From Creativity to Innovation: Understanding and Enhancing Creative Idea Selection

Yuxi Zhu

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Yuxi Zhu

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Aula
Radboud University

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Shuang Li
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Behavourial Science Institute
Radboud University
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Yuxi Zhu
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door
Yuxi Zhu
geboren op 2 Mei 1988
te Shandong, China
Promotor:
Prof. dr. A.J. Dijksterhuis

Copromotor:
Dr. S.M. Ritter

Manuscriptcommissie:
Prof. dr. M.A. Buijzen
Prof. dr. E.H. Kroesbergen
Prof. dr. B.A. Nijstad (Rijksuniversiteit Groningen)
CHAPTER 1

Introduction
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Background

Creativity and innovation

Imagine there is a time tunnel through which a person can fly a plane to travel back a thousand years. What would be the reaction of the people who greeted the time traveler as he stepped out of the plane? They would be amazed, of course, for they had seen nobody else flying before. But they would hardly be less amazed to learn from the traveler that in the time he or she came from a powerful instrument called a telescope allows humans to observe the activities of incredibly remote heavenly bodies, or that there were experts who understand how the brain works.

Our time traveler would not have to venture quite so far back into the past to grasp the shock of the creative and innovative. Fifty years ago, who would have thought that by the second decade of the new millennium we would have at our disposal an instrument—the internet—which allows instant access to and transmission of a huge wealth of knowledge? Creativity and innovation accelerate our history. They have brought about changes that constantly renew the world. But they have also created an environment in which the demand for creativity and innovation is constant—and that is a mighty challenge.

In this fast-changing, complex, and competitive world, creativity and innovation determine the success of individuals, organizations, and nations. The importance of creativity and innovation is recognized universally by business leaders, politicians, and educators. The IBM 2010 Global CEO study, for instance, which surveyed above 1500 global CEOs, found that most of them expected business environment to become increasingly complex; most importantly, they identified creativity as the single most important leadership competency for the successful
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terprises of the future (IBM, 2010). In 2004, more than 500 American leaders attended the National Innovation Initiative Summit. The Summit produced a landmark report—*Innovate America: Thriving in a World of Challenge and Change*, which stated that “innovation will be the single most important factor in determining America’s success through the 21st century”. The American leaders urged all stakeholders, big and small, to take action to facilitate innovation (Council on Competitiveness, 2005). In response, the America COMPETES Act, rooted in the report and in the work of the NII Summit, was signed by President George W. Bush into law in 2007. The act aims to improve the competitiveness of the United States by facilitating innovation through research and development. In 2009, the European Union proclaimed that “Europe’s future depends on the imagination and creativity of its people” and nominated 2009 as the “European Year of Creativity and Innovation” (European Commission, 2009). The leaders of Asian countries have similarly stressed the importance of innovation and creativity. For example, in 2015, the President of China asserted that “innovation is the primary engine of development” to his nation (Xi, 2015).

Despite the acknowledged importance of creativity and innovation, there lacks consensus on how to define these two terms. However, it is generally agreed that creativity involves the generation or development of a product, idea, or problem solution that is both novel (original) and valuable (appropriate and useful) (e.g., Hennessey & Amabile, 2010; Sawyer, 2012), and that innovation involves the successful implementation or execution of creative ideas (Amabile, 1988; Anderson, Potočnik, & Zhou, 2014). Creativity and innovation are not synonymous but closely linked—creativity is the prerequisite for innovation. From the beginning, creativity research has mainly concentrated on maximizing the generation of creative ideas,
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whereas it neglected to study how to effectively select the most creative ideas for implementation, which is vital for successful innovation.

Numerous studies have been devoted to the study of the generation of creative ideas, and various theories of creativity have been developed. The “4P framework” is the most influential. Proposed by Rhodes (1961/1987), the 4P framework suggests that creative studies can be divided into four categories—product, person, process, and press. These clarify the four key aspects of creativity—the what, the who, the how, and the where. Existing research on creativity generally follows the rationale of the 4P framework and has studied various factors of person, process, and press that may influence the generation of creative products.

A product is what is created—the outcome of a creative activity. A product can be many things, including ideas, designs, paintings, poems, music, inventions, and patents. A creative product, by definition, should be both original and valuable. There are different levels of creativity, depending on the influence that a product has. “Big C” and “Little c” are terms used for two of these levels. “Big C” (eminent) products are creative breakthroughs of great importance and influence to the entire society. Newton’s laws of motion, Beethoven’s Symphony No. 5, and Da Vinci’s Mona Lisa are quintessential Big C products. Products called “Little c” (or everyday) creativity, by contrast, are those produced in the process of daily problem-solving, and reflect people’s ability to adapt to change. In many studies of creativity, the creativity of products is used as a criterion to measure the creativity of people. The Consensual Assessment Technique (CAT) is used to assess the creativity of products. The CAT, originally developed by Amabile (1982), is based on the assumption that experts or experienced raters can recognize and agree on the creativity in a product, and that the latter can be validly assessed based on the consensus of experts. This dissertation is
concerned with Little c products generated to solve certain societal problems. Its dependent variable—creativity of ideas—is measured by aggregating the ratings of experts or trained raters.

A creative person is one who generates creative products. Creative people vary in the degree of their creativity and the degree of creativity of their products. There are a few genius creators, those who are able to generate Big C masterpieces. But many more who may not rise to Big C creativity possess enough creativity to generate Little c products. Research into the person category assumes that creativity is a personality trait that is “relatively enduring and largely stable”; it focuses on personal characteristics that are related to creativity. The usual means to study creative people are interviews, personality tests, and in-depth case studies. Findings show that creative people share certain characteristics, such as intrinsic motivation (e.g., Amabile & Pillemer, 2012), autonomy and independence (e.g., Oztunc, 2011), and openness (Li et al., 2015).

The “creative process” refers to how ideas are created, the cognitive process through which creative ideas are generated. To study the creative process, researchers often divide the creative process as a whole into stages. Multiple models have been developed to clarify the activities definitive of each stage. In his four-stage model, Graham Wallas (1926) argued that a complete creative process consists of four consecutive stages—preparation, incubation, illumination, and verification. During preparation, people consciously identify and analyze problems and prepare relevant information and resources. The second stage is incubation, when people unconsciously combine associations, reject useless combinations and retain promising ones. The illumination stage is next; in this stage people become fully conscious of the retained combinations. The latter are further processed in the final verification
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stage, when ideas are consciously evaluated and improved.

“Press,” or “place”, is where people create products. Creative press research focuses on the external forces or situational factors that can influence the creative person or process, such as environmental, social, and cultural contexts. Research has identified press factors that encourage creativity in particular settings. For example, in organizational settings, creativity can be supported with the existence of press factors like trust, permissiveness, support for new ideas, and challenges, whereas a lack of these factors can inhibit creativity performance (Anderson et al., 2014).

In addition, techniques have been introduced to facilitate creative idea generation. For example, brainstorming, developed by Osborn (1953), is widely used by both individuals and organizations. The aim of brainstorming is to encourage individuals or groups to come up with tentative solutions to a particular problem. Osborn identified two principles underpinning ideation in brainstorming—deferral of judgment and quantity reaching. Based on these two principles, four key rules of brainstorming were established. It is stressed that during brainstorming, criticism is ruled out, freewheeling embraced, quantity desired, and combination and improvement sought. These techniques have significantly boosted the generation of creative ideas. They have allowed people to get over the problem of a lack of ideas, freeing them to focus on what among the brainstormed ideas are “worth every penny” for implementation.

**Idea selection: from creativity to innovation**

Generating more ideas and more creative ideas does not guarantee successful innovation because the ideas also need to be implemented. Successful innovation is dependent on the accurate evaluation and effective selection of creative ideas.
Creativity involves not only initial idea generation, but the succeeding phases of idea evaluation, idea selection, and idea implementation (Mumford, Medeiros, & Partlow, 2012; Rietzschel & Ritter, in press). Once people have generated ideas, they must evaluate them and select the most creative ones for implementation.

Many examples indicate that successful idea evaluation and selection can lead to big successes, whereas those who fail to evaluate and select ideas successfully can pay a heavy cost. The saga of the competition between Blockbuster and Netflix immediately comes to mind. Blockbuster was once the biggest rental services provider of home movies and video games, mainly through physical rental shops. At its peak in 2004, Blockbuster possessed 9000 stores worldwide and employed around 85,000 workers (U. S. Securities and Exchange Commission, 2005). But Blockbuster’s competitor Netflix, a 1997 startup, developed a new strategy for video delivery. Netflix limited itself to video-on-demand online and a mail-order service, calculating that customers would find its product more convenient. By 2011 Netflix had over 26 million subscribers whereas Blockbuster went bust in 2010 (Gershon, 2013). Success did not make Blockbuster innovate. Rather, intent on simply maintaining their poll position in the market, it rested on its laurels. Blockbuster missed at least two key chances to upgrade to the online video-selling strategy, both of which might have secured the future of the company. In 2000, Blockbuster CEO Antioco and his team declined Netflix’s proposal to purchase Netflix for a mere $50 million. Instead, Blockbuster chose to ignore the threat from Netflix and stick to its rental-shop strategy. In 2004, Antioco, who had become convinced that Netflix was a threat, drew up a plan for major changes to the rental-shop system and to develop an online platform strategy. But this idea was rejected by his board and Antioco was fired; the board thought that implementing the plan would be too costly and damage
profitability. Too late did the company realize its mistake and start to make changes, by which time the damage had been done.

Although the importance of idea evaluation and selection are recognized, both practitioners and researchers focus mostly on creative idea generation and neglect idea evaluation and selection. Thus far, idea evaluation and selection have been studied infrequently (for a summary, see Rietzschel & Ritter, in press), compared with idea generation. The same is the case with practice—idea evaluation and selection are largely disregarded. In 2006, the American Management Association surveyed 1356 global managers about innovation. The respondents identified the ability to select right ideas as one of the key factors for developing an innovative culture. Surprisingly however, most of the managers admitted that their companies did not have obvious strategies for selecting or even evaluating ideas (American Management Association, 2006).

**People are poor at selecting creative ideas**

Why are idea evaluation and selection neglected? One important reason may be that people believe that, once they have ideas at hand, they will be able to recognize and select the most creative ideas for implementation (Rietzschel, Nijstad, & Stroebe, 2010). However, this confidence is misplaced, especially with respect to idea selection, as both research (e.g., Putman & Paulus, 2009; Rietzschel, Nijstad, & Stroebe, 2010, 2014; Ritter, van Baaren, & Dijksterhuis, 2012) and practice (e.g., Ahmed, 2005; Lucas & Goh, 2009) indicates that people often perform sub-optimally when it comes to selecting creative ideas.

Both anecdotes and life experiences show that it is easy to underestimate creative ideas. People often have to fight hard to defend an original idea. People with
original ideas are subject to social rejection. They might find themselves in prison or even be murdered for their creativity, if their ideas transgressed the border of the socially acceptable. Giordano Bruno, after all, was burnt to death for insisting on the veracity of his theory of the cosmos, and Galileo experienced a few sticky moments. In the modern world, although there is generally more tolerance towards new ideas, creative ideas or products are often initially disregarded or even rejected. For example, Barry J. Marshall and J. Robin Warren discovered that bacteria cause stomach ulcers, a finding for which they were eventually awarded the Nobel Prize in Physiology or Medicine in 2005. However, back in the 1980s, when they proposed their theory, the idea was derided, since most scientists held that the acidic environment of the stomach was such that it could not support bacteria (Ahmed, 2005).

These well-known historical examples are supported by research findings that consistently show that people perform sub-optimally when evaluating and, especially, selecting creative ideas. People tend to underestimate novel ideas (Licuanan, Dailey, & Mumford, 2007, Mueller, Melwani, & Goncalo, 2011), and even deem them to be inappropriate (Benedek et al., 2016). They prefer commonplace to original ideas (Blair & Mumford, 2007). And when creative ideas are chosen, their selection criteria hardly gives them a better chance of finding a winner than if they had rolled dice: The ideas they choose are not more creative than the average creativity of all available ideas (Faure, 2004; Putman & Paulus, 2009; Rietzschel et al., 2006, 2010, 2014; Ritter et al., 2012). This suboptimal performance is the rule, whether the pool of ideas is small or large (Putman & Paulus, 2009; Reiter-Palmon & Arreola, 2015; Rietzschel et al., 2014).
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**The Present Dissertation**

In the present dissertation, I aim to expand the research field of creative idea selection by investigating several factors that may influence individuals’ creative idea selection performance. These factors are *processing mode* (intuitive processing vs. deliberative processing), *selection strategy* (choosing vs. elimination vs. paired comparison), and *selection type* (intrapersonal selection vs. interpersonal selection). Creative ideas can either be selected by the person who generated the ideas in the first place (intrapersonal selection) or by another person (interpersonal selection). In Chapters 2 and 3, I focus on interpersonal selection and investigate the effects of processing mode and selection strategy. In chapter 4, I investigate whether selection type can influence idea selection performance.

**Chapter 2 – Creativity: Intuitive Processing Outperforms Deliberative Processing in Creative Idea Selection**

When making decisions, people commonly use two distinct modes to process information—*intuitive processing* and *deliberative processing*. Intuitive processing is rapid, unconscious, and automatic, while deliberative processing is slow, conscious, and analytical. That processing mode may have an important role in the selection of creative ideas is suggested by both practice and research evidence. When selecting creative ideas, intuitive processing is often favored over deliberative processing by successful idea-screeners of various professions, such as early-stage investors (Huang & Pearce, 2015), filmmakers (Sinclair, 2012), and top chefs (Stierand & Dörfler, 2016). The existing literature also shows that intuitive processing is beneficial to both creative ideation and decision-making. However, the effect of the processing mode on creative idea selection has not yet been studied.

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Chapter 2 details two studies undertaken to investigate the relationship between processing mode and creative idea selection. In each study, participants were presented with 18 ideas to solve a societal problem and instructed to select the six most creative ideas, either intuitively or deliberatively. The results show that people select more creative ideas in the intuitive-processing mode rather than the deliberative -processing mode. Moreover, the studies indicate that intuitive processing leads to the selection of creative ideas, whereas deliberative processing leads to the selection of mainstream ideas. To the best of my knowledge, my research is the first attempt to study the role of processing mode in creative idea selection. My findings suggest the value of intuitive processing as a means to facilitate creative idea selection performance.

Chapter 3 – Creativity: The Effect of Selection Strategy on Creative Idea Selection Performance

When selecting the most creative idea from a pool of ideas, people use different strategies, such as choosing (i.e., selecting the most creative idea by choosing it directly), elimination (i.e., selecting the most creative idea by a stepwise removal of the less creative ones), and paired comparison (i.e., a series of choices made among pairs of ideas). However, it is still unknown whether different strategies lead to different selection performances. In Chapter 3, I report experiments on the effect of selection strategy on creative idea selection performance. I conducted four studies where participants selected the most creative idea out of 10 ideas using one of the three selection strategies. A meta-analysis was conducted on the data from the four studies, and it showed that paired comparison outperforms choosing and elimination in creative idea selection. The current findings provide the first evidence
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that selection performance differs with different selection strategies. I conclude that in order to enhance creative idea selection, people may consider using the paired comparison strategy.

Chapter 4 – Creativity: Intrapersonal and Interpersonal Selection of Creative Ideas

Once an individual has generated several ideas to solve a problem, the most creative idea can be selected by either the idea-generator (intrapersonal selection) or by another person (interpersonal selection). These two types of selection frequently happen in practice. But do intrapersonal selection and interpersonal selection of the most creative idea lead to different levels of performance? Previous research on intrapersonal and interpersonal selection is scarce and has not used the creativity of the selected idea as a dependent variable (Berg, 2016; Watts, Steele, Medeiros, & D. Mumford, 2017). In Chapter 4, I describe how selection type may influence the creativity of the selected idea. Participants in the study were paired and asked to generate six ideas to solve two different problems. They performed two idea selection tasks—intrapersonal selection and interpersonal selection, and selection performances were compared. In intrapersonal selection, the generator of ideas selected the most creative idea from his/her own ideas; in interpersonal selection, his/her partner made the selection from the same pool of ideas. The results showed no significant effect of selection type on creative idea selection performance. Both intrapersonal and interpersonal idea selection lead to the selection of mainstream ideas. The current research is the first to investigate the relationship between selection type and creativity of the selected idea. My findings suggest that selecting creative ideas is difficult, and that more research should be conducted to study creative idea selection.
Theoretical Contributions

Because creative idea selection is relatively understudied, little is known about what factors can influence creative idea selection. The present dissertation expands our knowledge of creative idea selection by studying several potentially influential factors in creative idea selection, including processing mode, selection strategy, and selection type. I found that processing mode and selection strategy can impact creative idea selection while intrapersonal and interpersonal selection do not. The present dissertation has several key theoretical implications.

