do not provide evidence for domain-general theories and they are not examples of domain-general cognitive mechanisms or personality traits — and not the kinds of things we might be able to train, nurture, or assess except in very domain-specific ways.

## HOW GRAND THEORIES OF CREATIVITY DISTORT, DISTRACT, AND DISAPPOINT

In the *Creativity Training* section above, one important problem with domain-general theories of creativity (and thus of all potentially grand or large-scale theories of creativity) was introduced, the problem of selecting content for creativity-training exercises. Under the assumption of domain generality, many training programs assume the content of the exercises doesn't really matter. After all, if creative-thinking skills are domain-general, then there is only one creative-thinking "muscle" (or a single set of such skills, applicable across domains), so any exercise that engages those skills will increase creative-thinking skills across the board. A trainer might as well use the most interesting or fun content. (If all food had the same nutritional value, there'd be little reason not to eat only desserts. If only!)

To the extent that creativity is domain specific, however, the content of training exercises matters very much. If all the exercises draw content from a single domain, creative-thinking skills in that domain will be improved, but this will have no effect on creative-thinking skills important in other domains (just as one can do endless pull-ups and have little effect on one's quadriceps). If the goal is to promote creativity in a single domain, then one would choose content from that domain for training exercises, but if the goal is to promote creativity in a wide range of domains, then content should come from very diverse fields and interest areas. Unlike the choices one might make under a domain-general approach, where (if the theory is wrong) the result could be much wasted effort, there is no risk to assuming domain specificity in selecting training exercises. Even if domain generality were 100% correct, the choices made under the assumption of domain specificity would be just as good as those made under domain generality. So assuming domain generality has a large potential downside, but assuming domain specificity has no real downside at all, regardless which theory is correct.

In fact, studies have shown that divergent-thinking training that focuses on a single domain does improve creative performance in that domain, but not in other, even somewhat related domains. Baer (1996) conducted a divergent-thinking training ex-

periment using only poetry-relevant content. Subjects were trained over several sessions using only poetry-relevant divergent-thinking exercises. They later wrote both poems and stories, both of which were rated for creativity by panels of experts who did not know who had had training and who had not been trained. The subjects with the poetry-relevant divergent-thinking training wrote more creative poems than the control group, but their short stories were no more creative than those of untrained subjects. This problem of transfer is not unique to creativity training, of course. General cognitive skills training research also suggests that transfer of skills, even closely related ones, is more rare than is commonly thought. A recent study reported in *Nature* (Owen, Hampshire Grahn, Stenton, Dajani, Burns, Howard, & Ballard, 2010) trained 11,430 subjects several times each week on cognitive tasks designed to improve reasoning, memory, planning, visuospatial skills, and attention. Improvements were observed in every one of the cognitive tasks that was trained, but no evidence at all was found for transfer effects to untrained tasks, even when those tasks were believed to be cognitively closely related.

Grand theories have a similar problem in the area of creativity assessment. As noted above, performance assessments of creativity tend to show very strong domain-specific effects, and subjects' actual creative performances on tasks in one domain tell us very little about their creative performance on tasks in other domains (Baer, 1993, 1994a). Performance assessments of creativity such as these, in which subjects create actual products that are later judged for creativity by experts in the relevant fields, have been called the "gold standard" of creativity assessment (Carson, 2006). But if creativity varies so much on these assessments depending on the content domain, they can provide little guidance except when measuring creativity in the particular domain used for the assessment.

As Plucker (1998) noted, more traditional assessments of creativity, such as divergent-thinking tests, both assume domain generality and provide (along with self-report creativity checklists) most of the empirical support for domain generality. If one assumes a domain-general theory of creativity, then the assessments one will choose should naturally be ones that provide domain-general scores. This rules out performance assessments. Self-report checklists show domain-generality but are subject to all the potential biases of any transparent self-report measure, making their validity somewhat suspect at the outset. That leaves traditional assessments of creativity, most of which are divergent-thinking tests.

