



# From Brains to Music: a Multi-Faceted Discussion of Creativity with Dr. Anthony Brandt

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## Abstract

This article is part of an ongoing series by the authors and the Deep Play Research Group, which focuses on the intersection of creativity and technology in education. In this article, Dr. Anthony Brandt, professor of composition and theory at Rice University shares his thoughts about the study of creativity. He uses his experiences as a musician and composer to highlight the important role that creativity plays in our lives, providing examples that illustrate multiple understandings of creativity. His work with neuroscientist David Eagleman is highlighted and serves to illustrate how our understanding of the brain has influenced our knowledge about the way that humans have evolved to engage in creative acts. Dr. Brandt shares his excitement about opportunities that the future will bring as researchers collaborate with scientists and use ground-breaking technological advancements to study creativity. He further offers implications for education and technology.

**Keywords** Creativity · Education · Technology · Neuroscience · Learning · Brain science · Schools · Creative development

## Introduction

For this article in our series featuring distinguished creativity scholars, we spoke with Dr. Anthony Brandt, Professor of Composition and Theory at *Rice University*. Dr. Brandt is co-founder and artistic director of the contemporary music ensemble *Musiqqa*, and co-author with neuroscientist David Eagleman of the book *The Runaway Species: How Human Creativity Remakes the World*. He has received numerous awards and recognitions and has been featured in *TIME*, *Harvard Business Review*, and *The Wall Street Journal*. In our interview, Dr. Brandt discussed his life as a musician and composer, his study of creativity, and his excitement for the future of creativity studies.

Dr. Brandt grew up in New York City and credits his parents with providing an environment that supported his childhood creativity. His parents often provided he and his sister with toys, like Lincoln Logs and art supplies, that required constructing and creating. From an early age he learned that if he wanted something, he had to make it himself. This fueled his creativity, as he shared, “I would periodically turn my room into a museum and charge my parents admission to come see it. I remember once holding a ‘grand opening’ for an aquarium.” His parents limited television to two hours on Fridays and Saturdays, with the flexibility to negotiate times. He recognizes now that this promoted an ability to create his

*“Some of the most brilliant, creative people I know did not do well at school. Many of them didn’t really discover what they could do—and who they really were—until they’d left school and recovered from their education.”*

– Sir Ken Robinson

*“The creative adult is the child who survived.”*

– Ursula K. Le Guin

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own entertainment and keep his mind active. In addition, as a child he was surrounded by classical music, having a grandfather that was a violinist with the *Budapest String Quartet*, and himself playing violin and composing at an early age.

Dr. Brandt's interest in the study of creativity occurred after he learned of a gifted and talented test that evaluated creativity by asking a child to find alternative ways of throwing a piece of paper into a trash can. Dr. Brandt related this seemingly arcane method of measurement to the NFL draft:

Think of all the metrics they use. They time the athletes, measure them, film them, study them for weeks, investing enormous amounts of time—and still 50% of the draft picks are a bust. And you tell me you are going to look at a five-year old, with such a banal way of measuring what they are doing, and somehow know if they are creative?

The use of such an arbitrary test to measure a young child's creative potential "appalled" him and became fuel for his study of creativity.

Another key experience occurred when he was invited to speak about the importance of music to teaching social studies. In preparing for this talk he realized that he would be speaking to hundreds of teachers and principals—not just social studies teachers. This prompted him to expand his topic and broaden his argument to make a case for the role of the arts in supporting *all* subjects. Around this time, he attended a talk by Mark Turner, a cognitive scientist from *Case Western University*. Dr. Brandt describes this talk as pivotal to his thinking:

Mark Turner was the first person I had heard argue that all creativity could be explained by one cognitive mechanism, which he called a dual-scope integration or conceptual blending. He looked at it anthropologically, where around 75,000 years ago all sorts of innovation happened in the human species simultaneously. People tended to fragment that and look at leaps forward in religion, technology, and the arts all separately. But Turner said, 'isn't it a better explanation if one switch went on in the brain which had all of these ramifications?'