In Chapter 2, I observe that processing mode affects creative idea selection—intuitive processing outperforms deliberative processing in the selection of the most creative ideas. Besides, I show that when assessing an idea’s creativity, intuitive processing enables people to rely on both originality and usefulness, but mainly originality, whereas deliberative processing encourages people merely to focus on usefulness. My findings contribute to the understanding of the creativity bias—the phenomenon that people desire creativity but perform sub-optimally at recognizing creative ideas (e.g., Faure, 2004; Rietzschel et al., 2010, 2014). Previous research has studied the underlying mechanisms of the bias as well as means to overcome it; however, the bias has not been well-understood (Mueller et al., 2011) and only a few means have been found to facilitate creative idea selection (De Buisonjé, Ritter, de Bruin, ter Horst, & Meeldijk, 2017; Rietzschel et al., 2014; Ritter et al., 2012). My findings suggest that processing style plays an important role in the formation of the creativity bias. When selecting creative ideas for implementation, people intuitively favor creative ideas. However, as the goal of creative idea selection is to select ideas that are not only original but also effective and feasible for practical implementation, people have a need to reduce uncertainty during idea selection. Therefore, they may
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scrutinize creative ideas and magnify the risks of these ideas. In comparison, commonplace ideas, which are seemingly more feasible, may undergo less analytical evaluation. Consequently, people deliberatively reject novel ideas but select mainstream ideas for implementation. Thus, compared with deliberative thinking, following intuition is a more effective means for creative idea selection.

So far, creativity researchers have studied idea selection solely via the means of the choosing strategy—typically, they instructed participants to make the selection by choosing the optimal ideas directly—and neglected the role of selection strategy in creative idea selection. Previous research showed that people perform poorly when using the choosing strategy to select creative ideas. Thus, the choosing strategy seems not to be optimal for creative idea selection. But it is unclear whether people’s selection performance will change when using other selection strategies. In Chapter 3, I describe how I found that selection strategy affects both idea selection performance and how people feel about the selection task. Specifically, paired comparison outperforms choosing and elimination in creative idea selection, but, at the same time, selection using paired comparison is more tiring than selection using choosing and elimination. In addition, elimination is rated more difficult than choosing and paired comparison. These findings suggest paired comparison is beneficial for creative idea selection, but that people should use it smartly, that is, in a way less likely to lead to tiredness. Besides, choosing is shown to be not optimal for creative idea selection, and I discovered the reason why people still like to use choosing—it is least effortful among the three strategies.

In addition, I verify a close relation between idea evaluation and idea selection: Selected ideas are evaluated more creatively than the unselected ideas, irrespective of whether idea evaluation happens before or after idea selection. In
Chapter 2 (two studies) and 3 (four studies), both idea evaluation and selection are considered, and the described evaluation-selection relation is observed in five of the six studies. Moreover, in Chapter 2, I also observe that evaluations of originality and usefulness can be influenced by processing mode. Specifically, people under intuitive processing evaluate the selected ideas to be more original but not necessarily more useful than the unselected ideas, whereas people under deliberative processing behave in the opposite way—they evaluate the selected idea to be more useful but identically original to unselected ideas. In Chapter 3, it is concluded that selection strategy does not affect idea evaluation performance.

Creativity is generally valued, so various techniques (e.g., brainstorming) have been developed to facilitate creative idea generation and they have been shown to be effective. But creative idea selection is still challenging. Previous research has consistently shown that people are poor at selecting creative ideas (Faure, 2004; Putman & Paulus, 2009; Rietzschel et al., 2006, 2010, 2014). This phenomenon is once again observed in Chapter 4. I found that people are unable to select better than chance level—the idea selected is not more creative than an average idea, no matter whether people select from among their own or others’ ideas. In Chapter 2, I found that intuitive processing is beneficial for creative idea selection, as under intuitive processing people can select better than chance level, while under deliberative processing they cannot. In Chapter 3, I found that people’s selection effectiveness can be affected by the idea pool used for the selection task. When people select ideas from a certain idea pool, they cannot select better than chance level; however, when they select from other idea pools, they are able to select ideas that are more creative than an average idea, no matter which selection strategy they use. In addition, besides selection type, previous research has shown that several other factors do not affect
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idea selection performance (Faure, 2004; Putman & Paulus, 2009; Rietzschel et al., 2010). This suggests that idea selection is a complex process and altering selection performance is not easy. Therefore, more research is encouraged to investigate creative idea selection.

**Practical Implications**

Given that creative ideas are generally valued nowadays, people from different fields frequently encounter situations in which they must select creative ideas. Although practitioners understand the importance of creative idea selection, they know little about how to make creative idea selection more effective. With little knowledge to refer to, they may select creative ideas on the basis of personal preferences. They may prefer a certain processing mode, selection strategy, or type of selection, without knowing whether their preferences are beneficial or detrimental for selecting creative ideas. My findings suggest that creative idea selection performance can be altered under the influence of several factors. People select ideas of different creativity when selecting under different processing modes, or using different selection strategies. Moreover, in Chapter 4, I show that intrapersonal and interpersonal selection seem to yield identical and suboptimal selection outcomes. These findings, as well as those in previous research, provide important knowledge based on which practitioners may improve their performance of creative idea selection.

Successful practitioners, like angel investors, base their decisions largely on intuitive thinking (Huang & Pearce, 2015). My findings in Chapter 2 provide scientific evidence to support this practical belief in intuition. This message is essential, as people are inclined to regard creative ideas analytically during idea
selection, so as to be certain that they have selected ideas that are suitable for implementation. Making decisions based on gut feelings is often regarded as irresponsible and thought to lead to mistakes. However, whether trust in deliberation and doubt about intuition are appropriate when it comes to selecting creative ideas is an unexamined question. My findings suggest that since deliberative processing impairs creative idea selection in relation to intuitive processing, practitioners might consider the role of intuitive processing in their selections. To evaluate ideas without bias and successfully to select the most creative ones for implementation, idea gatekeepers may need to change their minds—try not to be too reflective, but to rely more on their gut feelings.

When selecting the most creative idea in practice, individuals have their preferred strategies. It is very natural and facile to choose the most creative one directly. Sometimes, to avoid mistakes, they select the most creative idea by eliminating those that seem the most uncreative. In comparison, paired comparison may be the least frequently used idea selection strategy, since it is more time-consuming and costs more cognitive effort (i.e., multiple selections and a preference order needs to be calculated by their selections). In Chapter 3, I show that although people tire more easily when using the paired comparison strategy, their selection performance is better than those who use the choosing and the elimination strategies. Based on these findings, I suggest that people may consider adopting the paired comparison strategy for creative idea selection, but, at the same time, that they also need to find ways to avoid its disadvantages for better selection effectiveness.

Given the competitive nature of modern environments, creative idea selection has been viewed as vital for successful innovation. Benefiting from ideation research and techniques, we are rich in ideas, but still poor at selecting the most creative ones
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for implementation. Researchers and practitioners have not paid enough attention to idea selection, and, as a result, little is known about creative idea selection and its enhancement. However, the findings of the present dissertation broaden our knowledge of creative idea selection and have important practical implications.
CHAPTER 2

Creativity: Intuitive Processing Outperforms Deliberative Processing in Creative Idea Selection*

Chapter 2 - Processing Mode and Creative Idea Selection

Abstract

Creative ideas are highly valued, and various techniques have been designed to maximize the generation of creative ideas. However, for actual implementation of creative ideas, the most creative ideas must be recognized and selected from a pool of ideas. Although idea generation and idea selection are tightly linked in creativity theories, research on idea selection lags far behind research on idea generation. The current research investigates the role of processing mode in creative idea selection. In two experiments, participants were either instructed to intuitively or deliberatively select the most creative ideas from a pool of 18 ideas that systematically vary on creativity and its sub-dimensions originality and usefulness. Participants in the intuitive condition selected ideas that were more creative, more original, and equally useful than the ideas selected by participants in the deliberative condition. Moreover, whereas selection performance of participants in the deliberative condition was not better than chance level, participants in the intuitive condition selected ideas that were more creative, more original, and more useful than the average of all available ideas.

Keywords: Idea selection; Processing mode; Creativity; Decision-making; Intuition
Chapter 2 - Processing Mode and Creative Idea Selection

Introduction

Creativity is one of the most important cognitive skills in our fast-changing world (Ananiadou & Claro, 2009; Geisinger, 2016), and various techniques have been designed to maximize the generation of creative ideas over the past decades. However, before creative ideas can be actually implemented, the most creative ideas must be selected from a larger pool of ideas. Although idea generation and idea selection are tightly linked in creativity theories (e.g., Basadur, 1995; Finke, Ward, & Smith, 1992; Guilford, 1967; Lubart, 2001; Maier, 1967; Reiter-Palmon & Illies, 2004; Runco & Basadur, 1993; Runco & Vega, 1990; Sawyer, 2006; Simonton, 2003; Sternberg, 2006), research on idea evaluation and idea selection lags far behind research on idea generation (Amabile & Mueller, 2008; Herman & Reiter-Palmon, 2011; Hunter, Friedrich, Bedell, & Mumford, 2006; Kozbelt, 2007; Rietzschel, et al., 2010; Runco & Smith, 1992). This is unfortunate, as history is replete with cases in which creative ideas were first unwisely rejected. For example, flying, personal computers, and online shopping were first deemed to be crazy, but eventually became big successes that changed our world. In addition, the scarce research on idea selection has shown that people perform poorly at selecting creative ideas. They tend to select mainstream ideas at the expense of creative ideas (Faure, 2004; Putman & Paulus, 2009; Rietzschel, et al., 2006), even when they are explicitly instructed to select creative ideas (Rietzschel et al., 2010).

Thus far, few studies have been conducted to investigate creative idea selection. In comparison, idea evaluation, which is closely related to idea selection, has attracted more attention. In the literature on the creative problem-solving process, researchers have stated that idea evaluation happens after idea generation and before the selection of ideas for implementation (e.g., Amabile, 1983; Herman & Reiter-
Palmon, 2011). During idea evaluation, available options are assessed against certain standards (Hunter et al., 2006) for implementation, rejection, or revision (Mumford, Lonergan, & Scott, 2002). Creativity researchers have observed errors in the evaluation of ideas, in that people tend to underestimate the originality of ideas (Licuanan, et al., 2007). They prefer commonplace ideas but disregard original ideas (Blair & Mumford, 2007). To investigate how people’s evaluation performance can be improved, several studies have been conducted and some means have been examined to be effective. For example, Blair and Mumford (2007) found that participants are more likely to prefer original ideas when evaluation criteria are loose and time pressure is high. In another research, Mueller and colleagues (2014) found that participants with a high-level abstract construal can evaluate a creative idea more accurately than participants with a low-level concrete construal.

Research has thus far shown that improving creative idea selection is difficult (Faure, 2004; Rietzschel, et al., 2014). Researchers (Faure, 2004; Putman & Paulus, 2009; Rietzschel et al., 2006) studied idea selection performance by nominal groups (in which members perform tasks individually) and interactive groups (in which members perform tasks interactively). They found that the ideas selected by both groups were only of average originality and feasibility. In other words, participants did not select better than chance. Other manipulations, such as providing instructions to select creative ideas (i.e., participants were asked to select an idea that is both original and feasible; Rietzschel et al., 2010), providing quality ratings before selection (participants had to rate the quality of available ideas; Rietzschel et al., 2010), and using a narrow (versus broad) problem for which ideas were generated (i.e., a narrowly defined problem that is a subcategory of the overall problem; Rietzschel et al., 2014) had no effect on selection performance. Explicitly instructing participants to
select the most creative (versus the best) ideas did facilitate the selection of more original ideas, but it also decreased participants’ satisfaction and the rated effectiveness (i.e., the estimated likelihood that the idea will turn out to be an improvement) of the chosen ideas (Rietzschel et al., 2010). The failure of the earlier mentioned efforts suggests that creative idea selection is still far from being well understood and needs more exploration.

Selecting truly creative ideas is difficult as there are often no prototypes or explicit criteria against which an idea can be judged. In fact, the violation of expectations with regard to the solution is often at the heart of perceiving an idea as creative (for example, see research on effective surprise; Wiggins & Bhattacharya, 2014). Intuition is a common tool for coping with ill-defined situations (Pétervári, Osman, & Bhattacharya, 2016) and hence, in the idea selection phase, intuition may help people to recognize original contributions and to judge whether an idea will be useful. Sinclair (2012) has shown that filmmaking professionals use intuitive expertise as a means to create unity amongst film crew members, and employ intuitive foresight for selecting projects and spotting talents. Eling and colleagues (2015) investigated new product idea evaluation decisions during idea generation activities, and revealed that combining intuition and rationality leads to both the highest decision quality and improved decision speed. However, empirical research on the role of intuitive and deliberative processing in the creative idea selection process is lacking. Let us have a closer look at intuition and deliberation.

According to dual-processing theories, people commonly process information by using two distinct modes: intuitive processing and deliberative processing—intuitive processing is rapid, unconscious, and automatic, while deliberative processing is slow, conscious, and analytical (Gigerenzer, 2007; Wilson & Schooler,
So far, many studies have been conducted to understand and distinguish the effect of processing mode in both decision making (Phillips, Fletcher, Marks, & Hine, 2016) and creative idea generation (for reviews, see Pétervári et al., 2016; Ritter & Dijksterhuis, 2014). Intuitive processing has been shown to outperform deliberative processing in various judgment and decision-making circumstances, such as deception detection (Albrechtsen, Meissner, & Susa, 2009) and complex decision-making (e.g., Usher, Russo, Weyers, Brauner, & Zakay, 2011). Meanwhile, intuition has also been identified to be important in idea generation of creative professionals, such as Nobel laureates (Marton, Fensham, & Chaiklin, 1994) and Michelin chefs (Stierand & Dörfler, 2016). Moreover, this beneficial role of intuition has been supported by empirical evidence, which demonstrates that intuitive individuals are able to generate solutions of higher quality and elegance (Eubanks, Murphy, & Mumford, 2010) and of higher originality (Garfield, Taylor, Dennis, & Satzinger, 2001) to specific problems than deliberative people. Moreover, an intuitive creativity technique could boost the generation of higher original and paradigm-modifying solutions than a deliberative technique (Garfield et al., 2001). However, the role of processing mode in creative idea selection, which combines decision making and creativity, has been scarcely studied (Eling, et al., 2015; Pétervári et al., 2016). Interestingly, however, in many circumstances practitioners use their intuition when searching for highly original and useful ideas (Sadler-Smith, 2016; Stierand & Dörfler, 2016). For example, angel investors, who aim to find extraordinarily profitable investments by providing capital for a business start-up, report a heavy reliance on intuition in making their decisions (Huang & Pearce, 2015). Why may an intuitive processing style be beneficial for creative idea selection?

Creative ideas are generally characterized to be both original and useful.
Chapter 2 - Processing Mode and Creative Idea Selection

(Hennessey & Amabile, 2010; Runco & Jaeger, 2012), and when selecting creative ideas one should take both the originality and usefulness of the ideas into consideration. However, it is likely that during creative idea selection, people do not focus on originality and usefulness simultaneously, but follow a sequential order—they first focus on originality and, thereafter, on usefulness. Originality is viewed as the hallmark of creativity (Runco & Charles, 1993), and it is often associated with positive concepts such as intelligence (Niu & Sternberg, 2006). Therefore, it is not surprising that people value originality (Rietzschel et al., 2010) and even at an implicit level favor creativity and originality above practicality and usefulness. Using an Implicit Association Test (IAT), Mueller and colleagues (2011) showed that in conditions of low uncertainty (or when a high tolerance for uncertainty was evoked), participants associated positive words more often with originality-related words (e.g., novel) relative to usefulness-related words (e.g., functional). Finally, original ideas are salient, and our brain gives priority to process salient, novel, and unexpected stimuli (Corbetta & Shulman, 2002). Therefore, when asked to select creative ideas, people may, at first place, intuitively focus on originality. In support of this idea, Rietzschel and colleagues (2010) have shown that when participants were instructed to select creative ideas (without mentioning its two sub-dimensions), they relied heavily on originality.