The Torrance Tests are the most widely used and validated divergent thinking tests (Kim, 2006, 2009, in press), so they are the natural choice. There are two forms, figural and verbal. Which one to use? Domain generality suggests that it doesn't matter, so users may choose whichever is more convenient. But wait — it turns out that the Torrance Tests themselves are also rather domain specific. As noted above, Torrance himself found them to be virtually orthogonal measures that had almost no shared variance[11] (Crammond, Matthews-Morgan, Bandalos, & Zuo, 2005). Plucker

[11] The actual correlation Torrance reported between the two forms of his test was .06. He recognized that these two forms of a test that both bear the name "Torrance Test of Creative Thinking" were in fact measuring two different, unrelated cognitive skills, according to Crammond, Matthews-Morgan, Bandalos, and Zuo (2005). "Reponses to the verbal and figural forms of the TTCT are not only expressed in two different modalities . . . but they are also measures of different cognitive abilities. In fact, Torrance (1990) found very little correlation ($r$ = .06) between performance on the verbal and figural tests." (pp. 283-284)

also found that the two forms of the tests made quite different predictions; in his re-analysis of Torrance's longitudinal data, one of the two Torrance tests that subjects had taken positively predicted later self-reported creative performance — but the other did not (Plucker, 1999).

So even though divergent-thinking tests like the Torrance Tests are based on domain-general assumptions and have been used as evidence for domain generality, the content of those tests seems to matter quite a bit. Depending on which of the two Torrance Tests a researcher happened to choose — and bear in mind that domain generality assumes it doesn't matter which one chooses because there is really only a single set of skills to assess that are applicable across all domains — that researcher might get very different results, as Plucker (1999) showed in his re-validation study of the Torrance Tests:

> The results regarding figural and verbal DT are much more difficult to interpret. Although verbal DT was a better predictor of creative achievement than intelligence, figural DT was not a factor in the model. (p. 109)

So if only the figural divergent-thinking test had been used, it would have predicted little about creative achievement, whereas the verbal test was highly predictive. This may be because the achievements in question may be more verbal than figural in nature. Plucker (1999) does in fact make this case:

> [T]he importance of verbal DT relative to figural DT may be due to a linguistic bias in the adult creative achievement checklists. For example, if a majority of the creative achievements required a high degree of linguistic talent, as opposed to spatial talent or problem solving talents, the verbal DT tests would be expected to have a significantly higher correlation to these types of achievement that other forms of DT. (p. 110)

This seems to argue that both creativity and creativity tests are indeed quite domain specific. More importantly, it suggests that assuming domain generality in selecting an assessment might completely change the results of a study — which makes it rather hard to trust results based on a divergent-thinking test. (Want different results? Just use a different — supposedly domain-general — divergent-thinking test.)

Another area in which a large-scale, domain-general approach to creativity has misled researchers is in the potential relationship between creativity and mental illness. Recorded observations that the incidence of mental illness was higher among creative people goes back almost a century (Ellis, 1926). Research has shown that creative people tend to be both less sane and more sane than their less accomplished counterparts, which has led to very hard-to-resolve disputes and data interpretation (Simonton, 2010). The problem, however, seems to be the domain-general nature of the questions that have been asked. In some fields, such as the arts, there is a positive correlation between creativity and mental illness. In contrast, creators in other domains, such as the sciences, may show no mental illness-creativity connection. Even within larger domains (like the arts) where the evidence generally points in the same direction, there may be very distinct micro-domain differences (Kaufman, 2001a, 2001b; Kaufman & Baer, 2002). As Simonton (2010) wrote, "the rate and intensity of adulthood symptoms vary according to the particular domains in which

creative genius is expressed. . . . geniuses in the natural sciences tend to be more mentally healthy than in the social sciences; geniuses in the social sciences, more so than those in the humanities; and geniuses in the humanities, more so than those in the arts" (pp. 226-228). Because researchers were looking for large-scale, domain-general answers, a great deal of excessive disputative heat was generated over three quarters of a century of theorizing. Once researchers began asking more domain-specific questions, the answers came readily to light.

These examples support a more general statement regarding ways in which grand theories of creativity distort, distract, and disappoint: Grand theories of creativity often founder because of a false assumption of domain generality. There is so much we want to know about creativity, and large-scale theories can be seductive because they seem to provide short-cuts; a theory that would work everywhere would be much more powerful (and much more cited!) than a theory that works only in a single domain. There has not been a dearth of large-scale theories of creativity, but none has really captured the field with the possible exception of divergent-thinking theory. As will be explained in the next section, the best of these theories are really most useful if thought of as meta-theories or heuristics that can be useful in generating a variety of smaller, domain-limited theories. Researching creativity domain by domain is certainly hard work, but it offers the possibility of theories that can tell us a great deal, even if only about creativity in a single domain — as opposed to grand theories that tell us very little about creativity in many domains. And small, well-researched and validated domain-specific theories may generate hypotheses and evidence for somewhat larger theories, or even domain-general meta-theories, as described in the next section.

