



## Creativity in Science

### Scientific Essay

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**Abstract:** Modern science is expected to generate new knowledge and understanding. In this scientific essay, I wish to explore the field of creativity in science by contributing a theoretical perspective on creativity and the creative process, which will include exemplifying different factors that promote or inhibit creativity, as well as reflecting on creativity in my own research project. In addition, I examine how we can help strengthen creativity in the context of discovery in research, then I provide a discussion of the issue.

**Keywords:** Creativity, science, cultural entrepreneurs

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### Introduction

Modern science is expected to generate new knowledge and understanding. According to Merton (1942), the institutional goal of science is to extend certified knowledge. This requires new ideas, new hypotheses, and new approaches, not merely the accumulation of more data. Therefore, originality and novelty have been added to the four ethical norms that Merton said comprised the ethos of modern science. Scientists need to be creative, ask new questions, find unexplored areas of inquiry, and look for new interpretations and solutions, but where does creativity come from? Academic preparation as a PhD student involves education and training in both theory and research methods, but little attention has been paid to creativity, which has puzzled me. Why is creativity not more strongly addressed in the context of science, when creativity appears to be a precondition for scientific discoveries and innovations? Maybe this creative neglect can be linked to Popper, an influential 20th century philosopher who made a significant contribution to the debate on what comprises science. He was keen on distinguishing science from pseudoscience, i.e., the so-called demarcation problem. Popper (1963) also

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distinguished between the context of discovery and the context of justification. What gave a theory scientific status, as Popper saw it, was that its premises could be tested and refuted. The important aspect was not how an idea occurred to a person (the context of discovery), but whether and how the idea was justified (the context of justification). As creativity belonged to the context of discovery, it was irrelevant from a scientific perspective.

Despite the fact that creativity in science is "a never-ending story," it is vital that a new academic like me can reflect on and ask questions about this issue within the institution of science. A possible attempt to read and understand the field as a newcomer to academia can be made through an institutional approach, which is a familiar concept for a sociologist. One can use an institutional perspective, like a constructivist with an interpretative approach, emphasizing that rational norms and values have a social and cultural origin. How can one be creative while simultaneously following the rational norms and values of social science? The motivation for this scientific essay was to comprehend the power of creativity and its position in the scientific community, as well as cultivate reflections that can relate to both novice and experienced academic scholars. This scientific essay aims to connect the different aspects of the concept of creativity with my personal experience and biographical level, inviting and hopefully inspiring you to reflect similarly on your own research. Since this scientific essay involves an extended view of creativity, it also presents a series of photos related to the concept, borrowed from my blog [www.prosjektmadammen.com](http://www.prosjektmadammen.com).

The first sections provide a theoretical perspective on creativity and the creative process, followed by some examples of different factors that promote or inhibit creativity. In the main section, I examine the scientific community's perspective on creativity in the research process and reflect on creativity in my own research project. Finally, I present closing remarks with some reflections on what is needed to be creative and innovative in the context of discovery in research.

## **Creativity**

*Creativity*, as a term, emerged academically during the first decades of the 20th century, introduced in the field of pedagogy by Dewey in 1921 and in psychology by Allport in 1938 (Davis & Scott, 1971). Dewey defined *creativity* in terms of the qualitative aspects of the mind, rather than as an exceptional personal trait, referring more precisely to the constructive aspect of intellectual activity. Dewey said that any thought contains something creative in it, i.e., thought implies the discovery of something new and invented (Mihai, 2016). I define *creativity* through this perspective, as opening up the mind while you experience the eagerness to create. Other researchers and theorists define *creativity* based on the characteristics of the person involved and on the process itself. Creativity is a complex and multifaceted phenomenon with an explicitly human dimension – a phenomenon often used to define an individual and his or her actions, as a psychological aspect (Kováč, 1998). Some people are known to be creative and use their creativity to develop new ideas in their daily lives, in businesses and organizations, or in scientific pursuits. Barron and Harrington (1981) define *creativity* as a socially recognized achievement manifested in novel products that one can cite as evidence—e.g., inventions, theories, buildings, published writings, paintings, sculptures, and films. Amabile (1988) defines *creativity* as the production of novel and useful ideas by an individual or small group working together. Ideas can be considered novel if they are unique in relation to other ideas. For an idea to be considered useful, it must have the potential for providing direct or indirect value to an organization, in the short or long term. I applied for the PhD position with a proposal that unfolded my idea for a thesis and a project description. The director of the School of Business and Economics must ensure that my idea and proposal suited the school's strategies and interviewed me to ascertain my motivation to ensure that my idea would be a good