The goal of idea selection, however, is to select an idea that is not only original but also has the potential to be implemented. Therefore, the available ideas also have to be evaluated on their usefulness. Original ideas are by definition relatively new and untested, and the more original an idea is, the higher the uncertainty (Amabile, 1996), perception of risk (Rubenson & Runco, 1995; Simonton, 1984), likelihood of social rejection (Nemeth, 1986), and doubts about whether the
idea can be realized (Metcalfe, 1986). Due to the uncertainty associated with original ideas, evaluating the usefulness of original ideas may elicit deeper and more analytical processing than when evaluating the usefulness of mainstream ideas. The existing literature has identified a positive relation between deliberative decision-making tendency and risk aversion. It has been shown that deliberative thinkers are more risk-aversive than intuitive thinkers, and that in risky and uncertain decision making environments deliberative processing is more likely to lead to conservative and risk-aversive decisions (Butler, Guiso, & Jappelli, 2014). Therefore, during creative idea selection, deliberative thinkers may focus on evaluating the potential risks of the available ideas. As a consequence, they may overestimate highly useful ideas of average originality, while underestimating original high-quality ideas. Mueller and colleagues (2011) showed that under condition of high uncertainty or when a low tolerance for uncertainty was evoked, participants were more implicitly biased against originality relative to usefulness. Also, participants in the low-uncertainty-tolerance condition evaluated creative ideas as less creative than those in the high-uncertainty-tolerance condition. Importantly, it has been shown that manipulating reliance on intuition can reduce risk aversion (Butler, Guiso, & Jappelli, 2013). By being less risk-aversive during creative idea selection, intuitive processing may lead to a more accurate evaluation of ideas and result in the preference of high-quality original ideas relative to mainstream ideas. As creativity correlates higher with originality than with usefulness (Diedrich, Benedek, Jauk, & Neubauer, 2015), we hypothesize that intuitive processing outperforms deliberative processing in selecting creative ideas. Two experiments were designed to test this hypothesis. In both experiments participants had to select the six most creative ideas from 18 possible solutions to a problem, and selection instructions were manipulated to foster an
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intuitive or deliberative processing mode during idea selection (Dane, Rockmann, & Pratt, 2012).

Experiment 1

Method

Participants and Design

A total of 87 (64 female, 23 male) participants between the ages of 18 and 32 years old ($M = 22.38, SD = 3.07$) gave informed consent to participate in the study, which was conducted according to the principles expressed in the Declarations of Helsinki. All the participants were Dutch speaking and recruited for voluntary participation via the online research participation system (Sona) of Radboud University. Participants were given a choice of earning course credits or €5 for their participation.

A between-subjects design was used with processing mode (intuitive vs. deliberative) as independent variable and idea evaluation and idea selection performance as dependent variables. Participants were randomly assigned to one of two between-subjects conditions, that is, the intuitive condition ($n = 44$) or the deliberative condition ($n = 43$). In the intuitive condition, participants were instructed to intuitively select the most creative ideas, whereas in the deliberative condition, participants were instructed to select the most creative ideas on the basis of a careful analysis. Two participants in the intuitive condition were excluded from the analyses as they did not follow the task instructions. The remaining 85 participants (62 female, 23 male; 42 in the intuitive condition, 43 in the deliberative condition) had a mean age of 22.34 years ($SD = 3.10$).
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**Procedure**

Participants were first greeted and then ushered to an individual cubicle. While being seated in the cubicle, the experimenter explained that all task instructions are provided on the computer screen, that the participant can contact the experimenter at any time (e.g., to ask for clarification), and that the experiment will last approximately 30 minutes. Participants were randomly assigned to either the intuitive condition or the deliberative condition by the computer program. In both conditions, participants performed two tasks—an idea evaluation and an idea selection task—and they answered several questions. Finally, participants were thanked, debriefed, and rewarded for their participation.

All parts of the experiment were identical for both conditions, except for the task instructions prior to the idea evaluation and the idea selection task. Importantly, before both tasks, that is, before the evaluation task and before the selection task, participants’ processing mode was manipulated by means of verbal instructions. In the intuitive condition, participants were instructed to intuitively evaluate and select the ideas. In the deliberative condition, participants were instructed to carefully evaluate and select the ideas.

**Materials**

**Idea pool.**

To generate a pool of ideas from which participants in this experiment could select, a separate sample of 40 participants were asked to generate ideas to solve a problem (i.e., how to encourage more people to take the train; see De Buisonjé, et al., 2017). One-hundred-six ideas were collected. Overlapping ideas were trimmed and 72 ideas remained. These ideas were then evaluated by 10 creativity experts (e.g.,
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**Idea selection task.**

Participants had to select six ideas from the idea pool. For each of the 18 ideas in the idea pool, expert ratings of creativity, originality, and usefulness are available. Based on a 3 (originality: low, medium, high) by 3 (usefulness: low, medium, high) idea matrix, the six most creative ideas were identified. In the selection task, participants were first informed that a creative idea has to meet two criteria—it has to be both original and useful. Thereafter, participants were presented with the problem statement and the 18 ideas simultaneously. The ideas were presented in the form of a 3 (column) by 6 (row) idea matrix where the position of the ideas was randomized. Finally, they had to select the six most creative ideas.

**Idea evaluation task.**

In the beginning of the evaluation task, participants were informed that a creative idea has to be both original and useful. During the evaluation task, participants were presented with the problem statement and the 18 ideas, and they had to evaluate all the ideas first on creativity, then on originality, and finally on
usefulness on a 7-point scale (1 = not at all, 7 = very much). In each evaluation session, the order of the ideas was randomized.

Questions.

**Manipulation check.** To check whether the manipulation was successful, an implicit measure and an explicit measure were used. The implicit measure was the duration of the selection task. Participants in the intuitive condition were expected to make faster selections than those in the deliberative condition. The explicit measure was twofold. First, participants had to rate whether they evaluated and selected the ideas in an intuitive way or a deliberate way on a 7-point scale, ranging from 1 (very intuitive) to 7 (very deliberative). Thereafter, they had to answer five manipulation check items (e.g., “I selected ideas that felt right to me”, see Dane, Baer, Pratt, & Oldham, 2011). These items were rated on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Responses on the five items were averaged (alpha reliability = .78). Higher scores indicate that participants used a more deliberative processing style, while lower scores indicate a more intuitive processing style.

**Demographics.** Participants’ gender, age, and educational background were assessed.

**Dependent Variables**

**Idea selection.**

Creative idea selection performance was measured by five different variables: the creativity of the selected ideas, the originality of the selected ideas, the usefulness of the selected ideas, the number of the optimal ideas selected, and the selection effectiveness.
Chapter 2 - Processing Mode and Creative Idea Selection

The *creativity of the selected ideas* measures the creativity (based on expert ratings) of the six ideas that were selected as the most creative ideas. Per participant, the average creativity of the six selected ideas was calculated. In addition, per participant, the average originality and the average usefulness of the six selected ideas were calculated, resulting in the variables the *originality of the selected ideas* and the *usefulness of the selected ideas*. The *number of the optimal ideas selected* was measured by calculating how many of the six selected ideas can be considered optimal ideas, namely, the six ideas with the highest creativity according to the expert ratings. All dependent variables were compared between conditions to examine the effect of processing mode on idea selection performance.

The *selection effectiveness*, that is, whether participants selected better than chance level, was tested within each condition by comparing the creativity, originality, and usefulness of the six selected ideas with the mean creativity, originality, and usefulness of the available 18 ideas.

**Idea evaluation.**

Idea evaluation performance was measured by the *selection-evaluation consistency*. The *selection-evaluation consistency* examines whether participants selected ideas that they had evaluated as the most creative, by comparing participants’ averaged creativity evaluation of the selected ideas with that of the unselected ideas. Moreover, the same comparisons on the originality and the usefulness evaluation indicate whether or not participants relied on originality or/and usefulness when selecting the six ideas out of the 18 ideas. For example, if participants evaluated the selected ideas identically original but more useful than the unselected ideas, it means they referred to usefulness when selecting creative ideas.
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Results & Discussion

Manipulation Check

The key manipulation is eliciting the intuitive versus deliberative processing mode. The manipulation-check variables include the two explicit measurements of processing tendency and the duration of the selection task. A MANOVA on these variables showed a significant effect of processing mode, \( F(3, 81) = 93.34, p < .001, \eta_p^2 = .78 \). Separate ANOVAs (see Table 1) revealed significant effects of processing mode on both self-report manipulation-check measurements as well as on selection latency. As shown in Table 1, compared to participants in the deliberative condition, participants in the intuitive condition reported a more intuitive selection and used less time to finish the idea selection task.

Table 1

Descriptive Statistics for Manipulation Check Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intuitive ((n = 42))</th>
<th>Deliberative ((n = 43))</th>
<th>(F(1, 83))</th>
<th>(p)</th>
<th>(\eta_p^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-item manipulation check</td>
<td>3.26 (1.48)</td>
<td>5.70 (0.83)</td>
<td>87.78</td>
<td>&lt;.001</td>
<td>.51</td>
</tr>
<tr>
<td>Five-item manipulation check</td>
<td>2.40 (0.60)</td>
<td>4.32 (0.49)</td>
<td>260.93</td>
<td>&lt;.001</td>
<td>.76</td>
</tr>
<tr>
<td>Selection duration</td>
<td>42.16 (18.58)</td>
<td>77.68 (86.31)</td>
<td>6.81</td>
<td>.011</td>
<td>.076</td>
</tr>
</tbody>
</table>

Note. The table reports means, with standard deviations in parentheses. The unit of selection duration is second.

Idea Selection

Creativity of selected ideas. An independent samples t-test on the creativity of the six selected ideas revealed that, participants in the intuitive condition selected ideas that were more creative than participants in the deliberative condition (see Figure 1), \( t(83) = 3.82, p < .001, \) Cohen’s \( d = 0.83 \). Furthermore, independent t-tests
on the expert-rated originality and usefulness showed that participants in the intuitive condition selected ideas that were more original ($t(83) = 3.93, p < .001$, Cohen’s $d = 0.85$), but slightly less useful ($t(83) = 1.80, p = .075$, Cohen’s $d = 0.39$) than those in the deliberative condition.

![Graph showing mean rating by experts for creativity, originality, and usefulness by processing mode.]

*Figure 1:* Expert rating of creativity, originality, and usefulness of the six selected ideas by processing mode. Error bars represent standard errors.

***$p < .001$. †$p < .1$

**Number of optimal ideas selected.** An independent t-test on the number of the optimal ideas selected showed that, participants in the intuitive condition ($M = 3.26$, $SD = 1.23$) selected a significantly larger number of ideas from the six optimal creative ideas than participants in the deliberative condition ($M = 2.35$, $SD = 1.41$), $t(83) = 3.17, p = .002$, Cohen’s $d = 0.69$.

**Selection effectiveness.** To examine selection effectiveness—whether participants were able to select better than chance level—a one-sample t-test was
Chapter 2 - Processing Mode and Creative Idea Selection

carried out for each condition, with the average expert-rated creativity of the six
selected ideas as the test variable, and the average expert-rated creativity of all the 18
ideas as the test value. The results showed that participants in the intuitive condition
(M = 3.11, SD = 0.37) selected ideas that were more creative (t(41) = 6.95, p < .001,
Cohen’s d = 1.07) than the total idea set (M = 2.72, SD = 0.84), whereas participants
in the deliberative condition (M = 2.76, SD = 0.48) selected ideas that were not more
creative (t = 0.54, p = .59, Cohen’s d = 0.08) than the average idea. In other words,
participants in the intuitive condition selected above chance level, whereas
participants in the deliberative condition did not. A one-sample t-test on originality
showed that participants in the intuitive condition (M = 3.37, SD = 0.47) selected
ideas that were more original (t(41) = 5.36, p < .001, Cohen’s d = 0.83) than the idea
set (M = 2.98, SD = 1.02); this difference was not significant (t = 0.75, p = .46,
Cohen’s d = 0.11) for participants in the deliberative condition (M = 2.91, SD = 0.60).
A one-sample t-test on usefulness yielded significant effects for both the intuitive
condition (t(41) = 3.01, p = .004, Cohen’s d = 0.47) and the deliberative condition
(t(42) = 6.19, p < .001, Cohen’s d = 0.94). Participants in both the intuitive condition
(M = 3.38, SD = 0.45) and the deliberative condition (M = 3.55, SD = 0.39) selected
ideas that were more useful than the average idea (M = 3.18, SD = 1.08).

Idea Evaluation

Selection-evaluation consistency. Selection-evaluation consistency, namely,
whether participants selected the ideas that they had evaluated as the most creative
ones, was examined with a 2 (Processing Mode [intuitive, deliberative]) × 2 (Average
Participant-rated Creativity [of the selected ideas, of the unselected ideas]) mixed
model ANOVA (see Table 2). The analysis showed a significant main effect of
within-subjects factor creativity (F(1, 83) = 23.86, p < .001, ηp² = .22), a marginally
significant main effect of between-subjects factor processing mode ($F(1, 83) = 3.95, p = .050, \eta_p^2 = .045$), but no significant creativity $\times$ processing mode interaction effect ($F = 0.011, p = .92, \eta_p^2 < .001$). Specifically, as shown in Table 2, participants in the intuitive condition evaluated ideas generally more creative than those in the deliberative condition. Moreover, participants in both conditions selected ideas that they evaluated more creative.

Similar analyses were also conducted on originality and usefulness (see Table 2). The analysis on originality showed a significant main effect of originality ($F(1, 83) = 6.70, p = .011, \eta_p^2 = .075$), a significant originality $\times$ processing mode interaction ($F(1, 83) = 5.55, p = .021, \eta_p^2 = .063$), but no significant main effect of processing mode ($F(1, 83) = 1.07, p = .30, \eta_p^2 = .013$). Simple effects analysis showed that participants in the intuitive condition selected ideas evaluated more original ($F(1, 83) = 12.08, p = .001$) than the unselected ideas; this difference was not significant for those in the deliberative condition ($F = 0.03, p = .87$).

The analysis on usefulness showed a significant main effect of usefulness ($F(1, 83) = 6.23, p = .015, \eta_p^2 = .070$), a main effect of processing mode ($F(1, 83) = 8.61, p = .004, \eta_p^2 = .094$), and a marginally significant usefulness $\times$ processing mode interaction ($F(1, 83) = 3.78, p = .055, \eta_p^2 = .044$). Simple effects analysis showed that participants in the deliberative condition selected ideas evaluated more useful ($F(1, 83) = 9.97, p = .002$) than the unselected ideas, however, this difference was not significant for those in the intuitive condition ($F = 0.15, p = .70$).
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Table 2

*Descriptive Statistics for Selection-evaluation Consistency*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intuitive (n = 42)</td>
<td>Deliberative (n = 43)</td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selected ideas</td>
<td>4.55 (0.24)</td>
<td>4.33 (0.32)</td>
<td></td>
</tr>
<tr>
<td>Unselected ideas</td>
<td>3.97 (1.12)</td>
<td>3.77 (0.86)</td>
<td></td>
</tr>
<tr>
<td>Originality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selected ideas</td>
<td>4.91 (0.53)</td>
<td>4.42 (0.58)</td>
<td></td>
</tr>
<tr>
<td>Unselected ideas</td>
<td>4.12 (1.33)</td>
<td>4.38 (0.97)</td>
<td></td>
</tr>
<tr>
<td>Usefulness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selected ideas</td>
<td>4.68 (0.60)</td>
<td>4.69 (0.66)</td>
<td></td>
</tr>
<tr>
<td>Unselected ideas</td>
<td>4.59 (1.07)</td>
<td>4.00 (0.97)</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The table reports means, with standard deviations in parentheses.

The results of Experiment 1 showed that intuitive processing enhances creative idea selection performance compared to deliberative processing. Specifically, intuitive processing led to the selection of ideas that are more creative and original but slightly less useful, in comparison to deliberative processing. Moreover, by using intuitive processing, participants were able to select ideas more creative, more original, and more useful than the average idea, while deliberative mode influenced participants to select ideas merely more useful but not more creative and original than the average idea.