## WHAT KINDS OF GENERAL THEORIES OF CREATIVITY MIGHT STILL BE POSSIBLE?

There are two kinds of general theories, that, despite the arguments I've made above, can nonetheless be valuable for creativity theory, research, and training:

1. Meta-theories that describe processes that although cognitively unrelated may nonetheless (a) point to analytic similarities and (b) serve as heuristics that suggest possible domain-specific theories and approaches to creativity, creativity assessment, and creativity training
2. Detail-rich composite theories that provide scaffolding to help organize a variety of domain-specific creativity theories, even though it is actually domain-specific evidence and details that are doing most of the work in these models (e.g., hierarchical models)

As five examples of meta-theories, consider divergent thinking, expertise, intrinsic motivation, Kaufman and Beghetto's (2009) Four-C model, and Simonton's (1999, 2009a) Blind Variation and Selective Retention (BVSR) model, the first three of which have already been introduced above.

*Divergent thinking:* Training in divergent thinking in one domain increases creative performance in that domain, but not other domains (Baer, 1993, 1996). The underlying skills being trained are apparently different, and what this means for creativity training has already been discussed above. Divergent thinking fails as a grand, domain-general theory of creativity because research has shown the skills collectively

termed "divergent thinking" are actually a motley collection of skills. These skills may have a superficial resemblance from the outside (as opposed to inside the thinker's mind, where they are discrete) or when looked at from a sufficiently abstract perspective (e.g., when viewed simply as thinking skills that produce many variant ideas in response to a prompt). But divergent thinking theory misleads us by suggesting that these skills are generalizable or that they transfer across domains.

Divergent thinking can nonetheless be a useful meta-theory that proposes that there may be thinking skills in many domains (possibly all, but this is an open question) that can be trained and elicited in certain ways. For example, brainstorming instructions, which are designed to produce large quantities of diverse ideas, might often produce ideas with potential value to creators when applied in different domains [12]. The key is to bear in mind that the kind of thinking brainstorming is designed to produce — thinking that goes by the generic name divergent thinking — is not actually a generic or domain-general thinking skill or process. Forgetting that will lead to false ideas about creativity and lead to nonproductive creativity-training activities.

*Expertise:* Expertise matters in creative performance, although the degree of necessary knowledge and training may vary greatly from domain to domain. More importantly, the skills and knowledge that count as expertise in different domains vary by domain. Expertise and knowledge are not fungible across domains; although one can sometimes use knowledge from another field to spark ideas, most knowledge and skills important in a domain are specific to that domain. But the idea that expertise matters in creative thinking and creative performance — even if none of that expertise is in any way transferable or commensurable or fungible across domains — is still useful to creativity theorists, researchers, and trainers. And unlike the case of divergent thinking, there is little likelihood that confusion will arise regarding the domain specificity of most expertise. No one assumes that because someone know a great deal about poetry that person is likely to know a great deal about auto mechanics, medieval history, or fly fishing or that her knowledge of poetry will transfer readily to work in those other fields.

*Intrinsic motivation:* As explained above, the idea that intrinsic motivation leads to more creative performance may be true in many domains. It may even be true in all domains (but see the discussion above for caveats). As such, the idea that increasing intrinsic motivation to do a given task, or the idea that reducing extrinsic constraints related to that task, might positively impact creativity can be a useful one even if intrinsic motivation, like expertise, is very severely domain specific. But this helpful idea needs to be separated from the potentially confusing ideas that (a) intrinsic motivation is intrinsic motivation, something some people have more of than others that makes them generally more creative than others or (b) influencing intrinsic motivation on one task is likely to impact creativity on other, unrelated tasks.

*The Four-C Model of creativity (Beghetto & Kaufman, 2007; Kaufman and Beghetto,*

[12] The evidence for brainstorming's power to do this has recently been called into question (see, e.g., Diehl & Stroebe, 1991; Mullen, Johnson, & Salas, 1991; Nijstad, Stroebe, & Lodewijkx, 2003; Rickards, 1999). It is possible, of course, that different findings regarding brainstorming may reflect domain-based differences, as has been shown in the case of mental illness-creativity research. It is not the goal of this paper to evaluate the evidence for and against the effectiveness of brainstorming, however, and it is used only as an example of a way that a meta-theory might generate a useful heuristic.