investment for them. This distinguishes between ideas and innovations, as innovation occurs after an idea has been selected and implemented. Creativity is conceptualized as a necessary first step in innovation (Shalley, Zhou, & Oldham, 2004). *I invite you to reveal your own consciousness and perceptions of creativity.*

Christoffersen (2011) proposes that creative processes thrive best in a formal, restrictive frame with a stringent set of rules that function as barriers and establish compulsory for success in the process. You must be swept off your feet and depart the security of everyday routines. This prevents the everyday setting's norms and stereotypes from disrupting your efforts to elicit the creative flow, which can be difficult to grasp, but once you have been there, you know and feel the concept. Creativity arises in different settings—for me, it occurs when I am driving. I have driven between Harstad and Lødingen hundreds of times to visit my parents in Hamarøy. The familiar distance gives me peace of mind and a unique opportunity to let my thoughts wander, possibly due to being strapped into a vehicle and in motion while feeling the flow of the beautiful landscape. The trip takes one hour, and I usually come up with new ideas during this time. *Reflect on where and when you experience creative flow.*

Nordahl-Pedersen (2016) presents a systematic, creative problem-solving process inspired by Farstad and Jevnaker (2010) and Forsth (2004). The first step is to define the problem as formulated by those who created it. The second step is to search for facts. What information about the company, product, or person do we need to determine the totality of the circumstances involved? The people closest to the problem to be solved initiate the strongest innovation. In the third step, this systematic, creative process takes for granted that the people involved have enough knowledge to formulate the problem amid numerous opposing views. The next step is to search for ideas, which involves a divergent and convergent stage, using different brainstorming methods to create and develop an idea. When do you have enough ideas? Jessen (2008) suggests that if you compare your idea to 100 other ideas and conclude that yours is the best, your idea is novel. It is essential to settle on the identifying criteria for choosing an idea in before the process of developing the idea begins. The next phase is to determine who is responsible for transforming the idea into action through a project plan that describes who will be involved, how, when, the cost, and the desired result (Strøm, 2016). Any business or organization that is developing new ideas and innovations can conduct this creative process, as can a researcher in a scientific community. I recognized this systematic creative process while developing my PhD proposal. *It would be inspiring to deliberate on how the prestigious research groups developing projects for the European Commission or the Research Council of Norway conducted their systematic creative solving process.*



Figure 1. Laughter can release tension. Photo: ©Veronica Melå.

Different factors can promote or inhibit creativity. The lower the stress levels, the better the perceived creative climate (Talbot, Cooper, & Barrow, 1992). When being creative and getting into the flow, I need to have fun. Teaching project management, I work with a colleague in creative processes in which we help students develop different ideas before choosing projects. For some students, this process is frightening. We have experienced students leaving the classroom because of their anxiety about entering the unknown world that a creative process can present. However, other students embrace the setting, take on leading roles, and inspire their fellow students to dare to let go of everyday-life norms. We make an effort to build a secure atmosphere in which students can let their guard down. Laughter releases tensions (illustrated in Figure 1), which my drama teacher taught me when I was an exchange student at a high school in North Dakota, U.S.A. We all have experienced a physical feeling of well-being after having fun and laughing about something. Tension disappears, and we experience pure joy. The strict rule is to laugh with each other, not at each other. Overholser (1992) examined and measured humor appreciation and creativity in 96 college students. The results showed that humor was associated with decreasing feelings of loneliness and depression and boosting self-esteem. However, these associations differed depending on the subject's gender and the frequency with which subjects used humor to cope. The results support the notion that a sense of humor plays an important role in some subjects' psychological adjustment. Having fun and experiencing humor cultivate achievements in diverse settings, as well as stimulate creativity. *Expose yourself to fun and laughter in scientific settings, and experience what it does to your body and soul.*