**Experiment 2**

To replicate the finding of Experiment 1 that intuitive processing facilitates creative idea selection compared with deliberative processing, a second experiment was conducted. In Experiment 1, the evaluation task was placed before the selection task to increase the ecological validity of the acquired findings, as people normally
evaluate ideas before making selections in their daily lives. However, it is still questionable whether the effect of processing mode on idea selection performance was influenced by the preceding evaluation task. To get an uncontaminated performance of creative idea selection under intuitive versus deliberative processing, the order of the tasks was changed in Experiment 2. Specifically, participants had to perform the selection task first and the evaluation task thereafter. Moreover, to investigate whether intuitive processing also outperforms deliberative processing in the selection of the single most creative idea, we asked people to rank order the six selected ideas after they had completed the selection task.

We pre-registered our hypothesis, methods, and data analysis plan via Open Science Framework (see https://osf.io/msh6q/).

Method

Participants and Design

A total of 137 students\(^1\) from Radboud University (111 female, 26 male) aged between 18 and 39 (\(M = 22.30\) years, SD = 3.46) took part in the experiment for course credits or money (€5).

As in Experiment 1, a between-subjects design was employed with processing mode as independent variable, and idea selection and evaluation performance as dependent variables. Participants were randomly assigned to either the intuitive condition (\(n = 68\)) or the deliberative condition (\(n = 69\)). No participants were excluded from the data analyses.

\(^1\) Based on the power analysis (for details, see the pre-registered study plan), we planned to recruit 128 participants. Considering possible exclusions, we actually recruited nine more participants than planned.

\(^2\) In the current research, idea evaluation performance was included for exploratory reasons. It is not directly related to the main research question; thus, the description of the idea evaluation task and all


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**Procedure**

The procedure was identical to Experiment 1, except for two changes. First, the order of the evaluation and the selection task was swapped—participants in both conditions first performed the selection task and then the evaluation task. Second, instead of one phase (i.e., selecting the six most creative ideas) in the selection task, there was an additional phase—participants had to rank order the six selected ideas.

**Materials**

**Idea pool.**

In the current experiment, creative idea selection performance was measured by the same idea pool used in Experiment 1.

**Idea selection task.**

Unlike Experiment 1, the selection in Experiment 2 had two phases. In the first phase, participants had to select the six most creative ideas from the 18 ideas. In the second phase, they had to rank the selected ideas in order of creativity (most creative idea, second most creative idea, etc.).

**Idea evaluation task.**

The idea evaluation task used in the current experiment was the same task as used in Experiment 1.

**Questions.**

All measures were the same as Experiment 1, except that we also recorded the time participants took to rank-order their choices.

**Dependent Variables**

**Idea selection.**

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In the current experiment, creative idea selection performance was measured by the five variables as described in Experiment 1 as well as three additional variables, the \textit{creativity of the most creative idea}, the \textit{originality of the most creative idea}, and the \textit{usefulness of the most creative idea}.

The \textit{creativity of the most creative idea} measures the quality (based on expert ratings) of the idea that was ranked by each participant as the most creative idea in the rank-ordering phase of the idea selection task. In addition, per participant, the originality and the usefulness of the most creative idea were used as variables the \textit{originality of the most creative idea} and the \textit{usefulness of the most creative idea}.

\textbf{Idea evaluation.}

Idea evaluation performance was measured by the same variable as described in Experiment 1.

\section*{Results & Discussion}

\textbf{Manipulation Check}

The four manipulation-check variables included the two explicit measurements and the two implicit measurements of processing tendency. A MANOVA on these variables showed a significant effect of processing mode, $F(4, 132) = 48.21, p < .001, \eta_p^2 = .59$. Separate ANOVAs (see Table 3) revealed significant effects of processing mode on both self-report manipulation-check measurements as well as on selection and rank-ordering latency. Specifically, as shown in Table 3, compared to participants in the deliberative condition, participants in the intuitive condition reported a more intuitive selection, and were faster to finish both the selection phase and the rank-ordering phase of the selection task.
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Table 3

**Descriptive Statistics for Manipulation Check Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intuitive (n = 68)</th>
<th>Deliberative (n = 69)</th>
<th>F(1, 135)</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-item manipulation check</td>
<td>3.10 (1.35)</td>
<td>5.20 (1.04)</td>
<td>104.32</td>
<td>&lt; .001</td>
<td>.44</td>
</tr>
<tr>
<td>Five-item manipulation check</td>
<td>2.45 (0.69)</td>
<td>4.38 (1.02)</td>
<td>166.35</td>
<td>&lt; .001</td>
<td>.55</td>
</tr>
<tr>
<td>Selection duration</td>
<td>65.63 (24.22)</td>
<td>108.56 (72.86)</td>
<td>21.28</td>
<td>&lt; .001</td>
<td>.14</td>
</tr>
<tr>
<td>Rank-ordering duration</td>
<td>31.05 (12.87)</td>
<td>50.76 (36.51)</td>
<td>17.67</td>
<td>&lt; .001</td>
<td>.12</td>
</tr>
</tbody>
</table>

*Note. The table reports means, with standard deviations in parentheses. The unit of durations is second.*

**Idea Selection**

**Creativity of selected ideas.** An independent samples t-test on the expert-rated creativity of the selected ideas showed that, participants in the intuitive condition (compared with participants in the deliberative condition) selected ideas that were more creative, *t*(135) = 2.63, *p* = .010, Cohen’s *d* = 0.45, and more original, *t*(135) = 2.65, *p* = .009, Cohen’s *d* = 0.45. However, there was no statistically significant difference between processing modes on usefulness, *t* = 0.73, *p* = .47, Cohen’s *d* = 0.12. See Figure 2a for a plot.

**Creativity of most creative idea.** An independent t-test on the creativity of the most creative idea showed that the-most-creative idea ranked by participants in the intuitive condition was more creative, *t*(135) = 2.83, *p* = .005, Cohen’s *d* = 0.48, and more original, *t*(135) = 3.52, *p* < .001, Cohen’s *d* = 0.60, than that ranked by participants in the deliberative condition. However, no significant difference between the two conditions was found on the usefulness of the ranked most creative idea, *t*(135) = 1.43, *p* = .15, Cohen’s *d* = 0.24. See Figure 2b for a plot.
Table 3
Descriptive Statistics for Manipulation Check Variables

<table>
<thead>
<tr>
<th>Condition</th>
<th>Variable</th>
<th>Intuitive (n = 68)</th>
<th>Deliberative (n = 69)</th>
<th>F (1, 135)</th>
<th>p</th>
<th>( \eta^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single-item manipulation check</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.10 (1.35)</td>
<td>5.20 (1.04)</td>
<td>104.32</td>
<td>&lt; .001</td>
<td>.44</td>
</tr>
<tr>
<td></td>
<td>Five-item manipulation check</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.45 (0.69)</td>
<td>4.38 (1.02)</td>
<td>166.35</td>
<td>&lt; .001</td>
<td>.55</td>
</tr>
<tr>
<td></td>
<td>Selection duration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>65.63 (24.22)</td>
<td>108.56 (72.86)</td>
<td>21.28</td>
<td>&lt; .001</td>
<td>.14</td>
</tr>
<tr>
<td></td>
<td>Rank-ordering duration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>31.05 (12.87)</td>
<td>50.76 (36.51)</td>
<td>17.67</td>
<td>&lt; .001</td>
<td>.12</td>
</tr>
</tbody>
</table>

Note. The table reports means, with standard deviations in parentheses. The unit of durations is second.

Idea Selection
Creativity of selected ideas. An independent samples t-test on the expert-rated creativity of the selected ideas showed that, participants in the intuitive condition (compared with participants in the deliberative condition) selected ideas that were more creative, \( t(135) = 2.63, p = .010, \) Cohen's \( d = 0.45 \), and more original, \( t(135) = 2.65, p = .009, \) Cohen's \( d = 0.45 \). However, there was no statistically significant difference between processing modes on usefulness, \( t(135) = 0.73, p = .47, \) Cohen's \( d = 0.12 \). See Figure 2a for a plot.

Creativity of most creative idea. An independent t-test on the creativity of the most creative idea showed that the most creative idea ranked by participants in the intuitive condition was more creative, \( t(135) = 2.83, p = .005, \) Cohen's \( d = 0.48 \), and more original, \( t(135) = 3.52, p < .001, \) Cohen's \( d = 0.60 \), than that ranked by participants in the deliberative condition. However, no significant difference between the two conditions was found on the usefulness of the ranked most creative idea, \( t(135) = 1.43, p = .15, \) Cohen's \( d = 0.24 \). See Figure 2b for a plot.

** Figure 2: Mean creativity, originality, and usefulness of (a) the six selected ideas and (b) the most creative idea by processing mode. Error bars represent standard errors. **

** \( p < .01 \). *** \( p < .001 \).
Chapter 2 - Processing Mode and Creative Idea Selection

Number of optimal ideas selected. An independent t-test on the number of the optimal ideas selected revealed that, participants in the intuitive condition \((M = 2.90, SD = 1.58)\) selected more ideas from the six optimal creative ideas than the participants in the deliberative condition \((M = 2.16, SD = 1.61)\), \(t(135) = 2.71, p = .008\), Cohen’s \(d = 0.46\).

Selection effectiveness. As in Experiment 1, one-sample t-tests were conducted for each condition with the average expert-rated creativity, originality, or usefulness of the six selected ideas as test variables, and the average evaluations of all the 18 ideas by experts as test values. Similar to Experiment 1, the analysis on creativity revealed that participants in the intuitive condition \((M = 2.92, SD = 0.49)\) selected ideas that were more creative \((t(67) = 3.44, p = .001, \text{Cohen’s } d = 0.42)\) than the average level \((M = 2.72, SD = 0.84)\). However, this difference was not significant \((t = 0.42, p = .68, \text{Cohen’s } d = 0.05)\) for participants in the deliberative condition \((M = 2.69, SD = 0.54)\). This means participants in the intuitive condition selected above chance level whereas participants in the deliberative condition did not. Similarly, the analysis on originality showed that participants in the intuitive condition \((M = 3.15, SD = 0.61)\) selected ideas that were more original \((t(67) = 2.31, p = .024, \text{Cohen’s } d = 0.28)\) than the average level \((M = 2.98, SD = 1.02)\); this difference was not significant \((t(68) = 1.45, p = .15, \text{Cohen’s } d = 0.18)\) for those in the deliberative condition \((M = 2.87, SD = 0.64)\). The analysis on usefulness yielded significant effects for both the intuitive condition \((t(67) = 2.74, p = .008, \text{Cohen’s } d = 0.33)\) and the deliberative condition \((t(68) = 3.81, p < .001, \text{Cohen’s } d = 0.46)\). Specifically, participants in both the intuitive condition \((M = 3.32, SD = 0.42)\) and the deliberative condition \((M = 3.37, SD = 0.42)\) selected ideas that were more useful than the average level \((M = 3.18, SD = 1.08)\).
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Similar analyses were conducted on the creativity, originality, and usefulness of the most creative idea. The analysis on creativity showed that the most-creative idea ranked by participants in the intuitive condition (\(M = 3.25, SD = 0.59\)) was more creative (\(t(67) = 7.38, p < .001\), Cohen’s \(d = 0.90\)), and that ranked by participants in the deliberative condition (\(M = 2.89, SD = 0.84\)) was slightly more creative (\(t(68) = 1.75, p = .084\), Cohen’s \(d = 0.21\)), than the total idea set. The analysis on originality revealed that participants in the intuitive condition (\(M = 3.61, SD = 0.74\)) selected an idea that was more original (\(t(67) = 7.05, p < .001\), Cohen’s \(d = 0.85\)) than the average idea, however, this difference was not significant (\(t = 0.98, p = .33\), Cohen’s \(d = 0.12\)) for those in the deliberative condition (\(M = 3.09, SD = 0.96\)). The analysis on usefulness yielded no significant results for both the intuitive condition (\(t(67) = 1.07, p = .29\), Cohen’s \(d = 0.13\)) and the deliberative condition (\(t = 0.96, p = .34\), Cohen’s \(d = 0.12\)). The most-creative-idea ranked by participants in both the intuitive condition (\(M = 3.01, SD = 1.26\)) and the deliberative condition (\(M = 3.29, SD = 0.97\)) was not significantly different from the average idea in usefulness.

**Idea Evaluation**

**Selection-evaluation consistency.** A 2 (Processing Mode [intuitive, deliberative]) × 2 (Average Participant-rated Creativity [of the six selected ideas, of the unselected ideas]) mixed model ANOVA (see Table 4) showed a significant main effect of creativity (\(F(1, 135) = 55.44, p < .001\), \(\eta_p^2 = .29\)), but no significant main effect of processing mode (\(F = 0.15, p = .70\), \(\eta_p^2 = .001\)) and no creativity × processing mode interaction (\(F(1, 135) = 2.08, p = .15\), \(\eta_p^2 = .015\)). This means participants in both conditions evaluated the six selected ideas more creative than the unselected ideas.
Similar analyses were also conducted on originality and usefulness (see Table 4). The analysis on originality showed a significant main effect of originality \((F(1, 135) = 26.87, p < .001, \eta_p^2 = .17)\) and a significant originality \times\) processing mode interaction \((F(1, 135) = 13.85, p < .001, \eta_p^2 = .093)\), but no significant main effect of processing mode \((F = 0.44, p = .51, \eta_p^2 = .003)\). Simple effects analysis showed that participants in the intuitive condition evaluated the selected ideas more original \((F(1, 135) = 39.37, p < .001)\) than the unselected ideas; this difference was not significant for those in the deliberative condition \((F(1, 135) = 1.08, p = .30)\). The analysis on usefulness showed a significant main effect of usefulness \((F(1, 135) = 76.98, p < .001, \eta_p^2 = .36)\), a significant main effect of processing mode \((F(1, 135) = 4.22, p = .042, \eta_p^2 = .030)\), and a significant usefulness \times\) processing mode interaction \((F(1, 135) = 4.01, p = .047, \eta_p^2 = .029)\). Simple effects analysis showed that participants in both the intuitive condition \((F(1, 135) = 22.76, p < .001)\) and the deliberative condition \((F(1, 135) = 58.49, p < .001)\) evaluated the selected ideas more useful than the unselected ideas.
Similar analyses were also conducted on originality and usefulness (see Table 4). The analysis on originality showed a significant main effect of originality ($F(1, 135) = 26.87$, $p < .001$, $\eta^2_p = .17$) and a significant originality × processing mode interaction ($F(1, 135) = 13.85$, $p < .001$, $\eta^2_p = .093$), but no significant main effect of processing mode ($F = 0.44$, $p = .51$, $\eta^2_p = .003$). Simple effects analysis showed that participants in the intuitive condition evaluated the selected ideas more original ($F(1, 135) = 39.37$, $p < .001$) than the unselected ideas; this difference was not significant for those in the deliberative condition ($F(1, 135) = 1.08$, $p = .30$). The analysis on usefulness showed a significant main effect of usefulness ($F(1, 135) = 76.98$, $p < .001$, $\eta^2_p = .36$), a significant main effect of processing mode ($F(1, 135) = 4.22$, $p = .042$, $\eta^2_p = .030$), and a significant usefulness × processing mode interaction ($F = 4.01$, $p = .047$, $\eta^2_p = .029$). Simple effects analysis showed that participants in both the intuitive condition ($F(1, 135) = 22.76$, $p < .001$) and the deliberative condition ($F(1, 135) = 58.49$, $p < .001$) evaluated the selected ideas more useful than the unselected ideas.

Table 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th>Intuitive ($n = 68$)</th>
<th>Deliberative ($n = 69$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creativity</td>
<td>Selected ideas</td>
<td>5.06 (0.97)</td>
<td>4.82 (0.98)</td>
</tr>
<tr>
<td></td>
<td>Unselected ideas</td>
<td>3.80 (1.05)</td>
<td>3.97 (0.87)</td>
</tr>
<tr>
<td>Originality</td>
<td>Selected ideas</td>
<td>5.12 (0.99)</td>
<td>4.69 (1.04)</td>
</tr>
<tr>
<td></td>
<td>Unselected ideas</td>
<td>3.94 (0.93)</td>
<td>4.49 (0.78)</td>
</tr>
<tr>
<td>Usefulness</td>
<td>Selected ideas</td>
<td>5.22 (0.99)</td>
<td>5.27 (0.96)</td>
</tr>
<tr>
<td></td>
<td>Unselected ideas</td>
<td>4.38 (0.84)</td>
<td>3.94 (0.81)</td>
</tr>
</tbody>
</table>

*Note.* The table reports means, with standard deviations in parentheses.