*2009):* The Four-C Model argues that there are more than the traditional two levels of creativity (Big-C and little-c). By adding Pro-C and mini-c, this model allows finer grained distinctions among levels of creativity. This in turn allows researchers to look for different factors that might impact creative performance in a domain at several different levels. The answers to the questions the Four-C Model might generate are likely to vary by domain, however. For example, the ten-year rule applies only to Big-C creativity, but what kind of domain-specific study and practice might be needed for Pro-C or little-c creativity? It seems likely that the answers will vary by domain (even in the case of Big-C creativity). The kinds and extent of domain-specific knowledge and skill needed to make creative contributions in advertising or jingle-writing at different levels might, for example, require less intensive study and practice than, say, creative performance in history, biology, or fiction. But these are empirical questions that, although generated with the help of the Four-C meta-theory, would still need to be answered on a domain-by-domain basis.

*Blind Variation and Selective Retention (BVSR)*: Simonton (1999, 2009a, in press) has argued that creativity is based on a process that involves an essentially random generation of ideas followed by evaluation of those ideas. Simonton has distanced this model from comparisons with Darwinian evolution by noting that "it does not matter that creativity and discovery are not based on strictly 'random' variations or that creators are volitional creatures purposely engaged in creativity and discovery" (in press).

BVSR is clearly intended as a large-scale, domain-general model of creativity, but to the degree it actually describes creative thinking it likely involves very significant domain-specific constraints. Simonton (in press) has recently argued that the BVSR model does not require complete blindness in the production of ideas, which has been a principal criticism of the theory. Simonton has offered a formal explanation of a blind-sighted continuum along which ideation variants might lie. Significantly, the degree of blindness or sightedness of the idea generation process might vary considerably from domain to domain. BVSR might thus be thought of as a meta-theory that suggests an interesting continuum on which creativity in different domains might vary. BVSR is a model that might spawn many more specific models of creative thinking in different domains.

Meta-theories such as these can be very useful heuristics for creativity researchers, but it is important to emphasize the limited nature of meta-theories. When large-scale, domain-general meta-theories of creativity are confused with theories of how creative thinking actually works, these theories promise far more than they can deliver. Domain specificity, to the extent that it is true of creativity, limits the scope of *any* grand theory of creativity. It is not within the purview of this paper to argue the case for domain specificity, which I believe has been convincingly made elsewhere (e.g., Baer, 1993, 1994a, 1996, 1998b, 2010). My more modest goal has been to show how domain specificity, to the extent that it is true, limits the possibilities for grand theories of creativity of any kind.

Expertise is an especially clear model for how we might most profitably think about large-scale theories of creativity. Everyone agrees that expertise matters to some degree; there is much dispute about whether more is always better when it comes to expertise in a given domain; and no one doubts that expertise varies by domain. There is thus little doubt that expertise is an issue with which creativity theorists must contend but little danger that theorists will confuse the need for some

kind of expertise with a domain-general assumption that expertise does not vary by domain or that it is readily transferable across domains, or even that expertise is equally important in all domains — it might be easier in some domains for outsiders or nonexperts to make significant creative contributions. Here are three ways that the general idea that expertise might be a significant contributor to creative performance in many domains (which is what a meta-theory of expertise tells us) could be useful:

1. Creativity theorists might agree that expertise is important for creative thinking and creative performance in many domains, and they might use this as a scaffold to help elucidate the kinds of expertise that matter in different domains. They might also dispute the relative importance of expertise to creativity in different domains (see, e.g., Simonton, 1983, 2006; Weisberg, 1999, 2006).
2. Creativity researchers might explore the kinds and degrees of expertise that promote creativity in different domains and at different levels in different domains (see, e.g., the Four-C Model of Creativity; Beghetto & Kaufman, 2007; Kaufman and Beghetto, 2009).
3. Creativity trainers might promote the acquisition of relevant expertise in the area(s) of creativity they hope to develop in their students (see, e.g., Baer, 1999, 2002, 2003).

In doing these things, no one would need to suggest that expertise is essentially the same across domains, that one should expect much in the way of transfer of expertise across domains, or that acquiring expertise in one area will influence creativity in unrelated domains. The same is true of any meta-theory of this kind, including meta-theories that argue that domain-specific divergent thinking, intrinsic motivation, willingness to take risks, openness to experience, etc., enhance creativity in many domains.