## **Creativity in science**

In the late 1950s, Bonner (1959) raised the question of scientists' creativity by examining their emotions, e.g., whether they did their jobs stoically in white lab coats—until they suddenly found a cure or

stumbled upon a discovery. We all think we can recognize a creative artist by listening to funky music or admiring a beautiful painting, but how can a creative researcher be identified? Bonner (1959) believes that creativity in science lies deep in the formulation of relations between facts, which are the genesis of theories, uniting previously separated observations under one roof. He further defines creative performance in science in sequences of steps, and those that he describes are almost identical with the systematic creative solving process presented earlier in this essay. First, the scientist defines the question, then in the second step, he or she fills it with facts. In the third step, the scientist lets time pass; the scientist may ponder the facts, i.e., consider solutions. In principle, the scientist waits for solutions to surface at this stage. The fourth step is when the scientist arrives at one or more solutions, which can appear subconsciously when you sleep or daydream. Alternatively, they may be revealed when driving to Lødingen, in my case. The principal point of creative solutions in science is that they tend to occur at quite arbitrary and unpredictable times (Bonner, 1959). Page: 5

Scientists generally formulate hypotheses, then test them by gathering data to create theories and test the facts/data. Rosca and Todoroi (2011) demonstrate in their research how the period from formulating a problem to arriving at a solution is when the intellect works on the problem, even during times when the person is not thinking about the problem consciously. It happens in the same way as other brain functions, such as breathing and digesting food: subconsciously and automatically. The fifth step is to assess the solution: Is it useful in the context of the research we are conducting? Does it fit the research question, or can it become an argument in a paper? The first, second, and fifth steps are conscious and logical, while the third and fourth are not. To shorten the wait, Bonner (1959) suggests that scientists use creative brainstorming to expedite the process. *Experiment with different brainstorming methods and choose one that expedites realization of scientific solutions.*



Figure 2. The demands of research today: How do you measure research time? Photo: ©Veronica Melå.

Rüegg (1986) defended the researcher's needs and explained the importance of taking idle time out. He compares science to a vehicle without a road to follow, a boat in the open sea, or an airplane or spacecraft, needing reference points to determine its position and its new course. Repeatedly, the scientist must find fixed points in the process in which he is engaged, on a rapid course into the unknown. This is why scientific activity needs an "institution of disciplined leisure." Leisure, as action without any direct purpose, comprises time that need not be accounted for and is an essential process for researchers' efficacy. I easily can recognize myself in this process, specifically the impatience while seeking a solution. One of my colleagues recommended that I have several articles in the pipeline to avoid long, unproductive periods. So, when can I take time out to be idle? This also can demonstrate problems with today's research demands. How do you measure research time? Does an idle person have a place in today's system, which demands regular publication of research? These concrete and timely issues are relevant to researchers today and journal issue in the future. Being an impatient person who needs to get things done, I became quite frustrated when I started writing my first research article. I have worked on the article for two years and plan to send it to a special issue in November 2018. If my plan succeeds and is not extended further, I will publish the article in 2019, thereby having spent four years from when I started until publication. Fortunately, I realized that the idle periods during the research process may have been the most important in arriving at my results. *Reflect on the importance of idle time during research and consider the possibilities of accommodating this concept in your academic life.*



Figure 3. Be creative in collaboration. Photo: ©Veronica Melå.

You can be creative on your own, but for many of us, it is more interesting to be creative with other people. Creativity puts you in a vulnerable state of mind because it opens up new senses and thoughts. If you are fully creative with others, you must trust them. Redvall and Strandvad (2011) consider trust to be a central ingredient in creative collaboration. Based on several case studies of development processes in the Danish film industry, their analysis exemplifies three kinds of trust: 1) calculative trust in emerging collaborations; 2) trust based on relations or identity in established collaborations; and 3) knowledge-based trust in the institutional field (Redvall & Strandvad, 2011). The trust issue can be one of the reasons why it takes you years to establish research collaborations. Starting out as a PhD student writing a thesis and publishing articles, the general rule seems to be that you publish articles with your supervisor. Is it even possible to be creative with a person whom you respect so highly that you are almost afraid of that person? By working with your supervisor over the years, you learn to know and trust that person. You may even build trust to be creative together. As a PhD student, you put a calculated risk in trusting this hopefully emerging collaboration. Establishing a good student-supervisor relationship may create the possibility of continuing the collaboration if you become an academic. Alternatively, the supervisor can betray your trust and steal your creative ideas. However, the academic system requires that you take this calculated risk because it relies on the supervisor's ethics. A famous professor told me that I should work only with people whom I trust. *Indicate to what extent your research collaborations are trustworthy enough to be creative.*