The results of Experiment 2 replicated the results in Experiment 1, by showing that intuitive processing improves creative idea selection compared with deliberative processing, even without a separate evaluation phase before the selection. Specifically, under intuitive processing, the six ideas and the most creative idea selected are more creative than under deliberative processing. Moreover, intuitive processing led to the selection of idea(s) more creative than the average idea, while deliberative processing influenced people to select ideas not more creative than the average idea.

**General Discussion**

People desire creativity but tend to select mainstream ideas for implementation (Putman & Paulus, 2009; Rietzschel et al., 2010). In the current research, we hypothesized that, compared to deliberative processing, intuitive processing improves creative idea selection. The findings from two experiments supported our hypothesis. It was shown that when instructed to select ideas intuitively, participants selected...
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ideas that were more creative, more original, but not more useful, than when they were asked to select ideas deliberatively. Furthermore, participants in the intuitive condition chose ideas that were more creative, more original, and more useful, than the average idea; whereas participants in the deliberative condition chose ideas that were merely more useful, but not more creative and original, than the average idea.

Why does intuitive processing outperform deliberative processing in selecting creative ideas? Our findings suggested that participants in both conditions selected ideas that they deemed to be more creative than the average idea, however, they differed significantly in which sub-dimension(s) they relied on to value idea creativity. Specifically, intuitive processing helps people incorporate both originality and usefulness, but mainly originality, as criteria to assess creativity, while deliberative processing leads people to regard usefulness as the only criteria for judging creativity. Thus, this advantage of intuitive processing in idea evaluation may result in the better selection of creative ideas in the intuitive condition.

The role of processing mode in creative idea selection may, to some extent, be compared to the dual pathway to creativity model (Nijstad, De Dreu, Rietzschel, & Baas, 2010), which states that the generation of creative ideas is a function of two qualitatively different processes—cognitive flexibility (the ability of considering different perspectives) and cognitive persistence (depth of thinking in limited perspectives). Nijstad and colleagues (2010) stated that high cognitive flexibility is associated with decreased cognitive control and enhanced distractibility, while high cognitive perseverance employs systematic and effortful search processes that require more executive control. Both high cognitive flexibility and perseverance can benefit creative ideation by leading to the generation of ideas of many categories and within a few categories respectively, both leading to increased originality of ideas. Moreover,
they also showed that some traits or states can influence creative ideation through their impact on cognitive flexibility and perseverance, such as motivation, regulatory focus, and mood. Furthermore, they proposed that creative ideation may be improved by using both flexibility and perseverance, although at different times and to different degrees. Differing from creative ideation, creative idea selection benefits from the unbiased recognition of originality and usefulness of ideas. Future research may examine whether a combined use of intuitive and deliberative processing mode can further improve creative idea selection, and whether specific traits or states, manipulations and trainings (e.g., Nijstad et al, 2010; Ritter et al., 2012; Ritter & Mostert, 2016) can influence creative idea selection.

Our study contributes to the understanding of the creativity bias—a phenomenon that people desire creativity but perform sub-optimally in selecting creative ideas (Faure, 2004; Rietzschel et al., 2010). Although researchers have been inspired to study the underlying mechanisms of the creativity bias and how creative idea selection can be improved, the bias has not been well-understood (Mueller et al., 2011), and only a few effective means have been found to facilitate creative idea selection (De Buisonjé et al., 2017; Rietzschel et al., 2014; Ritter, et al., 2012). We suggested that processing style plays an important role in the formation of the bias. When selecting creative ideas for implementation, people intuitively desire creative ideas, but they deliberatively reject them and turn to select mainstream ideas. Therefore, following intuitions may lead to better creative idea selection performance than deliberative thinking. Moreover, as stated in the existing literature (e.g., Dörfler & Ackermann, 2012), our findings showed that selection speed is indicative of processing style—the faster (slower) the idea selection is, the more intuitively (deliberatively) participants make selections.
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To our best knowledge, our study is the first to assess evaluation performance to elucidate the selection performance. The existing literature of creativity has stated a close link between evaluation and selection, that is, idea evaluation is the inevitable phase prior to idea selection (Amabile, 1983), and that idea selection should be based on evaluations of ideas (Eling et al., 2015). Thus, evaluation performance should predict and explain the selection performance. However, in previous research, this relation has never been examined and idea evaluation has never been combined with selection. Our findings indicated that people select ideas that were evaluated highly creative earlier. In other words, people’s evaluations of ideas provide the bedrock for the latter idea selection.

Our findings also have important practical implications. Successful corporate leaders often believe that intuition enables them to identify business opportunities and they have frequently employed intuition in practical creative decision making (Sadler-Smith, 2016). Our findings provided scientific evidence for this practical belief, by showing the beneficial effect of a simple short-term manipulation to induce intuitive processing. Merely instructing novices to rely their decisions on gut feelings significantly improves the creative idea selection performance, compared to when asking them to make decisions after careful analyses. Extending the current findings, future research may include expertise and investigate whether or not expertise can moderate the effect of intuitive processing.

The current study has several limitations. First, although the current research indicates that intuitive processing outperforms deliberative processing in creative idea selection, it is unclear whether intuitive processing improves creative ideas selection and/or deliberative processing undermines it. Previous research has shown that a natural idea selection approach (i.e., without manipulating processing mode) leads to
suboptimal selection performance (i.e., not better than chance level; Faure, 2004; Rietzschel et al., 2006, 2010, 2014). The current findings suggest that intuitive processing improves creative idea selection as it helps people to select better than chance level, whereas deliberative processing leads to an average selection performance. To experimentally clarify this issue, a follow-up study could be conducted in which participants are, in a between-subjects design, instructed to select ideas by either using a natural processing mode, an intuitive processing mode, or a deliberative processing mode. Second, when developing the idea pool, the experts were instructed to evaluate the ideas on creativity, originality, and usefulness. No instructions were provided with regard to processing mode. However, we cannot rule out the possibility that the experts may have adopted an intuitive approach when evaluating the ideas, resulting in a better match in processing mode between experts and participants in the intuitive selection condition. Third, we used only one pool of ideas to solving a specific social problem to investigate the effects of processing mode. Clearly more idea pools are needed in different domains to explore the generality of our findings. Fourth, our study focuses merely on individual selection. Future research may also examine whether intuitive processing can enhance group selection of creative ideas. In most real-world settings, many decisions are made collectively, rather than individually, by interactive groups of individuals such as committees, governing bodies, and business partners (Ambrus, Greiner, & Pathak, 2009), when the decision directly affects the group or requires group’s involvement to complete. Finally, the current study focuses on the selection of ideas generated by other people but not by selectors themselves. So far, little is known about the difference between selecting from self-generated ideas and other-generated ideas. Hence, future research may also examine the role of processing mode in selection of self-generated ideas.
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Given the enormous value of creativity, governments, research institutes, and businesses often call for creative ideas to solve problems or make profit. But meanwhile, it is poorly understood how creative ideas can be selected for implementation. Strict criteria or rigorous review processes are believed by many to guarantee that the optimal ideas would be accepted. However, this deliberative process may lead to the selection of mainstream ideas at the expense of creative ideas. We suggest that when selecting creative ideas, the role of intuition needs to be taken seriously. In addition, except for the facilitating role of intuitive processing in our study, only a few effective means have been found to enhance creative idea selection. Although many techniques (e.g., brainstorming) have been developed to improve people’s idea generation ability, the idea selection process has been neglected. Without the ability to recognize and select creative ideas for implementation, the endeavor of facilitating idea generation cannot fulfill its initial purpose. Thus, future research should turn more attention from boosting idea generation towards understanding and enhancing idea selection.

Open Practices

Experiment 2 in this article earned Open Practice Pre-registration Badge for transparent practices from the Journal of Experimental and Social Psychology. The hypothesis, materials, and analysis plan for the experiment are available at https://osf.io/msh6q/.
Chapter 3

Creativity: The Effect of Selection Strategy on Creative Idea Selection Performance

Abstract

When people have to choose from a set of ideas to tackle a problem that requires a creative solution, they perform suboptimally— they tend to select mainstream ideas at the expense of creative ideas. In the current research, we examined the effect of selection strategy on creative idea selection by comparing three different selection strategies: choosing (i.e., selecting the most creative idea by choosing it directly), elimination (i.e., selecting the most creative idea by stepwise removing the less creative ones), and paired comparison (i.e., a series of choices from pairs of ideas). In four experiments, participants selected the most creative idea from a pool of 10 ideas by using one of the three selection strategies, and selection performance was compared. Besides, a meta-analysis was conducted on the data of the four studies. The current findings provide the first evidence that paired comparison outperforms choosing and elimination in creative idea selection.

Keywords: Creativity; Idea selection; Selection strategy; Choosing; Elimination; Paired comparison
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Introduction

Kodak, the former world leader in the field of analog photography, dropped to the verge of bankruptcy in 2012 after they rejected a strategy change from analog photography to digital photography (Lucas & Goh, 2009). Notably, they invented the first digital camera ever but paid little attention to it and refused to put it on the market (Estrin, 2015). Besides Kodak, there have been numerous cases in history showing that people tend to reject creative ideas—ideas that are original (i.e., novel) and useful (i.e., appropriate and feasible, see e.g., Hennessey & Amabile, 2010)—sometimes with tremendous consequences. Although recognized to be an essential step in the creative process, research on creative idea evaluation and idea selection is scarce (for exceptions, see e.g., Faure, 2004; Mueller, et al., 2014; Putman & Paulus, 2009; Rietzschel, et al., 2010, 2014; Toh & Miller, 2016; Zhu, et al., 2017). We will first briefly review the literature on creative idea evaluation and creative idea selection. Thereafter, we will elaborate on how different selection strategies may influence creative idea selection performance.

Idea Evaluation and Selection

Compared to idea generation, research on idea evaluation has received little attention (Rietzschel & Ritter, in press). The research on idea evaluation focuses on the question whether and when (i.e., under which circumstances) people can accurately evaluate the creativity of ideas, and it has thus far shown inconsistent findings. In a series of studies, Runco and colleagues (Basadur, Runco, & Vega, 2000; Runco, 1993; Runco & Basadur, 1993; Runco & Chand, 1994; Runco & Chand, 1995; Runco, McCarthy, & Svenson, 1994; Runco & Smith, 1992; Runco & Vega, 1990) examined people’s idea evaluation accuracy. They found that people are generally quite accurate in evaluating others’ ideas, indicated by a significant positive
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correlation between their evaluations and those of experts. However, other research has suggested that people are poor at idea evaluation. For example, Licuanan and colleagues (2007) found that people tend to underestimate the originality of highly novel ideas. Blair and Mumford (2007) showed that people prefer commonplace ideas but disregard original ideas. Benedek and colleagues (2016) revealed that people tend to misjudge creative ideas as inappropriate.

Previous research also investigated how idea evaluation performance can be stimulated, and several factors have been identified that influence idea evaluation. For example, Herman and Reiter-Palmon (2011) investigated the relationship between regulatory focus and idea evaluation performance. They found that people high on trait promotion focus rate their own ideas more accurately on originality but less accurately on quality (i.e., how logical and workable ideas are), whereas those high on trait prevention focus rate their own ideas more accurately on quality but less accurately on originality. Mueller and colleagues (2011) studied how tolerance of uncertainty can influence creativity evaluation. They found that when a low tolerance of uncertainty is induced, people are implicitly biased against creativity and they rate a creative idea as less creative than when a high tolerance of uncertainty is induced.

Relative to idea generation, idea selection has been mostly neglected in both research (for exceptions, see e.g., Rietzschel et al., 2014; Ritter, et al., 2012; Zhu et al., 2017) and in the applied domain (for exceptions, see e.g., Kennel, Reiter-Palmon, de Vreede, & de Vreede, 2013; Sadler-Smith, 2016). This may be due to the intuitive assumption that once a pool of ideas has been generated, people should be able to identify the most creative ones (Rietzschel et al., 2010). However, this assumption is at odds with empirical evidence: People perform suboptimally at selecting creative ideas—they tend to select mainstream ideas at the expense of creative ideas (Putman...
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So far, only a few means have been shown effective to enhance creative idea selection performance. For example, Rietzschel and colleagues (2014) studied the influence of selection instruction on idea selection performance. They found that people select more creative ideas when they are instructed to base their selections on originality, compared to when instructed to base on their personal experiences. Ritter and colleagues (2012) examined the effect of unconscious thought on creative idea generation and idea selection. Participants were either asked to consciously think about a problem before generating and selecting possible solutions, or were distracted from the problem, which allows for unconscious task-related thought (Dijksterhuis & Nordgren, 2006). Across two studies, selection performance was higher in the unconscious thought condition. Zhu and colleagues (2017) studied the effect of intuitive versus deliberative processing on creative idea selection. They found that intuitive processing outperforms deliberative processing in creative idea selection. When instructed to select creative ideas intuitively, people selected more creative
ideas than when they are asked to make selections deliberatively. Moreover, intuitive processing led to the selection of ideas more creative than chance level, whereas deliberative processing did not. De Buisonjé and colleagues (2017) examined whether promotion focus, positive affect, and self-affirmation can facilitate creative idea selection. They found that participants selected ideas that were more creative when promotion focus, positive affect, and self-affirmation were induced jointly, compared to a control condition where participants performed corresponding filler tasks. Conversely, several other means have been shown to be unsuccessful in facilitating creative idea selection. For example, Rietzschel and colleagues (2010) examined whether providing instructions for idea selection (i.e., selecting ideas that are both original and feasible) and rating ideas before selection can influence idea selection performance and they found no effects of both manipulations. In other research, Rietzschel and colleagues (2014) found that narrowing the problem for which ideas are generated also does not affect idea selection performance.

Thus far, only one idea selection strategy has been focused on in the literature: the choosing strategy (i.e., selecting the most creative ideas by choosing them directly). In this paper, we aim to investigate whether selection strategy influences creative idea selection performance, and we compare three different idea selection strategies: The choosing strategy, the elimination strategy and the paired comparison strategy. In the next paragraphs, the three selection strategies are introduced, and we discuss their possible influence on idea selection performance.

**Idea Selection Strategies**

There are several strategies that individuals can employ to select the most creative ideas. First, individuals can use a *choosing strategy*. In the choosing strategy, individuals are presented with several ideas simultaneously and they directly select
Chapter 3 - Selection Strategy and Creative Idea Selection

the ideas that meet certain requirements (e.g., most creative). Often people choose from a large pool of ideas and this has both advantages and disadvantages. Compared to small choice assortments, people are more attracted to large choice assortments (Iyengar and Lepper, 2000) and they perceive the selections from large choice assortments to be more enjoyable (Babin, Darden, & Griffin, 1994). Moreover, people can perceive greater variety (e.g., Broniarczyk, Hoyer, & McAlister, 1998), freedom of choice (e.g., Kahn, Moore, & Glazer, 1987), and decision flexibility (e.g., Kahn & Lehmann, 1991) from large choice assortments. On the other hand, choosing from larger assortments is associated with an increase in the cognitive costs (Chernev, Böckenholt, & Goodman, 2015), and it is more difficult and more frustrating (Berger, Draganska, & Simonson, 2007; Iyengar & Lepper, 2000). Also, choosing from larger assortments leads to worse decisions (Schwartz, 2004), decreased after-choice satisfaction, increased regret, and reduced actual-purchasing behavior (Chernev 2003; Iyengar and Lepper 2000; Schwartz 2004). Importantly, as selecting from large assortments is more difficult, it leads to the selections of options that can be easily justified (e.g., choose utilitarian over hedonic options, Sela, Berger, & Liu, 2009). However, an original idea, by its very nature, is relatively new and untested. The more original an idea is, the higher the perception of risk (Rubenson & Runco, 1995) and uncertainty concerning the idea’s feasibility (Amabile, 1996). In comparison, mainstream ideas (i.e., ideas low on originality and high on feasibility) are less queried regarding their feasibility. Thus, original ideas are harder to justify than mainstream ideas. Therefore, choosing from large assortments of options may not be optimal for creative idea selection.