Despite the limitations of meta-theories such as these, they can be very helpful both conceptually and practically. They allow us to see (and encourage us to look for) commonalities across domains, which can spur researchers and theorists studying creativity in a given domain to seek potentially viable parallels based on work in other domains. They can also suggest possible techniques that might enhance creative thinking and creative performance, based on work that has been shown to enhance creativity in other domains.

Most of the important work in conceptualizing and training creativity that needs to be done remains a domain-by-domain effort, however. So, for example, the content of expertise needed for creative performance will of course vary across domains, but so might the need for expertise itself (or at least the need for high levels of expertise). Observing the need for expertise in many areas does not guarantee a similar need in all areas, even if one is positing only the need for domain-specific expertise. It may be possible to be highly creative in some fields with only a passing familiarity of previous work, whereas expertise of the highest caliber might be required to contribute significantly in other fields (which might explain, at least in part, the varying ages at which peak creativity is typically reached in different fields; Simonton, 1988). The same we-can't-know-if-it-matters-in-a-domain-until-we-research-it-in-that-domain guideline will be true for other meta-theories of creativity (like divergent thinking, which might be crucial in some domains but of little significance in others; we simply can't know without further research).

Domain-by-domain research is time consuming and sometimes messy. There are potentially a huge number of domains, and domain boundaries are unclear. As Simonton (2009b) wrote:

> If anything, these investigations have produced too many results. Not only can we distinguish between scientific and artistic creativity, but we can also discern dispositional and developmental contrasts among diverse forms of either science or art. A creative physicist is not the same as a creative psychologist, nor is a novelist the same as a poet (e.g., Ludwig, 1998). Even two physicists may psychologically differ in ways that tells us something about the nature of their scientific creativity (e.g., Roe, 1953). Hence, what we currently possess is a chaos of miscellaneous puzzle pieces that we hope can be eventually placed together to form a single coherent picture of how the creative process and person might systematically vary across different domains of creativity. (p. 441)

Simonton (2009a) offered what he termed a "a hierarchical model of domain-specific disposition, development, and achievement" (p. 441) that might allow researchers to group scientific fields on a single continuum "ranging from the 'hard' natural sciences to the 'soft' social sciences" (p. 441). Because similar fields are more likely to share domain-specific constraints than dissimilar fields, a researcher interested in determining something like (a) the relative importance for creative performance of intrinsic motivation in a domain or (b) the degree of blindness/sightedness in the typical production of ideational variants in a domain might use this hierarchy as a guide.

The other kinds of general theory that might be useful in creativity research and training are composite theories that include many domain-specific theories. Hierarchical models that posit very modest amounts of domain generality in combination with many domain-specific elements are one example of a composite theory. Kaufman and Baer (2005; Baer, & Kaufman, 2005a) have proposed an APT Model of Creativity that includes:

- a few very general factors like intelligence that impact creative performance to some degree across many domains,
- a small number of general thematic areas that describe large domains like science or writing that share some creativity-relevant skills, and
- many more specific domains and micro-domains that require skills and expertise that matter for creative performance only in one or a few very constrained domains or micro-domains.

The first level is very general, and each subsequent level gets more and more domain-specific. These are general theories of creativity in two limited senses:

- they may contain some significantly domain-general aspects, even though most of the work is being done at several different levels of domain specificity, and
- by including many different domain-specific theories and descriptions of creativity, a composite theory can encompass creativity across many domains.

Like Simonton's (2009b) hard-soft continuum of scientific disciplines, a hierarchical model of creativity might also help guide researchers as they make hypotheses about the importance of some meta-theoretical factor in a given domain or group of similar domains.

## CONCLUSIONS

Although there are some kinds of general theories of creativity that can be both informative and useful (such as the meta-theories and composite theories described in the previous section), for the most part grand theories of creativity promise far more than they can deliver. Grand, all-encompassing theories of creativity tend to distract researchers from the real (and generally domain-specific) work that needs to be done for us to understand creativity; they distort creativity theory in ways to lead to misconceptions; and they disappoint researchers and trainers who rely on unreliable domain-general tests of creativity or whose efforts are less effective because they have been based on faulty, domain-general assumptions. Creativity theory, research, and training are better served by multiple, limited, domain-specific theories of creativity.

There is a lot of hard work ahead for those who want to understand creativity. We should waste less of it seeking impossible grand theories that inevitably prove themselves not up to the task.

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