To recognize what to observe, we must be creative as researchers. To find a subject to study creatively, it must grab your emotions. What inspired my research on cultural entrepreneurs, and how did the issue grab my emotions? My uncle, Jack Berntsen, was a significant cultural entrepreneur who established the northern Norwegian folk-song tradition in the 1970s. He founded *Trolltampen*, a music festival and a platform where young people can perform their folk music in their local northern Norwegian dialect. I grew up with his songs, such as "Det bor et troll i Senja," "Karamell og sukkertøy," and "Hvor er hammeren Edvard?" He had no children of his own until I was a teen, so my brothers and I received gifts and positive attention from him (illustrated in Figure 4). Uncle Jack always acknowledged my educational and career choices. I never became an artist myself, even though I have acted in theater, sang in choirs and bands, played the saxophone, and painted in oils on canvas. However, my real talent was organizing, so I became a producer, managing artists and organizing events. Working at Harstad University College with 3 million kroner from Sparebank1, I established a course that qualified producers for the creative industry. It feels like my life's path led to this PhD and the topic of cultural entrepreneurs. I am doing my PhD in honor of Uncle Jack because of our shared belief that cultural entrepreneurs hold an important place in our rural communities. If you ask researchers what grabs their emotions, a number of them will tell you a personal story about their motivation for being researchers. *If you haven't told anyone, formulate your own story and save it for a rainy day.*



Figure 4. My inspiration: Jack Berntsen and us kids on summer vacation in 1979 in Tverråsen, Hamarøy, Uncle Jack's birthplace. Photo: ©Hans Jørgen Berntsen.

## Methodology and creativity

It is essential to have an active and purposeful perspective on creativity when working on a PhD on the creative industry. I will be studying cultural entrepreneurs in northern Norway and North Jutland in Denmark through a comparative analysis. This study will use an inductive approach through an exploratory design. The phenomenon to be explored longitudinal and studied in depth. Case studies are a preferred strategy for following present events (Yin, 2014). Swedberg (2006) defines cultural entrepreneurship as performing a novel combination that results in something new and appreciated in the cultural sphere. Musicians create new songs, actors perform on stages and in movies, artists paint, and we, as the audience, expect them to give us novelty. However, how do cultural entrepreneurs produce continuous innovation? Surely, they need to be creative, but how do they approach the systematic creative solving process on a daily basis? Whereas ordinary entrepreneurs build their success on economic capital (Hisrich, Peters, & Shepherd, 2017), the cultural entrepreneur is more focused on being appreciated in the cultural sphere (Ellmeier, 2003). Building alternative capital, i.e., cultural and symbolic capital (Bourdieu, 1994), is considered a key element in developing cultural entrepreneurship, which traditionally embraced the conflict between art and commerce. Cultural entrepreneurs relate to these competing institutional logics in their work. Danielsen and Børset (2017) believe that commercial ambitions are perceived as being incompatible with artistic freedom, but they also argue that this attitude is changing, noting that many artists today want to do business and do not view artistic integrity and market-oriented activity as incompatible. This discussion indicates that my study may take an institutional-theory approach. The theory of institutional logics is grounded in the perspectives of organizational sociology and new institutional theory (Hinings, Tolbert, Greenwood, & Oliver, 2008).