Besides the choosing strategy, individuals can also use an elimination strategy when making decisions (e.g., Nagpal, Lei, & Khare, 2015; Kuhn, 2015). In the...
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elimination strategy, individuals reject or remove the least suitable or desirable choice options (e.g., Kogut, 2011; Weber, Woodard, & Williamson, 2013). That is, when a person uses the elimination strategy to select the most creative ideas, he/she first excludes the least creative idea, then excludes the second least creative idea, and so on until only a couple of ideas—the most creative ones—are left. At first glance, the elimination and the choosing strategy seem nominally complementary—they should result in the same decision outcome (Yaniv & Schul, 1997, 2000). However, significant differences have been found between the two strategies (e.g., McDonald, Newell, & Denson, 2014; Rausch & Brauneis, 2015). Previous research studying this difference focused mainly on making a choice set for further consideration from an initial array of alternative options. A consistent finding is that by using the elimination strategy, as compared to choosing strategy, a larger consideration choice set is formed, which is more likely to contain the optimal option (e.g., Levin, Jasper, & Forbes, 1998; Yaniv, Schul, Raphaelli-Hirsch, & Maoz, 2002).

Using the elimination strategy, people decide which idea is the most creative after having removed all the less creative ones. Thus, they may first exclude ideas more certain to be uncreative. For this reason, the elimination strategy may be superior to the choosing strategy. However, the elimination strategy may also have disadvantages which may impair creative idea selection. The elimination strategy may induce a prevention focus, and this may be detrimental to creative idea selection. According to the regulatory focus theory, a prevention focus is related to a concern of safety and avoiding errors and undesirable outcomes (Higgins, 1998, 2000). People are prevention focused when using the elimination strategy to identify and avoid those least optimal ideas from being selected (Cheng, Yen, Chuang, & Chang, 2013; Kuhn, 2015). Prevention focus has been shown to be harmful not only to idea generation...
elimination strategy, individuals reject or remove the least suitable or desirable choice options (e.g., Kogut, 2011; Weber, Woodard, & Williams, 2013). That is, when a person uses the elimination strategy to select the most creative ideas, he/she first excludes the least creative idea, then excludes the second least creative idea, and so on until only a couple of ideas—the most creative ones—are left. At first glance, the elimination and the choosing strategy seem nominally complementary—they should result in the same decision outcome (Yaniv & Schul, 1997, 2000). However, significant differences have been found between the two strategies (e.g., McDonald, Newell, & Denson, 2014; Rausch & Brauneis, 2015). Previous research studying this difference focused mainly on making a choice set for further consideration from an initial array of alternative options. A consistent finding is that by using the elimination strategy, as compared to choosing strategy, a larger consideration choice set is formed, which is more likely to contain the optimal option (e.g., Levin, Jasper, & Forbes, 1998; Yaniv, Schul, Raphaelli-Hirsch, & Maoz, 2002).

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*Paired comparison* is another strategy that individuals use to select ideas, and it has been widely and successfully used in practice (e.g., Pachur & Olsson, 2012; Tarrow, 2010). The paired comparison selection consists of multiple binary choices between options in the choice assortment, which determines the order of the options (Kingsley & Brown, 2010). For example, given a set of three options (e.g., A, B, and C), there are three possible comparisons (i.e., A vs. B, A vs. C, B vs. C). The ranking order in creativity is determined by the preferences of each option to the other options (e.g., A>B>C, when A>B, A>C, and B>C).

We proposed that the paired comparison strategy has important advantages compared with the choosing strategy. During the paired comparison selection, participants choose, each time, from a much smaller set. Like the elimination strategy, this may reduce the selection difficulty greatly.

**The Current Research**

To examine the role of selection strategy in creative idea selection performance, four experiments were conducted to compare the relative effectiveness of the three strategies. Specifically, the choosing and the elimination strategy were compared in experiment 1, the choosing and the paired comparison strategy were compared in Experiment 2a and 2b, and all the three strategies were compared in Experiment 3. Finally, a meta-analysis of all studies was conducted. Each of the three selection strategies described above has their own pros and cons, making it difficult to
predict the most beneficial strategy for creative idea selection. Therefore, the current researcher is exploratory rather than confirmative.

**Experiment 1**

**Method**

**Participants and Design**

A total of 81 (71 female, 10 male) participants between the age of 18 and 52 ($M = 22.49$, $SD = 4.88$) participated for course credits or financial compensation (€5), and were recruited via the online Radboud Participation System (SONA).

A between-subjects design was used with selection strategy as independent variable and idea selection performance as dependent variable. Participants were randomly assigned to one of the two conditions—the choosing condition ($n = 41$) or the elimination condition ($n = 40$).

**Procedure**

Participants were welcomed and accompanied to an individual cubicle by the experimenter. After being seated, they were explained that all task instructions are provided on the computer screen, and that they can contact the experimenter at any time for clarification. The computer program randomly assigned participants to either the choosing condition or the elimination condition. In both conditions, participants first performed the idea selection task, then answered several questions, then performed the idea evaluation task\(^2\), and finally answered several demographic questions. At the end, participants were thanked and rewarded.

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\(^2\) In the current research, idea evaluation performance was included for exploratory reasons. It is not directly related to the main research question; thus, the description of the idea evaluation task and all relevant variables, analyses and results were presented in the supplemental materials.
Chapter 3 - Selection Strategy and Creative Idea Selection

Materials

**Idea pool.** To measure people’s idea selection performance, we used a pool of 10 ideas varying on creativity in five identical intervals—from very low to very high on creativity. These ideas were chosen from a larger idea pool (for details, please see Chapter 2) that was developed by de Buisonjé and colleagues (2017).

**Idea selection task.** At the beginning of the idea selection task, participants were told that a creative idea has to be both original and useful. During the idea selection task, participants had to select ideas either by using the choosing or the elimination strategy. In both conditions, participants were presented with the problem statement and the 10 ideas simultaneously, and they had to rank the order of the ideas stepwise. However, the two conditions differed in how the ideas were ranked. In the choosing condition, participants first selected the most creative idea, then the second most creative idea, then the third most creative idea, and so on. In the elimination condition, participants first selected the least creative idea, then the second least creative idea, then the third least creative idea, and so on until only one idea—the most creative idea—remained.

**Questions.** Participants were asked several questions about their idea selection experience. Specifically, participants had to indicate how confident they were that they had selected the most creative idea, how satisfied they were with the selection they had made, how difficult it was for them to perform the idea selection task, and how deliberatively/intuitively they performed the idea selection task on a 7-point scale (1 = not at all, 7 = very much).

**Demographics.** Participants’ gender, age, nationality, and educational background were assessed.
Dependent Variables

Idea selection performance was measured by five variables, the optimal selection, the creativity of the most creative idea, the originality of the most creative idea, the usefulness of the most creative idea, and the overall selection performance.

The optimal selection measured the percentage of participants who made the optimal selection. Among the 10 ideas for selection, there were two ideas evaluated more creative than the rest by the experts. Participants made the optimal selection when they had selected these two ideas as the most creative idea.

The creativity, the originality, and the usefulness of the most creative idea measured the creativity, originality, and usefulness (based on expert ratings) of the idea that was selected by the participants as the most creative idea.

The overall selection performance measured the overall quality of a participant’s selection, namely, how close an individual’s order of the ideas was to the ideal order (based on the experts’ creativity ratings of all ideas). This variable was calculated in several steps. First, each idea was given a weight according to its selected order among all the 10 ideas. Specifically, the most creative idea selected by an individual was given the weight 10, and the second most creative idea was given the weight nine, and the third most creative idea was given the weight eight, and so on. Second, the creativity of each idea (based on the expert ratings) was multiplied with its given weight value. Third, the formula presented below was applied. The higher an individual’s index was, the better his/her overall selection performance was.

Overall selection performance = $\frac{10\times C_{1st}+9\times C_{2nd}+8\times C_{3rd}+\ldots+3\times C_{8th}+2\times C_{9th}+1\times C_{10th}}{10+9+8+7+6+5+4+3+2+1}$  

Note. $C_{1st}$ represents the expert rating of the idea selected as most creative idea, $C_{2nd}$ represents the expert rating of the idea selected as second most creative idea, and so on so forth.
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Results

Idea Selection

Optimal selection. A Chi-square analysis (see Table 1) on the optimal selection showed no effect of selection strategy, \( \chi^2(1, N = 81) = 1.09, p = .34 \). The odds ratio was employed to measure the size of the effect of selection strategy on optimal selection (Fields, 2009). Based on the odds ratio, the odds of making the optimal selection was 1.79 times higher if they used the elimination strategy than if they used the choosing strategy during the idea selection task, which indicated a small effect of selection strategy on optimal selection.

Creativity of the idea selected as most creative idea. An independent t-test (see Table 1) on the creativity of the most creative idea showed no effect of selection strategy, \( t(79) = 1.44, p = .15, \text{Cohen's } d = 0.33 \). No difference was found between the choosing and the elimination condition.

Originality and usefulness of the idea selected as most creative idea. Independent t-tests (see Table 1) on originality (\( t(79) = 1.43, p = .16, \text{Cohen's } d = 0.32 \)) and usefulness (\( t = 0.33, p = .74, \text{Cohen's } d = 0.08 \)) also showed no effects of selection strategy. Participants using the choosing strategy and those using the elimination strategy did not significantly differ from each other on the originality and the usefulness of the idea that was selected as the most creative idea.

Overall selection performance. An independent t-test (see Table 1) on the overall selection performance revealed no significant effect of selection strategy, \( t(79) = 1.36, p = .18, \text{Cohen's } d = 0.30 \). The overall selection performance of participants using the choosing strategy was not significantly different from that of participants using the elimination strategy.
Chapter 3 - Selection Strategy and Creative Idea Selection

Table 1

Descriptive Statistics for Optimal selection, Creativity, Originality, and Usefulness of Most Creative Idea, and Overall Selection Performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Choosing (n = 41)</th>
<th>Elimination (n = 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal selection</td>
<td>24.4%</td>
<td>35.0%</td>
</tr>
<tr>
<td>The most creative idea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td>2.62 (1.15)</td>
<td>2.99 (1.11)</td>
</tr>
<tr>
<td>Originality</td>
<td>2.83 (1.21)</td>
<td>3.21 (1.16)</td>
</tr>
<tr>
<td>Usefulness</td>
<td>3.26 (0.45)</td>
<td>3.23 (0.31)</td>
</tr>
<tr>
<td>Overall selection performance</td>
<td>2.72 (0.31)</td>
<td>2.81 (0.28)</td>
</tr>
</tbody>
</table>

Note. The optimal selection is reported in percentages. For overall selection performance and creativity, originality, and usefulness of the idea that was selected as most creative idea, means are reported with standard deviations in parentheses.

Questions

An independent t-test with selection strategy as independent variable revealed a marginally significant effect of selection strategy on confidence, \( t(79) = 1.77, p = .080 \), Cohen’s \( d = 0.39 \). Specifically, participants in the elimination condition (\( M = 5.00, SD = 1.36 \)) felt slightly more confident that they had selected the most creative idea than those in the choosing condition (\( M = 4.44, SD = 1.48 \)). No effect of selection strategy was found for satisfaction, \( t(79) = 1.38, p = .17 \), Cohen’s \( d = 0.31 \), difficulty, \( t = 0.77, p = .44 \), Cohen’s \( d = 0.17 \), deliberativeness, \( t = 0.73, p = .47 \), Cohen’s \( d = 0.16 \), and intuitiveness, \( t = 0.16, p = .87 \), Cohen’s \( d = 0.04 \).

The results of Experiment 1 suggest that the elimination strategy and the choosing strategy do not differ on creative idea selection performance. No significant
differences were found between the choosing and the elimination strategy on any of the idea selection performance measures.

Experiment 2a

In the current experiment, we compared the paired comparison strategy with the choosing strategy, to examine whether they can lead to different performances of creative idea selection.

Method

Participants and Design

Eighty-four participants participated for course credits or financial compensation (€5). They were recruited via the SONA System (SONA). One participant could not complete the experiment due to technical problems, resulting in a final sample of 83 (63 female, 20 male) participants, whose ages varied between 18 and 61 (M = 22.89, SD = 5.26).

A between-subjects design was used, with selection strategy as independent variable and idea selection performance as dependent variable. Participants were randomly assigned to one of the two conditions—the choosing (n = 41) or the paired comparison condition (n = 42).

Procedure

In both conditions, participants first performed the idea selection task, then the idea evaluation task\(^3\), and then answered several demographic questions. Finally, participants were thanked, rewarded, and dismissed.

\(^3\) The description of the idea evaluation task and all relevant variables, analyses and results were presented in the supplemental materials.
Chapter 3 - Selection Strategy and Creative Idea Selection

Materials

Idea pool. To develop the idea pool, prior to the current study another group of 24 participants was asked to generate ideas to solve a societal problem (i.e., “How can we involve elderly people in society?”). Similar solution ideas were merged, which resulted in 42 unique ideas. It has been agreed in the literature that originality and usefulness jointly construct creativity (e.g., Hennessey & Amabile, 2010; Runco & Jaeger, 2012), and recently several researchers have been calling to split usefulness into effectiveness and feasibility—effectiveness describes how well the idea solves the problem if implemented, and feasibility describes how easily an idea can be realized or implemented (e.g., Barki & Pinsonneault, 2001; Nakui, Paulus, & Zee, 2011; Rietzschel, et al., 2010). Eleven experts (creativity researchers and creative professionals) evaluated the 42 ideas on creativity, originality, effectiveness, and feasibility on a 5-point scale (e.g., 1 = not creative at all, 5 = very creative). Interrater reliabilities were moderate to good (intraclass correlation coefficients were .79, .83, .61, and .70, for creativity, originality, effectiveness, and feasibility, respectively). Expert ratings on each dimension (i.e., creativity, originality, effectiveness, and practicality) were averaged for each idea. Thereafter, 10 ideas that varied in creativity in five identical intervals were chosen for the current experiment.

Idea selection task. In the beginning of the idea selection task, participants were told that a creative idea has to be original, feasible, and effective, and they were provided with the definition of originality, effectiveness, and feasibility. During the idea selection task, participants were instructed to select ideas by using either the choosing strategy (choosing condition, as in Experiment 1) or the paired comparison strategy (paired comparison condition). In the paired comparison condition, participants were presented with 45 pairs of ideas. Each time two different ideas from
the 10 ideas were compared. The two ideas were presented bilateral symmetrical on
the computer screen—one idea at the left part of the computer screen and the other
idea at the right part—and idea position was randomized. From each pair, participants
selected the most creative idea. Based on all the selections, a preference score was
calculated for each idea, representing the number of times that a participant preferred
a specific idea. Per participant, the preference order of the 10 ideas was determined by
ranking the preference scores, with large numbers indicating more creative ideas
(Kingsley & Brown, 2010).4

Demographics. Participants’ gender, age, nationality, and educational
background were assessed.

Dependent Variables

As in Experiment 1, idea selection performance was measured by the optimal
selection, the creativity of the most creative idea, the originality of the most creative
idea, and the overall selection performance. Moreover, instead of the usefulness of
the most creative idea, the effectiveness of the most creative idea and the feasibility of
the most creative idea were assessed.

Results & Discussion

Idea Selection

Optimal selection. A Chi-square analysis on the optimal selection showed no
effect of selection strategy, \( \chi^2(1, N = 83) = 1.56, p = .25 \). The proportion of
participants in the choosing condition who made the optimal selection (61.0%) was

4 In the cases of two ideas with the same preference score, the direct selection determined the order,
namely, the selected idea in the direct comparison received the higher order. For several ideas with the
same preference score, the order was determined by the direct comparisons. Among these ideas, the
more often an idea was preferred, the higher the order. In the cases of circular triads (e.g., ideas that
form a circular relation in preference score: A>B>C>A), the three ideas obtained the same order and
idea selection performance in that order was the average creativity of the three ideas.
not significantly different from that in the paired comparison condition (73.8%). Based on the odds ratio, it was 1.73 times more likely to make the optimal selection if participants used the paired comparison strategy than if they used the choosing strategy in the idea selection task, which indicates a small effect of selection strategy on optimal selection.

**Creativity of idea selected as most creative idea.** An independent t-test on the creativity of the most creative idea revealed a significant effect of selection strategy, $t(81) = 2.50, p = .015$, Cohen’s $d = 0.55$. As shown in Figure 1, the most creative idea selected by using the paired comparison strategy was more creative than the idea selected by using the choosing strategy.

**Originality, effectiveness, and feasibility of idea selected as most creative idea.** Independent t-tests on the originality, the effectiveness, and the feasibility showed that the most creative idea selected by participants in the paired comparisons condition was more original, $t(81) = 2.53, p = .014$, Cohen’s $d = 0.56$, more effective, $t(81) = 2.52, p = .014$, Cohen’s $d = 0.56$, and more feasible, $t(81) = 2.55, p = .014$, Cohen’s $d = 0.56$, than the idea selected by participants in the choosing condition (see figure 1).

