Introduction:

Stimulating Creativity
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In the current dissertation, I investigated what underlies our perception of ideas as being creative, and whether and by whom novel input is perceived as a creative contribution (Chapters 2 and 3). Additionally, I investigated whether various types of input are stimulating when brainstorming, and how this is affected by the individual characteristics of the perceiver (Chapters 3 and 4). How can the type of input be matched to the individual to reach optimal brainstorming outcomes (Chapters 3 and 4), and what cognitive pathways are used, and by whom, to generate ideas (Chapter 4)? But first things first: Creativity – why do we care?

Creativity – Why do we Care?

Creative ideas, those that are both novel and feasible, are wanted and needed by people and organizations (Hennessey & Amabile, 2010). Creativity is crucial for innovation and growth: it fosters new discoveries and positive change, enables people to respond effectively to unforeseen challenges, and is needed to flourish in an ever-changing environment (Zhou & Hoever, 2014). Being creative supports and increases well-being (Hirt, Devers, & McCrea, 2008) and is vital for the proactive development of new capabilities (Zhou & Hoever, 2014). Creativity is thus of great interest and meaning to individuals, teams, and organizations. Innovation, the successful implementation of creative ideas, creates the competitive advantage necessary to be able to stay ahead of competitors (Amabile, 1988). Hence, it is important to know more about how to create the optimal circumstances for people to generate creative ideas, and when this occurs, to ensure that these ideas are also recognized as such.
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Creativity – What is it About?

First, creative ideas are novel (Hennessey & Amabile, 2010). Novelty can be defined as the degree of newness and originality in the concepts, materials, or processes included in the idea. Whereas novelty is vital for creativity, novelty alone is not sufficient. To be considered creative, novel ideas should also be feasible: that is, have clear and practical applications, and fit with the problem or question at hand (Hennessey & Amabile, 2010). Highly original ideas that are not feasible or useful, or that cannot be implemented in practice, can be seen as weird or bizarre, and unrealistic. Note that generating feasible ideas that are not novel will not result in creativity either, but rather in common, everyday (or even boring!) ideas. The combination of novelty and feasibility is thus essential: Creative ideas are new and have clear and practical applications (Runco & Jaeger, 2012; Stein, 1953).

To illustrate how the elements of novelty and feasibility are both essential for creativity, consider the following example. A manufacturer thinks of possible new products for children, and after noticing that children like to imitate their fathers when shaving, comes up with a shaving razor for children. This could be seen as quite novel, something we do not encounter in everyday life, yet we can wonder to what extent an actual shaving razor for children would be useful (and safe!) in practice. As we will see in Chapter 3, such novel ideas could, however, still form a great starting point to build on when generating further ideas (at least for some). Here, the manufacturer could build on the razor idea to come up with a toy variant of a shaving razor, one that meets the criteria of being both new and feasible.

Creativity – How to get There? (Group) Brainstorming

A popular way to come up with creative ideas is brainstorming: generating a lot of ideas, and combining and improving these. The idea behind brainstorming is that the more ideas generated, the better: the greater the likelihood that they will include creative ideas. This is because novel ideas are frequently raw materials in their initial form and move toward
innovation through revision and improvement (Amabile, 1988; Csikszentmihalyi, 1997).

People often work together in brainstorming groups, where members contribute with their different knowledge, expertise, and opinions. Osborn’s (1957) brainstorming rules are often implemented to enhance creative idea generation in which (a) wild ideas are encouraged ("freewheeling") and (b) criticizing or judging ideas is left out. This way, ideas are not limited by rules or by standard ways of doing things. Also, (c) quantity is wanted, and (d) this is aimed at by combining and improving ideas.

Previous findings indicate that brainstorming groups have the potential, at least in theory, to perform better than the sum of their parts (i.e., all individuals separately), due to the exchange and collective processing of information (e.g., De Dreu, Nijstad, & van Knippenberg, 2008; Hinsz, Tindale, & Vollrath, 1997). Usually, however, brainstorming groups perform below their potential, and are less productive than individual brainstorming, as a result of production blocking (Diehl & Stroebe, 1987; Lamm & Trommsdorff, 1973; Nijstad & Stroebe, 2006). Being exposed to other group members’ ideas can interfere with one’s own idea generation process: for example, because one typically has to wait for another group member to stop talking before being able to contribute one’s own idea. Furthermore, monitoring the shared input may lead to cognitive interference and distraction, resulting in less effective idea generation (Diehl & Stroebe, 1991; Nijstad, 2000).

Nevertheless, one important reason for working together on brainstorming tasks is the potential for cognitive stimulation: Being exposed to other people’s ideas might enhance one’s own idea generation process (e.g., Nijstad & Stroebe, 2006). When people are exposed to others’ ideas, the features of these ideas can be used to increase productivity: generating new ideas through combining knowledge and forming new associations. Group brainstorming may increase idea diversity because group members can contribute different knowledge, expertise, and opinions to the group, which may trigger new ideas or areas of knowledge that...
would not be as easily activated without some external cue (Brown, Tomeo, Larey, & Paulus, 1998; Dugosh, Paulus, Roland, & Yang, 2000; Nijstad & Stroebe, 2006).