The roots of such an organizational and institutional approach lie within my field, which is sociology. Constructivists such as Berger, Wiik, and Luckmann (2000) have provided the institutional perspective in which they represent an interpretative approach, emphasizing that rational norms and values have a social and cultural origin. They further demonstrate how everyday reality can be perceived as intersubjective reality. Even though we share it with others, we all have different ways of viewing it. Constructivism implies great confidence in how people understand situations and experience reality. In such an approach, the researcher will seek to see the world from the viewer's perspective (Lacerda, Ensslin, & Ensslin, 2015). This section illustrates part of my study's potential analytic framework, which I also had in mind when entering the field. At the same time, I must avoid selecting the empirical material within a predefined theory or model. The research process will have different phases, each of which presents different challenges, partly due to the use of creativity. The methodological coherence that involves the logical incorporation of methods, scientific requirements, research traditions, and empirical findings into the research project must be the backdrop for all creative methods used. *This issue needs further deliberation, so I invite scholars in social science to join the debate on how methodological coherence can affect creativity during the different phases of a research project.*

Stumpf (1995) groups scientific creativity into a four-part classification comprising the creative product, the creative person, the creative process, and the creative situation. Methods for evaluating the creative product's impact and creativity can include citation analysis and inventory ratings. My PhD's creative impact can be measured by the quality of journals that publish my papers. My creative quality also may be measured through citations. The instructor in my academic-writing course did not give us much hope, telling us that if we were lucky, maybe five people would read our PhDs. In his section on creative people, Stumpf (1995) presents findings on creative scientists' personalities and research productivity across the life span of researchers. I consider myself a creative person who always has been a rebel, finding alternative perspectives more interesting. I always have been curious and want to learn more. This is why my 18 years in academia have been fruitful. I am looking forward to returning to my job with an analytical mind and a PhD to play an active role in the research community by being creative. Stumpf's section on the creative process reviews a stage theory on the creative process, including a summary of factors that are conducive to cultivating creative achievement and a discussion of the problem of multiple discoveries (Stumpf, 1995).



Figure 5. The feeling when starting the PhD journey and sensing the demands of creativity in research.  
Photo: ©Veronica Melå.

## Concluding remarks

Creativity is the essence of what it means to be human. We all have the capacity to apply our imagination in a manner that brings new ideas into existence. Consider that creative methods often are regarded as a mysterious and random process, despite the fact that they are more predictable and deliberate. Creative thinking and problem solving are essential skills, and it would be wise for researchers to take an active approach toward this issue. The scientific community could benefit from improved creative-thinking skills (Puccio, Cabra, Fox, & Cahen, 2010).

Rosca and Todoroi (2011) reason that when creativity is working, the individual, team and company succeed. In my experience, the same applies in science. Creativity is not about fooling around, but serious work that assists you as a researcher on your way to being innovative. This essay has inspired me to think differently about creativity and has encouraged me to view the research process in a different light. First, I must make plans to find a place and time to cultivate my creative flow. I like to have fun, but always have felt that my laughter and cheer prevented me from being a real academic. I now realize that scientific fun and laughter can release tension that builds naturally in a scientific environment. I also have learned that if you share your thoughts with a little bit of humor, your fellow academics feel more at ease, and theoretical discussions take on a deeper dimension. However, be aware that you must balance the desire for a fun atmosphere with the risk of being viewed as the class clown. From now on, creativity will be an asset in my collaborations. Through the process of writing this essay, I also became aware of my own story and the motivation for wanting an academic career. I feel stronger and more secure about the choices I've made in my research, knowing that its inspiration comes from my own family. Finding a higher purpose in my career trajectory encourages me, especially on bad days, which

we all experience. I already have had a good number of discussions with my fellow academics about taking idle time out. We did not prepare for that, which is why some of us became frustrated, as we want to be efficient. Knowledge about the creative process in research can calm your mind and increase your awareness that it is a long process that probably will take more time than planned.

This essay has created more new questions than answers about creativity in science. First, despite the fact that originality and novelty have been added to the four ethical norms that comprise the ethos of modern science, according to Merton (1942), I do not find the question of creativity to be emphasized in my research education, nor do I find many ongoing discussions about creativity in science/academic journals or in my research community. Nevertheless, I expect to contribute something novel, but not necessarily creative. How can we aspire to and strengthen creativity in the context of discovery in research and fill this gap? I miss debating with other PhD students on how to meet the expectations of being novel through creativity. Second, I would encourage professors and other senior researchers to introduce their experiences with creative scientific methods into this debate. Third, more research on this issue is needed. Answering the questions of how, when, who, and what in terms of creativity in science, in my opinion, will enhance understanding of the topic.

## Author presentation

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