**Overall selection performance.** An independent t-test on the overall selection performance showed no effect of selection strategy, $t(81) = 1.10, p = .27$, Cohen’s $d = 0.20$. The overall selection made by using the paired comparison strategy ($M = 3.10, SD = 0.08$) was not significantly different from that made by using the choosing strategy ($M = 3.08, SD = 0.12$).

The results of Experiment 2a suggested that the paired comparison strategy outperformed the choosing strategy in selecting the most creative idea from a pool of available ideas.
Based on the odds ratio, it was 1.73 times more likely to make the optimal selection if participants used the paired comparison strategy than if they used the choosing strategy in the idea selection task, which indicates a small effect of selection strategy on optimal selection.

Creativity of idea selected as most creative idea. An independent t-test on the creativity of the most creative idea revealed a significant effect of selection strategy, \( t(81) = 2.50, p = .015, \) Cohen’s \( d = 0.55 \). As shown in Figure 1, the most creative idea selected by using the paired comparison strategy was more creative than the idea selected by using the choosing strategy.

Originality, effectiveness, and feasibility of idea selected as most creative idea. Independent t-tests on the originality, the effectiveness, and the feasibility showed that the most creative idea selected by participants in the paired comparisons condition was more original, \( t(81) = 2.53, p = .014, \) Cohen’s \( d = 0.56 \), more effective, \( t(81) = 2.52, p = .014, \) Cohen’s \( d = 0.56 \), and more feasible, \( t(81) = 2.55, p = .014, \) Cohen’s \( d = 0.56 \), than the idea selected by participants in the choosing condition (see Figure 1).

Figure 1: Expert rating of creativity, originality, effectiveness, and feasibility of the idea that was selected as most creative idea by selection strategy. Error bars reflect standard errors. *\( p < .05 \).

Overall selection performance. An independent t-test on the overall selection performance showed no effect of selection strategy, \( t(81) = 1.10, p = .27, \) Cohen’s \( d = 0.20 \). The overall selection made by using the paired comparison strategy (\( M = 3.10, SD = 0.08 \)) was not significantly different from that made by using the choosing strategy (\( M = 3.08, SD = 0.12 \)).

The results of Experiment 2a suggested that the paired comparison strategy outperformed the choosing strategy in selecting the most creative idea from a pool of available ideas.
Chapter 3 - Selection Strategy and Creative Idea Selection

**Experiment 2b**

This experiment was conducted to examine whether the findings of Study 2a can be replicated. We pre-registered the methods and data analysis plan of Experiment 2b on Open Science Framework (see [https://osf.io/hzgmk/](https://osf.io/hzgmk/)).

**Method**

**Participants and Design**

One hundred and two (73 female, 29 male) participants between the ages of 17 and 48 ($M = 21.82$, $SD = 4.08$) participated in this experiment for course credits or monetary rewards (€5). They were recruited via the SONA participation system of Radboud University.

A 2 × 2 mixed factorial design was used. The within-subjects factor was the selection strategy. Different from Experiment 1a, each participant in this experiment used both the choosing and the paired comparison strategy on the same idea pool. The between-subjects factor was the order in which the two strategies were used. Half of the participants ($n = 51$) used choosing in the first idea selection task and paired comparison in the second selection task (the choosing-first condition), while the other half of participants ($n = 51$) used the two strategies in the reversed order (the paired-comparison-first condition). The performance of the first selection task was compared between the two conditions, to replicate the effect of selection strategy (choosing vs. paired comparison) found in Experiment 2a. As this between-condition comparison was our main interest, the analyses and results presented in the manuscript were merely for this comparison. Moreover, the performance of the first selection task and that of the second selection task were compared, to examine when one adopted two different strategies to select from the same idea pool, whether his/her selection...
This experiment was conducted to examine whether the findings of Study 2a can be replicated.

We pre-registered the methods and data analysis plan of Experiment 2b on Open Science Framework (see https://osf.io/hzgmk/).

**Method**

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One hundred and two (73 female, 29 male) participants between the ages of 17 and 48 (\(M = 21.82, SD = 4.08\)) participated in this experiment for course credits or monetary rewards (€5). They were recruited via the SONA participation system of Radboud University.

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**Procedure**

Participants were randomly assigned to either the choosing-first condition or the paired-comparison-first condition. Participants first performed an idea selection task and answered questions about the first idea selection task. Then, they performed the idea evaluation task\(^5\). Thereafter, they performed the second idea selection task and answered questions about the second idea selection task. After that, they answered the demographic questions. Finally, they were thanked, rewarded, and dismissed.

**Materials**

**Idea pool.** A pool of 10 solution ideas to solve a society problem (i.e., ideas on how to reduce food waste) was used in the current experiment. This pool was developed in the same way as the idea pool in the previous experiments\(^6\).

**Idea selection task.** During the idea selection task, as in Experiment 2a, participants had to select ideas by using the choosing strategy or the paired comparison strategy.

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\(^5\) The description of the idea evaluation task and all relevant variables, analyses and results can be found in the supplemental materials.

\(^6\) The solutions to this problem were generated by the same group of people who were recruited for the development of the idea pool that was used in Experiment 2a. After merging similar ideas, 47 unique ideas remained. Thereafter, eight experts evaluated these ideas on creativity, originality, effectiveness, and feasibility on a 5-point scale (1 = not at all, 5 = very much). Inter-rater reliabilities are moderate to good (intraclass correlation coefficients are .74, .77, .53, and .67, for creativity, originality, effectiveness, and feasibility, respectively). Expert ratings were averaged for each idea and each dimension. Finally, 10 ideas which vary in creativity in 5 identical intervals were used in the experiment.
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**Questions.** Participants were asked several questions about their idea selection performance. All questions and items were rated on a 7-point scale (1 = not at all, 7 = very much). Participants had to indicate how confident they were that they had selected the most creative idea (the choosing strategy) or the more creative idea from each pair (the paired comparison strategy), how satisfied they were with the selection they had made, how difficult it was to make the selections. Moreover, they had to indicate how motivated they were to perform the idea selection task, how effortful it was for them to perform the creative idea selection task, how well they could concentrate on the individual idea that they were evaluating, and how much they were distracted by other ideas when they were evaluating an individual idea in the idea selection task. Finally, intuitive and deliberative processing style was measured by a set of five items developed by Dane and colleagues (2011). Among the five items, three items measure how intuitive people were (e.g., “I selected ideas that felt right to me”; alpha reliability = 0.69) and the responses on these three items were averaged, and higher scores indicate that participates were more intuitive during idea selection. The other two items measure how deliberatively people were during idea selection (e.g., “I evaluated and selected ideas in a logical and systematic way”; alpha reliability = 0.68) and the responses were also averaged. Higher scores indicate that people selected ideas more deliberatively.

**Demographics.** Participants’ gender, age, nationality, and educational background were assessed.

**Dependent Variables**

As in Experiment 2a, idea selection performance was measured by the *optimal selection*, the *creativity of the most creative idea*, the *originality of the most creative idea*, the *efficacy of the most creative idea*, and the *feasibility of the most creative idea*. The results and discussion are presented as follows:

**Idea Selection**

**Optimal selection.** A Chi-square analysis (see Table 2) was used to compare between conditions on the optimal selection in the first selection task. The results showed no effect of selection strategy, $\chi^2(1, N=102) = 3.22, p = .11$. Based on the odds ratio, the odds of making the optimal selection were 2.06 times higher when participants used the paired comparison strategy than when they used the choosing strategy.

**Creativity of most creative idea.** To examine whether the paired comparison strategy outperformed the choosing strategy in selecting the most creative idea in the first selection task (as shown in Experiment 2a), an independent t-test (see Table 2) was conducted on the expert creativity rating of the idea selected as most creative idea. The results showed no significant effect of selection strategy, $t(100) = 1.49, p = .14$, Cohen's $d = 0.30$. Specifically, when the paired comparison strategy was used, the most creative idea was not significantly more creative than when the choosing strategy was used.

**Originality, effectiveness, and feasibility of idea selected as most creative idea.** Independent t-tests (see Table 2) on originality, effectiveness, and feasibility also showed that the most creative idea selected in the first selection task by using the paired comparison strategy was not significantly more original, $t(100) = 0, p = 1$, Cohen's $d = 0$, effective, $t(100) = 0.80, p = .42$, Cohen's $d = 0.16$, and feasible, $t(100) = 0.17, p = .86$, Cohen's $d = 0.03$, than that idea selected by using the choosing strategy.
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Idea, the effectiveness of the most creative idea, the feasibility of the most creative idea, and the overall selection performance.

Results & Discussion

Idea Selection

Optimal selection. A Chi-square analysis (see Table 2) was used to compare between conditions on the optimal selection in the first selection task. The results showed no effect of selection strategy, \( \chi^2(1, N = 102) = 3.22, p = .11 \). Based on the odds ratio, the odds of making the optimal selection were 2.06 times higher when participants used the paired comparison strategy than when they used the choosing strategy.

Creativity of most creative idea. To examine whether the paired comparison strategy outperformed the choosing strategy in selecting the most creative idea in the first selection task (as shown in Experiment 2a), an independent t-test (see Table 2) was conducted on the expert creativity rating of the idea selected as most creative idea. The results showed no significant effect of selection strategy, \( t(100) = 1.49, p = .14 \), Cohen’s \( d = 0.30 \). Specifically, when the paired comparison strategy was used, the most creative idea was not significantly more creative than when the choosing strategy was used.

Originality, effectiveness, and feasibility of idea selected as most creative idea. Independent t-tests (see Table 2) on originality, effectiveness, and feasibility also showed that the most creative idea selected in the first selection task by using the paired comparison strategy was not significantly more original, \( t = 0, p = 1 \), Cohen’s \( d = 0 \), effective, \( t(100) = 0.80, p = .42 \), Cohen’s \( d = 0.16 \), and feasible, \( t = 0.17, p = .86 \), Cohen’s \( d = 0.03 \), than that idea selected by using the choosing strategy.
**Overall selection performance.** To examine whether the paired comparison strategy outperforms the choosing strategy on overall selection performance in the first selection task, an independent t-test (see Table 2) was conducted. The results showed that participants using the paired comparison strategy did not significantly differ from those using the choosing strategy on the overall selection performance, $t = 0.064$, $p = .95$, Cohen’s $d = 0.10$.

Table 2

*Descriptive Statistics for Optimal selection, Creativity, Originality, Effectiveness, and Feasibility of Most Creative Idea, and Overall Selection Performance in the first selection task*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Choosing ($n = 51$)</th>
<th>Paired comparison ($n = 51$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal selection</td>
<td>35.3%</td>
<td>52.9%</td>
</tr>
<tr>
<td>The most creative idea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td>3.27 (0.74)</td>
<td>3.49 (0.71)</td>
</tr>
<tr>
<td>Originality</td>
<td>3.44 (0.66)</td>
<td>3.44 (0.82)</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>3.38 (0.51)</td>
<td>3.47 (0.56)</td>
</tr>
<tr>
<td>Feasibility</td>
<td>3.48 (0.34)</td>
<td>3.47 (0.32)</td>
</tr>
<tr>
<td>Overall selection performance</td>
<td>3.16 (0.11)</td>
<td>3.16 (0.09)</td>
</tr>
</tbody>
</table>

*Note.* The optimal selection is reported in percentages. For overall selection performance and creativity, originality, effectiveness and feasibility of the idea that was selected as most creative, means are reported with standard deviations in parentheses.

**Questions**

The descriptive statistics of the answers on the questions are presented in Table 3. Independent t-tests revealed significant effects of condition on satisfaction, motivation, and difficulty, and marginally significant effects of condition on
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distraction and confidence. Specifically, participants in the choosing-first condition, as compared to participants in the paired-comparison-first condition, were more satisfied with the selection they made in the first selection task, were more motivated to perform the first selection task, rated the first selection task as less difficult, were slightly less distracted when evaluating ideas, and were slightly more confident that they had selected the most creative idea in the first selection task. No significant effect of condition was found for effortfulness, concentration, and intuitive and deliberative processing style.

Table 3

Descriptive Statistics for Ratings of Questions about the First Selection Task

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th>t(100)</th>
<th>p</th>
<th>Cohen’s d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choosing (n = 51)</td>
<td>Paired-comparison (n = 51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>3.55 (1.39)</td>
<td>4.10 (1.40)</td>
<td>1.99</td>
<td>.050</td>
</tr>
<tr>
<td>Motivation</td>
<td>5.94 (0.86)</td>
<td>5.49 (0.95)</td>
<td>2.52</td>
<td>.013</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>5.73 (0.87)</td>
<td>5.35 (0.93)</td>
<td>2.08</td>
<td>.040</td>
</tr>
<tr>
<td>Distraction</td>
<td>3.37 (1.54)</td>
<td>3.90 (1.40)</td>
<td>1.82</td>
<td>.072</td>
</tr>
<tr>
<td>Confidence</td>
<td>5.51 (0.90)</td>
<td>5.18 (0.99)</td>
<td>1.77</td>
<td>.079</td>
</tr>
<tr>
<td>Effortfulness</td>
<td>4.41 (1.43)</td>
<td>4.43 (1.30)</td>
<td>&lt; 1</td>
<td>.94</td>
</tr>
<tr>
<td>Concentration</td>
<td>5.41 (0.80)</td>
<td>5.20 (1.30)</td>
<td>1.01</td>
<td>.32</td>
</tr>
<tr>
<td>Intuitive processing</td>
<td>5.06 (1.05)</td>
<td>5.20 (0.87)</td>
<td>&lt; 1</td>
<td>.45</td>
</tr>
<tr>
<td>Deliberative processing</td>
<td>4.95 (1.01)</td>
<td>4.79 (1.18)</td>
<td>&lt; 1</td>
<td>.47</td>
</tr>
</tbody>
</table>

Note. The table reports means, with standard deviations in parentheses.

The results of Experiment 2b did not replicate the findings of Experiment 2a. Specifically, the paired comparison strategy did not improve creative idea selection performance compared to the choosing strategy. Interestingly, the two selection strategies differed regarding the experience with the selection task. People using the
choosing strategy expressed more positive feelings (e.g., more satisfied) regarding their idea selection experience than people using the paired comparison strategy.

**Experiment 3**

In previous experiments, we studied the effect of selection strategy on creative idea selection performance by comparing the choosing strategy with the elimination strategy (Experiment 1) and with the paired comparison strategy (Experiment 2). In the current experiment, all three selection strategies were compared against each other. The methods and data analysis plan of Experiment 3 were pre-registered on Open Science Framework (see [https://osf.io/f6gsp/](https://osf.io/f6gsp/)).

**Method**

**Participants and Design**

A total of 519 native English speakers were recruited online via Prolific. Sixteen participants were excluded from analyses as they encountered technical problems. The remaining 503 participants (262 females, 241 males) had an age range from 18 to 72 ($M = 35.96, SD = 12.53$). Participants were rewarded one British Pound. They were randomly assigned to one of the three between-subjects conditions: the choosing ($n = 157$), the elimination ($n = 176$), or the paired comparison ($n = 170$) condition.

**Procedure**

Participants first performed the idea selection task, then answered several questions about the experience of idea selection, subsequently performed the idea evaluation task[^1], and finally answered demographic questions.

[^1]: The description of the idea evaluation task and all relevant variables, analyses and results can be found in the supplemental materials.
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Materials

**Idea pool.** The same idea pool as in Experiment 2a was used in the current experiment.

**Idea selection task.** The idea selection task was the same as in Experiment 1, 2a, and 2b. Participants were asked to select the most creative idea by using a specific (choosing vs. elimination vs. paired comparison) strategy, depending on which condition they were assigned to.

**Questions.** Participants were asked several questions about their experience during the idea selection task. Participants responded by rating on a 7-point scale (1 = not at all, 5 = very much). They had to indicate how difficult the selection task was, how hard it was to differentiate between the ideas for selection, how confident they were that they had performed the selection task well, how well they could concentrate during the selection task, and how much they liked the selection task.

**Demographics.** Participants’ gender, age, nationality, profession, and highest level of education were assessed.

Dependent Variables

Idea selection performance was measured by the same variables as in Experiment 2a and 2b, namely the *optimal selection*, the *creativity of the most creative idea*, the *originality of the most creative idea*, the *effectiveness of the most creative idea*, the *feasibility of the most creative idea*, and the *overall selection performance*. 
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Results & Discussion

Idea Selection

Optimal selection. A chi-square analysis (see Table 4) on the optimal selection showed no significant effect of selection strategy, $\chi^2 (2, N = 503) = 3.32, p = .19$. No significant difference was found between the three conditions on the optimal selection.