**Cognitive Stimulation**

To understand how input and ideas from others can cognitively stimulate or interfere, it is helpful to understand the cognitive processes that are activated during brainstorming. The SIAM model (Search for Ideas in Associative Memory) describes brainstorming as a two-stage cognitive process, moving from activating knowledge to combining knowledge (Nijstad, Stroebe, & Lodewijkx, 2002; Nijstad & Stroebe, 2006). Knowledge activation involves retrieving previously stored knowledge on the topic, by forming a search cue in one’s short-term memory that is used to explore one’s long-term memory. The phase of combining knowledge starts when the search cue activates an image in one’s memory. This image is used to generate new ideas by combining knowledge and forming new associations. This in turn activates more images and results in additional ideas that are semantically related (i.e., a ‘train of thought’). The train of thought stops when it no longer results in new ideas, after which a new search cue has to be activated to generate additional ideas (Nijstad et al., 2002).

To illustrate the use of these cognitive processes, let’s investigate the following example. When brainstorming on the topic of creating a healthy lifestyle, the cognitive process starts by investigating previous knowledge on the topic. This could activate the image of eating fruit as a way to achieve a healthier lifestyle. From this image, a train of thought is started, generating related ideas: eating fruit more often, taking vitamin pills, or wait (!), perhaps we can get more vitamins in a different way: we could add vitamins to chewing gum. This illustrates both what a train of thought can look like, and how generating more ideas on a subtopic can help to move away from everyday ideas that readily come to mind, towards more novel ideas (the more ideas, the better). After running out of ideas related to fruit, one
searches for a new image. Perhaps the idea of sport comes to mind, and the process of generating related ideas starts again.

On the one hand, receiving input when brainstorming can be very valuable and stimulating, especially when a person is running out of ideas or moving towards the end of a train of thought. In these instances, others’ ideas can help to activate new search cues and move to new trains of thought (Nijstad et al., 2002). Also, input from others may help to activate categories that are less salient or obvious, providing a wider selection of categories to generate ideas from (Deuja, Kohn, Paulus, & Korde, 2014). On the other hand, external input can result in cognitive interference, activating images that misfit with one’s own activated search cue (Diehl & Stroebe, 1991; Deuja et al., 2014; Nijstad, 2010; Nijstad et al., 2002). This input interrupts and thus shortens one’s train of thought (Nijstad et al., 2002), resulting in the loss of potentially useful ideas and worse performance as compared with individual brainstorming (Diehl & Stroebe, 1987).

Previous research indicates that group brainstorming can result in conformity to the categories of ideas posed by others, resulting in less (rather than more) variety in the ideas generated (Kohn & Smith, 2011). This may be because input from others increases the cognitive retrieval strength of similar ideas, thereby weakening or blocking the activation of alternative ideas (Smith, 2003). At the same time, input can increase the number of ideas generated within that category, thus increasing the length of a train of thought. Input may thus lower the number of categories explored, but may enhance the in-depth exploration of these categories (Kohn & Smith, 2011). In the current dissertation, I posit that one size does not fit all, and investigate what types of input are effective for whom to improve brainstorming outcomes. This is explained below.
One Size Does not fit All: Matching Person and Context

The degree to which sharing ideas results in cognitive stimulation depends on factors such as the attention given to these ideas and the type of ideas shared, including their novelty and semantic diversity (Dugosh & Paulus, 2005; Nijstad et al., 2002). The novelty of ideas affects the ease with which they can be combined into new ideas: common input is more closely related to one’s own semantic categories, and may therefore activate more associations than novel input would. At the same time, novel input may stimulate one to think of new categories or to include different perspectives from those one would otherwise have included (Leggert, 1997). The semantic diversity of input affects the diversity of ideas generated: input from a broad range of categories stimulates one to come up with more diverse ideas, whereas input from a smaller number of categories stimulates one to generate more in-depth ideas within these few categories (Nijstad et al., 2002).