The talk inspired Dr. Brandt to apply and extend these ideas to music. He associated blending with counterpoint—having multiple themes playing at the same time. But it seemed to him that other things could not be explained with this single construct, like jazz improvisation, covering a song, variations, fragmenting, and more. This brought him to explore other ways in which his knowledge of music could help explain the mechanisms underlying creativity. This in turn became the impetus for future work and collaborations with other scientists and musicians.

## A Brain-Based Understanding of Creativity

In defining creativity, Dr. Brandt firmly believes that many current definitions focus too much on usefulness or effectiveness, which indeed is an element of our own definition of creativity, (see Mishra et al., 2013) and is also included in most standard definitions of creativity (Runco and Jaeger, 2012). Instead, he advocates for separating the creative act from its cultural reception. By combining them, he argues, we open the gates to subjectivity, whereas any definition of creativity should be "as objective as possible." According to Dr. Brandt, constructs like usefulness in a definition of creativity subject it to bias. He referenced Dean Simonton's (2012) work on high-consensus and low-consensus fields arguing that in high-consensus fields, it might be plausible to include terms like useful or effective, because there is much agreement across researchers, with objective measures and definitions. But, in a field like the arts, it is a completely different experience:

In low-consensus fields, like the arts, there cannot and will never be those agreements. The minute you try to nail down any criteria, somebody's going to come and throw a monkey wrench into them. It's just the nature of art, part of what it contributes to human life. I think the solution is to have two definitions, one that describes creativity itself, and one that assesses its cultural/disciplinary value. This allows for recognition of the far-out and the wild, as well as what kids do that might not have the cultural relevance many definitions call for. If you define creativity separated from cultural value, then kids are amazingly creative, and it makes sense to nurture that whether or not they end up producing something of cultural value. I disagree with scientists who say that Schubert could write his Eighth Symphony and, because it wasn't played during his lifetime, he actually wasn't creative when he wrote it, but only 25 years later when the piece was played.

This perspective stands in contrast to work, for example, by Csikszentmihalyi (2014) where individual creativity is specific to a domain and has to be recognized by experts in that domain who act as gatekeepers. This is not to say that either of these viewpoints is incorrect, but rather speaks to the complexity of defining creativity and describing its broader impact.

Dr. Brandt believes that an operational definition, based on brain research, may eventually make the definition of creativity more objective, assuming we can identify tell-tale brain activity that occurs during a creative act. Until then, his own definition of creativity focuses on the novelty that emerges from the imagined and unforeseen, "the synergy of imagination, intention, and action that produces a novel result."

Dr. Brandt's research and writing help him understand creativity from varied perspectives, including the evolution of creative thought. From his collaborator David Eagleman, he learned that the initial purpose of brains was guided motion through space. Once animals knew how to guide themselves in different directions, decision-making became imperative:

At that point the predictive nature of the brain evolved. This was the ability to make judgements about where you would have the greatest probability of success in whatever you were doing, like looking for food or finding mates. Human imagination is a form of prediction. Animals are able to make predictions, but they are anchored in their experience and they cannot predict, as far as we know, anything that they haven't experienced already. Humans have the ability to predict things that have not happened and then make them come to pass.

Furthermore, animals are conditioned to choose likely outcomes based mainly on prior experiences, since those are the best guarantors of success. Our human brain, however, allows us to create and imagine new possibilities—and to choose unlikely outcomes. The ability to select unexpected outcomes may be the “secret sauce” that has allowed humans to become the imaginative, creative species that we are. In the brain, this involves the prefrontal cortex, which has seen the biggest increase in size over our history and is larger in humans than any other animal. Further, an additional process occurs that helps explain creative acts and thinking. As Dr. Brandt shared,

Human beings are in a fundamental tug of war between novelty and familiarity. It is a gigantic wrestling match in the brain. Generally, brains prefer homeostasis. They like the world to behave properly. That is where we get our confidence, security and sense of being able to navigate the world. But humans also have an unquenchable thirst for novelty. Part of the reason for that is repetition suppression, where if something becomes too familiar, we take it for granted. We are very social creatures and we can't afford to do that with each other. If our behaviors were all too predictable and we were constantly tuning each other out, we couldn't bond. We need a regular spark of novelty.

This tension between novelty and familiarity involves taking something that is known and using that to take us into the unknown. Dr. Brandt explained with musical examples,

Beethoven never changes everything all at the same time. He's the most radical composer of his day, but there's always a thread that connects one moment to the next... Similarly, Mozart will either change the key or he will

change the theme, but he will not change the theme and the key simultaneously, except at critical structural markers in the piece. He's a magician at being able to stay in the same key because he just bubbles up with beautiful ideas that keep it alive and you don't tune out to it, but he won't create the chaos of changing too many things all at the same time.

Dr. Brandt believes that this tension between novelty and familiarity is not well represented in the scientific literature and should be studied more. One relevant connection here is Sawyer's (2011) notion of creativity as ‘structured improvisation,’ a kind of flexible structure that provides familiarity in creative acts, as well as an emergence that is novel, situational and difficult to plan for. Notably, Sawyer also has a musical background and uses examples of jazz improvisation to support this idea—suggesting again how music and the arts have much to teach us.

Dr. Brandt describes creative acts that showcase the relationship between novelty and familiarity through the processes of bending, breaking, and blending. He calls these the Three Bs of creativity (a play on the three Bs of classical music – Bach, Beethoven, and Brahms). The three B's can be used to describe any type of creative act. Bending occurs when something already existing is twisted out of shape or varied. Breaking describes a whole being taken apart with something new being made out of some or all of the pieces. And blending happens when two or more sources are merged. Dr. Brandt's goal has been to see if he could apply these concepts to fields outside of the arts, which ultimately resulted in his book with David Eagleman, *The Runaway Species*, a TedTalk, and multiple interviews, articles, and invited speeches.

## Creativity's Essential Role in Education

Education is at the core of Dr. Brandt's passion for creativity. He noted that one of the main reasons he co-wrote *The Runaway Species* was to try to help more kids have access to the arts and to support creativity in schools. He fondly recalled his own teacher, Mel Powell, at the *California Institute of the Arts*, who said, “You tell a student something 36 times, they don't understand you. And then the 37<sup>th</sup> time they think they thought it up themselves.” This is something he often thinks about as he designs his own instruction. While making an impact in schools is essential to him, it is also an area of great frustration. He describes the support of the arts in schools as being fragmented and disorganized, because even though scientists are increasingly able to make an “ironclad argument” for the need for the arts, arts instruction is still sorely underfunded.

Dr. Brandt believes all students need to be encouraged in their creativity. Without this support there may be an occasional person who through, “luck, resilience, and incredible strength of

character will be able to surmount those obstacles” and find success. “But”, he says, “I can guarantee there are at least as many—and probably many more—very gifted people who will give up because they just can’t deal with the pressure and the resistance.” Dr. Brandt referenced an article in the *New York Times* to illustrate his point (Leonhardt, 2017). In the article, *Lost Einsteins: The Innovations We’re Missing*, the authors summarized a study that investigated people who have filed a patent in the United States. The demographics of patent holders show that someone in the top 1% income bracket was ten times more likely to file a patent than someone who was underprivileged. As Dr. Brandt shared,

The reason for that disparity was not the math scores. It was access to innovation. It was simply having exposure and encouragement. The Houston school district alone has a million students. So, when we are talking about the top 1% versus the underserved, a 10:1 imbalance is astronomical. Not only does it have an incredible human cost, it has a societal cost. For every person we’re giving an opportunity to, we’re potentially losing 10.

Dr. Brandt identified a clear disconnect between society and schools. In U.S. and other societies or in industry, we support the importance of innovation and disruption (i.e. Silicon Valley), but in schools we take the “opposite direction,” prioritizing conformity and standardization.

Dr. Brandt believes that the more we can prove the importance of teaching and supporting creativity and innovation, the more students will succeed. An essential goal is to prove the importance of ‘far transfer,’ for example, how the skills one learns in art class will make one a better engineer. This connects with our work on transdisciplinary creativity, which focuses on ‘cross-pollinating’ creativity across disciplines—by learning to value ideas from different disciplines and see how they might connect or apply across different contexts (Henriksen et al., 2014; Mishra, et al., 2014).