Moving beyond previous research on types of input, I propose that the extent to which these types of input stimulate idea generation also depends on individual differences. The type of input that is perceived as valuable and creative by one person may be perceived as disruptive and impractical by another, thus either stimulating or diminishing creativity. This perspective is in line with the interactionist theory on creativity (Woodman, Sawyer & Griffin, 1993), which indicates that creativity evolves from a complex person-context interaction. Thus, “the characteristics of the job or task […] may have differential effects on the creativity of employees exhibiting different states or traits.” (Zhou & Hoever, 2014, p.344). To understand creativity, we therefore need to have insight into the characteristics inherent to the person, the factors related to the context, and the interplay of both. In the person, both cognitive (such as preferred cognitive style) and non-cognitive aspects (such as personality) affect creativity (Woodman et al., 1993). This theory aligns with other researchers’ views of creativity as well. For example, Amabile (1983) emphasized that
creativity results from the interplay between personal characteristics, cognitive abilities, and environments. Zhou and Hoever (2014) further specify the various forms the person-context interaction of the interactionist theory can take. When the effects of the person and context are both positive to creativity, this will have a synergistic result that mutually stimulates creativity. When the characteristics of the person tend to restrict creativity, but the context facilitates creativity (or the other way around), the positive element can compensate for the negative element, forming a remedy to overcome potential losses for creativity. Alternatively, the negative element may inhibit the otherwise positive element. Last, the interaction between negative effects of both the person and context will have an antagonistic result, increasing the detrimental effects and diminishing potential gains for creativity (Zhou & Hoever, 2014).

Overview of Chapters

In the current dissertation, I investigated both positive and negative person-situation factors and their interactions in creativity, and potential ways to overcome negative effects in order to stimulate the generation and recognition of creativity. Specifically, I examined whether people perceived novel ideas as creative, valued such ideas as end products or starting points for further idea generation (Chapters 2 and 3), and whether this held for both laypeople and creative experts (Chapter 2). I investigated what type of input (novel vs. non-novel in Chapter 3; homogeneous vs. diverse in Chapter 4) matched with the characteristics of the individual (individual needs for structure and autonomy in Chapter 3; approach-avoidance motivation in Chapter 4), to produce optimal brainstorming outcomes (cognitive stimulation, increased performance, task enjoyment). These types of individual differences relate to the core personality traits that are associated with creativity, which include aspects such as attraction to complexity, autonomy, and independence of judgment (Barron & Harrington, 1981), and relate to previous findings indicating that the way people attend to and make use of others’ input depends on both epistemic and social motives (De Dreu et al., 2008). The
following section outlines the main findings per chapter in this dissertation.

1. *Does our common scholarly definition of creativity go hand-in-hand with people’s perception of what constitutes a creative idea?* Not necessarily, as we show in Chapter 2. In Chapter 2, we show that the extent to which ideas are perceived as being creative not only relates to characteristics of the ideas, such as their novelty and feasibility (Demirkan & Hasirci, 2009); it also seems to imply some sort of valuation or appreciation of the idea (Runco & Smith, 1992). We show that both wanted (i.e., perceived novelty and positive surprise) and unwanted elements (i.e., expected low feasibility and disruptiveness) are inherently associated with novel ideas. These elements differently affect the perception of creativity, and for both laypeople and people in creative industries, serially affect the expectations of success of novel ideas, willingness to endorse their implementation, and their perceived added value as a starting point for idea generation.

2. *Is novel input stimulating in generating creative ideas?* Not for everyone, as we show in Chapter 3. In Chapter 3, we show that perceiving the creativity in novel ideas forms a necessary first step to be cognitively stimulated by the input (that is, arrive at more productivity, idea diversity, task enjoyment, and not feeling blocked). Here, we aimed to address the inconsistent finding in the brainstorming literature that cognitive stimulation sometimes results from novel input (e.g., Berg, 2014), yet other times from non-novel input (e.g., Dugosh & Paulus, 2005). We demonstrate that the link between input novelty and cognitive stimulation partly depends on people’s psychological needs for structure and autonomy. Additionally, we show that the perceived creativity of the input mediates this relationship, in line with previous research indicating that the role of novelty in the perception of creativity is less than straightforward (e.g., Mueller, Wakslak, & Krishnan, 2014; De

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2 In the remainder of the dissertation, I will use the term “we” rather than “I” to reflect the contributions of my co-authors.
3. How do we use input to come up with creative ideas? In Chapter 4, we show that input diversity and individual differences determine the effectiveness of two cognitive pathways to generate ideas when brainstorming. Previous research indicates that input can result in cognitive stimulation both when it covers a wide and when it covers a small range of perspectives (i.e., is high or low in diversity) (Nijstad, Stroebe, & Lodewijkx, 2002). The extent to which input does so may depend on individual differences (also see, De Jonge, Rietzschel, Van Yperen, 2018 (Chapter 3)) that are associated with a preference for a particular cognitive pathway towards creativity. Approach-motivated people tend to use a flexible cognitive pathway that is characterized by generating ideas from diverse semantic categories, whereas avoidance-motivated people use a persistent cognitive pathway by generating ideas from deeper within few semantic categories. We argue and demonstrate that both the type of input and people’s approach-avoidance motivation determine which cognitive pathway results in creative idea generation.

By focusing on these person-situation interactions throughout the dissertation, I aimed to create more insight into when and how ideas are perceived as creative, as well as to understand the conditions that stimulate rather than inhibit creative performance. This way, we can better understand the mechanisms through which creative performance unfolds. And, when creative ideas are generated, we can increase the likelihood that these ideas will also be recognized as such. This will increase the likelihood that individuals, teams, and organizations can benefit from the creative ideas generated.