Dr. Brandt believes in arts-based learning for the intrinsic value it brings to individuals and societies, but he also underscores demonstrating how the arts and creativity can support other fields. If researchers can establish that this type of transfer is a key component of learning, there may be more support for creativity-supporting activities across disciplines.

Dr. Brandt mentioned multiple ideas for classroom practice that can help educators support students’ creativity. Of utmost importance is giving students sufficient time to engage in acts of creation. As a composer, he knows that creation takes time:

Today I was disassembling my string quartet and putting it back together in different ways to ensure that decisions that I had made previously were the right ones. Even if I end up sticking with my original version, that’s still always time well spent.

Dr. Brandt argues that time to play, rearrange, and try different permutations is essential to creative production. Unfortunately, schools rarely provide this kind of time to students—as increasingly, teachers and students are under testing-based or curricular pressures to cover content quickly in linear or perfunctory ways, valuing quantity over quality of learning (Nathaniel et al., 2016). Along with time, Dr. Brandt emphasizes the need to know children individually and provide them opportunities to engage in the type of creative work that *they* find meaningful and exciting. Further, he reminds educators to never make reproduction the end goal. For example, he compared two projects: in one, the objective is to create a facsimile of a Picasso painting; in the other, the student is asked to study a deceased artist and create what the artist might have painted next. The second scenario, subtly yet powerfully different, provides more opportunity for grounded imagination, leading to greater creativity and innovation.

Dr. Brandt emphasized the importance of divergent thinking and suggests that there are many ways across disciplines that teachers can support this—for instance, by encouraging multiple pathways to solutions, or having students come up with multiple workable solutions and then picking one to fully develop. He also encourages educators to push further away from source material when proliferating options, for example:

If we are solving an engineering problem today, how would you do it? Now, imagine it’s 50 years from now and there’s this new ‘x factor,’ how would you do it? If you are constantly training kids to go beyond the known into the unknown, then you’re really developing their creative faculties and you’re showing that it’s valuable.

In Dr. Brandt’s teaching he encourages this type of thinking and work ethic. He maintains a record of apparent mistakes and missteps, and is willing to explore unknown paths, even if he ultimately circles back on an initial idea. He suggests having plenty of paper available:

If you have to destroy what you’ve already done to try it differently, you’re less apt to make that change, and your brain is going to resist. My best advice is to have plenty of blank paper or whatever materials you need. Never run out because you cannot think freely if you have to erase your first attempt to try it another way. Do not treat what you are making as a piece of pottery which can’t be broken. Instead, constantly try it out different ways and know that as long as you have preserved the original, you can always go back to it.

This practice, he argues, helps avoid self-censorship. Dr. Brandt explained that Beethoven was a great example of this because he would write down all his ideas, even when one



might think, “Why even bother writing that down? And then you realize that he eventually molded it into a famous theme. The lesson is don’t treat anything like it’s stupid. Don’t censor yourself.”

## The Impact of Technology on Creativity

When it comes to the impact of technology on creativity, Dr. Brandt is excited about the future. Ever-advancing neuroimaging is proving that creativity is not localized in one region of the brain. Scientists used to believe that the brain was compartmentalized, but the current generation of researchers recognize, “It’s about the crosstalk. It’s how the brain is conversing with itself. The left/right brain dichotomy is wrong. The view that creativity is only on one side of the brain? That is wrong.” New technology shows that the left and right sides of the brain are comparable and the differences between them are subtle. As Dr. Brandt described, “Historically in evolution, the left hemisphere has become specialized in generalization and the right hemisphere in uniqueness.” This is why language is in the left hemisphere, but recognizing faces is in the right hemisphere. The view of creativity as being in the right hemisphere occurred because of over-attention to novelty. But, in order to have creativity, you have to have both the uniqueness and the generalization or the familiar. It is a “collaboration between both hemispheres. Someone whose left hemisphere is not working properly is not able to create. They can’t choose their ideas because they have no anchor for it.” He believes that as neuroimaging capabilities continue to advance, we will more deeply understand the brain’s role in creative acts.

One technology that Dr. Brandt feels will have a great impact on the study of creativity is the portable EEG cap developed by his colleague Pepe Contreras-Vidal. Artists like musicians or dancers or painters can wear the cap as they actively engage in the creative act. This technology allows for a more authentic study of creativity in the arts and of the brain’s involvement during the act of creation. The challenge is understanding and interpreting this new data and knowing what to do with it. It represents a “new frontier for the neurologic study of creativity. It is incredibly liberating.”

Dr. Brandt also notes the exciting potential in artificial intelligence (AI) as he sees it moving beyond reproducing something that already exists—for example, creating technology-generated music that sounds like Beethoven. But, if we can go beyond that through AI,

We might learn a lot about human creativity by being able to make a computer function more like a human, trying to divert from the familiar in a meaningful, constructive way. So far, I don’t think that’s happened: I’ve haven’t seen any computer output which, from one version of what it does to the next, feels unexpected or surprising.

Dr. Brandt also highlighted the role that technology has played in facilitating creativity across many different fields. He noted examples such as “Frank Gehry who creates incredible buildings thanks to computer modeling.” The fact that filmmakers can buy an HD camera and use their personal computers to edit films (or have access to video creating and editing tools on smart-phones) has opened doors to the creative process and the world at large. Similarly, among new technologies, he sees potential in virtual reality in opening new ways of experiencing the arts. For instance, he imagines a day when we have the ability to experience a music performance or ballet right in our own home in a fully immersive manner.

## The Future of the Field

Dr. Brandt is optimistic about the future of creativity studies even while recognizing areas in which it needs to improve. He believes we are on the brink of exciting new developments. One of the current issues he sees with research is the divide between neuroscience and psychology. He notes that the next generation of research will need to bridge that divide saying, “You have functional connectivity in neuroscience and the recombination of ideas in psychology. Those are really two ways of talking about the same thing. People should be studying that in an integrated way.”

Agreeing with the views of a previous creativity researcher highlighted in this series, Arne Dietrich (Mehta et al., 2017), Dr. Brandt believes that research questions need to reflect the dynamic, flexible, and integrative nature of the field rather than focusing on granular details. He explained, “There’s a tendency to get a snapshot of something that really has to be viewed as a moving part.” He also notes that the field is still overly Eurocentric. Referencing the article, *The Weirdest People in the World?* (Henrich et al., 2010), Dr. Brandt described the tendency for Western psychology to generalize findings from limited samples to humanity as a whole. The paper’s authors reviewed behavioral sciences literature and discovered that 99% of the authors were from Western countries and 67–80% of the subjects were American college undergraduates. Not surprisingly, this leads to a narrowed view of human experience and possibly incorrect generalizations.

Dr. Brandt believes that the field needs to be more diverse especially in creativity research in another way as well:

When researchers look for people to study, they tend to favor people with solid reputations and proven track records. But historically, we know that a lot of people will fall by the wayside, where others will end up emerging as truly revolutionary and innovative. You want data not just from the certified, but from the yet uncertified. That’s why that word useful again gets in the way, because if you’re

only looking for useful people, you're going to miss the avant-garde.

Dr. Brandt also believes that researchers need to partner with artists as co-investigators, not just as research subjects. The knowledge that both groups can bring would only strengthen research. He added,

I'm an advocate for trying to write in plain language...When reviewing papers, if I can't understand the introduction or the conclusion, something is wrong. I don't claim to be an expert, but I should be able to understand the intro and the conclusion. Academic jargon creates walls and barriers that impede progress in understanding and insight.

## Conclusion

Dr. Brandt's understandings of creativity helps us consider the topic in new ways. His description of all creative products as being a form of bending, breaking, or blending encourages investigation of how creative acts happen, and the fundamental role that existing ideas and products play in the novelty that is the outcome of creativity. We share his optimism about the future of the field and the potential for deep understandings and revelations that collaborations between neuroscientists, psychologists, and artists could bring. It is, as he suggests, an exciting time to engage in the study of creativity.

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