Creativity of most creative idea. A one-way ANOVA (see Table 4) on the creativity of the idea that was selected as most creative idea showed no effect of selection strategy, $F(2, 500) = 1.74, p = .18, \eta^2_p = .007$.

Originality, effectiveness, and feasibility of idea selected as most creative idea. One-way ANOVAs (see Table 4) on the originality, the effectiveness, and the feasibility of the idea that was selected as most creative idea revealed no effects of selection strategy on the originality, $F(2, 500) = 1.13, p = .32, \eta^2_p = .004$, the effectiveness, $F = 0.75, p = .47, \eta^2_p = .003$, and the feasibility, $F(2, 500) = 1.98, p = .14, \eta^2_p = .008$, respectively.

Overall selection performance. A one-way ANOVA (see Table 4) on the overall selection performance revealed a significant effect of selection strategy, $F(2, 500) = 3.56, p = .029, \eta^2_p = .014$. Post hoc tests showed a significant difference between the paired comparison condition and the elimination condition ($p = .026$). Specifically, participants in the paired comparison condition made a better overall selection than participants in the elimination condition. However, no significant difference was found on the overall selection performance between the paired comparison and the choosing condition ($p = 1.00$), and between the choosing and the elimination condition ($p = .31$).
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Table 4

*Descriptive Statistics for Optimal Selection, Creativity, Originality, Effectiveness, and Feasibility of Most Creative Idea, and Overall selection performance*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Choosing (n = 157)</th>
<th>Elimination (n = 176)</th>
<th>Paired comparison (n = 170)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal selection</td>
<td>45.2%</td>
<td>50.0%</td>
<td>55.3%</td>
</tr>
<tr>
<td>The most creative idea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td>3.37 (0.56)</td>
<td>3.40 (0.54)</td>
<td>3.48 (0.55)</td>
</tr>
<tr>
<td>Originality</td>
<td>3.23 (0.62)</td>
<td>3.26 (0.62)</td>
<td>3.33 (0.57)</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>3.39 (0.40)</td>
<td>3.42 (0.42)</td>
<td>3.45 (0.44)</td>
</tr>
<tr>
<td>Feasibility</td>
<td>3.40 (0.32)</td>
<td>3.37 (0.39)</td>
<td>3.44 (0.23)</td>
</tr>
<tr>
<td>Overall selection performance</td>
<td>3.11 (0.11)</td>
<td>3.09 (0.11)</td>
<td>3.12 (0.10)</td>
</tr>
</tbody>
</table>

*Note.* The optimal selection is reported in percentages. For overall selection performance and creativity, originality, effectiveness and feasibility of the idea that was selected as most creative idea, means are reported with standard deviations in parentheses.

Questions

The descriptive statistics of the answers on the questions are presented in Table 5. One-way ANOVAs revealed a significant effect of selection strategy on selection difficulty, differentiation difficulty, confidence, and tiredness. Pairwise comparisons revealed that participants in the elimination condition rated the selection task significantly more difficult than those in the choosing condition ($p < .001$) and the paired comparison condition ($p < .001$), and they also felt that it was more difficult to differentiate the ideas in creativity during the idea selection task than those in choosing condition ($p = .001$) and marginally more difficult than those in the paired comparison condition ($p = .083$). Moreover, participants in the paired comparison condition were more confident that they had performed the selection task well than
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those in the elimination condition ($p = .022$), and they rated the selection task significantly more tiring than those in the choosing ($p < .001$) and the elimination condition ($p = .002$).

Table 5

Descriptive Statistics for Ratings of Questions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th>$F(2, 500)$</th>
<th>$P$</th>
<th>$\eta^2_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choosing ($n = 157$)</td>
<td>Elimination ($n = 176$)</td>
<td>Paired comparison ($n = 170$)</td>
<td></td>
</tr>
<tr>
<td>Selection difficulty</td>
<td>2.76 (1.58)</td>
<td>3.64 (1.76)</td>
<td>2.55 (1.54)</td>
<td>21.82</td>
</tr>
<tr>
<td>Differentiation difficulty</td>
<td>2.72 (1.53)</td>
<td>3.35 (1.71)</td>
<td>2.96 (1.59)</td>
<td>6.42</td>
</tr>
<tr>
<td>Selection confidence</td>
<td>5.38 (1.39)</td>
<td>5.20 (1.44)</td>
<td>5.60 (1.32)</td>
<td>3.64</td>
</tr>
<tr>
<td>Concentration during selection</td>
<td>6.50 (0.74)</td>
<td>6.41 (1.09)</td>
<td>6.36 (1.08)</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Selection tiredness</td>
<td>1.69 (1.11)</td>
<td>2.02 (1.40)</td>
<td>2.55 (1.61)</td>
<td>15.67</td>
</tr>
<tr>
<td>Liking of selection task</td>
<td>4.89 (1.45)</td>
<td>4.65 (1.55)</td>
<td>4.53 (1.57)</td>
<td>2.28</td>
</tr>
</tbody>
</table>

Note. The table reports means, with standard deviations in parentheses.

The results of Experiment 3 showed no effects of selection strategy on the optimal selection and the creativity of the most creative idea. However, selection strategy influenced the overall selection performance. Specifically, the paired comparison strategy outperformed the elimination strategy on the overall selection performance. Moreover, participants using the choosing strategy reported the idea selection task as less negative (e.g., less difficult and tiring) than those using the other two strategies.
Meta-analysis

Thus far, we studied the effect of selection strategy on creative idea selection in four experiments. In Experiment 1, no difference was found between the choosing strategy and the elimination strategy on any of the dependent variables. Experiment 2a suggested that the paired comparison strategy outperformed the choosing strategy in selecting the most creative idea, but not on the optimal selection and the overall selection performance. However, in Experiment 2b, there was no significant difference between the choosing strategy and the paired comparison strategy on any of the selection variables. In Experiment 3, no difference on selection performance was found between the choosing strategy and the elimination strategy (as in Experiment 1), and between the choosing strategy and the paired comparison strategy (as in Experiment 2b). However, participants’ overall selection performance was better when using the paired comparison strategy than when using the elimination strategy.

The experiments provided findings that were not very consistent. We decided to perform a meta-analysis to have a closer look on the effect of selection strategy on idea selection performance. It was carried out using the statistical software MedCalc (MedCalc 2017, Version 17.2). The three dependent variables included in the analyses were the odds ratio of making the optimal selection (in short: optimal selection), the creativity of the most creative idea (in short: creativity), and the overall selection performance. The meta-analyses were conducted on the dependent variables to compare the choosing strategy and the elimination strategy, by using the data of Experiment 1 and 3. In addition, the meta-analyses were also conducted to compare the choosing strategy and the paired comparison strategy, by using the data of Experiment 2a, 2b, and 3. There was no meta-analysis on the differences between the
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paired comparison condition and the elimination condition, because they were used together in only one experiment—Experiment 3. However, the paired comparison condition was still compared with the elimination condition on the three dependent variables using the data in Experiment 3 by using MedCalc. See Table 6 for a summary of relevant effect sizes.

Table 6

Summary of Relevant Effect Sizes for the Meta-analysis

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Experiment</th>
<th>Sample size</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n&lt;sub&gt;c&lt;/sub&gt;</td>
<td>n&lt;sub&gt;e&lt;/sub&gt;</td>
</tr>
<tr>
<td>Elimination vs. Choosing</td>
<td>1</td>
<td>41</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>157</td>
<td>176</td>
</tr>
<tr>
<td>Paired comparison vs. Choosing</td>
<td>2a</td>
<td>41</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>2b</td>
<td>51</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>157</td>
<td>170</td>
</tr>
<tr>
<td>Paired comparison vs. Elimination</td>
<td>3</td>
<td>176</td>
<td>170</td>
</tr>
</tbody>
</table>

*Note.* The table reports means, with standard deviations in parentheses. n<sub>c</sub>, n<sub>e</sub>, and n<sub>p</sub> stands for the sample size of the choosing, the elimination, and the paired comparison condition, separately. Creativity stands for the creativity of the most creative idea.

Results

**Optimal selection.** The meta-analysis on the optimal selection of the paired comparison strategy against the choosing strategy showed a significant effect of
selection strategy according to the fixed effects model, $z = 2.74, p = .006, 95\% \text{ CI} = [1.15, 2.33]$. Specifically, participants were 1.64 times more likely to make the optimal selection using the paired comparison strategy than using the choosing strategy. The meta-analysis on the optimal selection of the elimination strategy against the choosing strategy showed no significant effect of selection strategy according to the fixed effects model, $z = 1.22, p = .22, 95\% \text{ CI} = [0.86, 1.89]$. The test on the optimal selection of the paired comparison condition against the elimination condition also showed no significant difference between the two conditions, $z = 0.55, p = .58, 95\% \text{ CI} = [0.63, 1.29]$.

**Creativity of most creative idea.** The meta-analysis on creativity between the paired comparison condition and the choosing condition revealed that the most creative idea selected by participants using the paired comparison strategy was significantly more creative than the idea selected by participants who used the choosing strategy, $t = 3.09, p = .002, 95\% \text{ CI} = [0.099, 0.45]$. The meta-analysis on the creativity between the elimination condition and the choosing condition showed no significant difference, $t = 1.16, p = .25, 95\% \text{ CI} = [-0.079, 0.31]$. An independent t-test on the creativity between the paired comparison condition and the elimination condition showed no significant difference, $t = 1.29, p = .20, 95\% \text{ CI} = [-0.040, 0.190]$.

**Overall selection performance.** The meta-analysis on the overall selection performance of the paired comparison strategy against the choosing strategy showed no significant difference between the two conditions, $t = 1.23, p = .22, 95\% \text{ CI} = [-0.065, 0.28]$. The meta-analysis on the overall selection performance of the elimination strategy against the choosing strategy also showed no significant difference between the two conditions, $t= 0.10, p = .92, 95\% \text{ CI} = [-0.44, 0.48]$. An
independent t-test on the overall selection performance showed that participants using the paired comparison strategy made a better overall selection than participants in the elimination condition, $t = 2.66, p = .008, 95\% CI = [0.008, 0.053]$. 

The results of the meta-analyses show that for both the optimal selection and the creativity of most creative idea, the paired comparison strategy outperformed the choosing strategy. However, no significant difference on these two variables was found between the choosing strategy and the elimination strategy, and between the elimination strategy and the paired comparison strategy. For the overall selection performance, the paired comparison strategy outperforms the elimination strategy. However, no significant difference on this variable was found between the choosing and the elimination strategy, and between the choosing and the paired comparison strategy.

**General Discussion**

In the current research, the influence of selection strategy on creative idea selection performance was studied by comparing the effectiveness of three different selection strategies—the choosing, the elimination, and the paired comparison strategy—in four experiments. Our meta-analytic findings suggest that the paired comparison strategy outperformed the choosing strategy and the elimination strategy. Specifically, when using the paired comparison strategy, a larger proportion of participants selected the most creative idea than when using the choosing strategy. In addition, the idea that was selected as most creative by using the paired comparison strategy was more creative than that selected by using the choosing strategy. Moreover, participants using the paired comparison strategy showed a better overall selection performance than those using the elimination strategy. No difference was found between the elimination and the choosing strategy.
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Besides, we found selection strategy influenced people’s feelings towards the idea selection task experience. Generally, participants, who used the choosing strategy to select ideas, rated the idea selection experience as less negative than those using the other two strategies. Specifically, participants using the choosing strategy experienced the selection as less tiring than participants in the paired comparison condition, and as less difficult than participants in the elimination condition, as shown in Experiment 3. Moreover, participants using the choosing strategy felt more motivated to perform the selection task than those using the paired comparison strategy, as shown in Experiment 2b. Previous research has shown the existence of a “law of less work”—people have a strong tendency to choose actions or work with less physical as well as mental effort (e.g., Gray, 2000; Kool, Mcguire, Rosen, & Botvinick, 2010). Therefore, these benefits of the choosing strategy in saving physical and cognitive effort in relation to the other two strategies may lead people to adopt it while neglecting its shortcomings and other strategies’ strengths.

By investigating the effect of selection strategies on creative idea selection, the current research contributes to the existing literature on idea selection. So far, although the value of creative idea selection has been stressed by creativity researchers (e.g., Amabile, 1983; Nijstad & De Dreu, 2002) and practitioners, it has received relatively little research attention. Moreover, researchers generally use one type of idea selection paradigm—the choosing strategy—to study idea selection. In most studies participants are instructed to select the most optimal ideas from a large pool of ideas (e.g., Putman & Paulus, 2009; Rietzschel et al., 2010, 2014). The influence of selection strategy on creative idea selection, thus, has not yet been investigated. The findings of the current research suggest that selection strategy can
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affect selection performance, which expands the research on creative idea selection, and provides insightful information for future research in this field.

Moreover, the current finding expanded the research on selection strategies. Previous research (e.g., Rietzschel et al., 2010; Yaniv et al., 2002) mainly focused on how well participants can form a consideration set from an initial idea pool. It was consistently found that the elimination strategy outperforms the choosing strategy by generating a larger consideration set, which is more likely to contain the optimal options. However, it was not investigated whether these two strategies differ in selection quality, when used to make the final selection directly from the initial pool. Our research investigated this question and showed no difference in the effectiveness of the two strategies on idea selection. Moreover, previous research did not study the difference between the paired comparison strategy and the choosing or the elimination strategy. We also addressed this question and found that paired comparison outperforms the other two strategies on creative idea selection.

The current research has several limitations and raises suggestions for future research. First, in the current research, the idea selection settings were simplified (e.g., make selections from 10 ideas), which may decrease the generalizability of our findings. Real-life idea selections involve factors besides selection strategy that may influence idea selection performance, such as inter-personal interactions, expertise, type of problem, number of ideas for selection, and idea ownership. Regarding idea ownership, we only focused on the inter-individual idea selection (i.e., selection of ideas generated by others) but not on intra-individual idea selection (i.e., selection from self-generated ideas). Future research may investigate how these factors can influence the effect of selection strategy on creative idea selection. Second, in the current research, several factors that may influence idea selection were not controlled...
for. Future research may consider reducing the influence of these factors. For example, idea selection in the paired comparison condition takes longer than in the other two conditions. The longer the selection task, the more familiar people get with the ideas, but meanwhile the more exhausted people get.

Future research may study how creative idea selection can be enhanced by keeping a strategy’s pros and meanwhile avoiding its cons. For example, when using the paired comparison strategy, rests during the selection may reduce fatigue produced by multiple selections, meanwhile keep the benefits of the paired comparison strategy for selecting creative ideas. In addition, it is also interesting to investigate whether using a combination of different strategies can improve creative idea selection. For example, during creative idea selection, people may first use the elimination strategy to form a consideration set by removing the least creative ideas, then use the paired comparison to get the rank of the ideas in creativity. This makes use of the advantage of the elimination strategy in excluding the least creative ideas, and that of the paired comparison strategy in enhancing idea selection, and meanwhile reduces the fatigue induced by paired comparison.

Our world is changing more and more rapidly and becoming intensely competitive. Hence, the ability to successfully select and implement creative ideas can determine success or failure for a company. However, people are poor at selecting creative ideas—they tend to select mainstream ideas instead of creative ideas. In practice, when having several ideas at hand, people often use different strategies—choosing, elimination, or the paired comparison—to perform the selection, yet little is known whether the strategy they favor is beneficial for creative idea selection. We provided the first evidence that the paired comparison strategy may be more effective than the choosing and the elimination strategy for selecting the most creative idea.
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Supplemental Materials

Experiment 1

Method

Materials

Idea evaluation task. During the evaluation task, participants were first informed that a creative idea has to be original and useful and were explained what originality and usefulness are. Thereafter, participants were presented with the problem statement and the 10 ideas, and they had to evaluate all the ideas first on creativity, then on originality, and finally on usefulness on a 5-point scale (e.g., 1 = not at all creative, 5 = very much creative). For each evaluation session, the ideas were presented in a random order.

Dependent Variables

Selection effectiveness. The selection effectiveness indicates whether participants selected better than chance level, in other words, whether the idea selected as most creative is better than the average idea in the pool. It was tested within each condition by comparing the creativity, originality, and usefulness of the most creative idea with the mean creativity, originality, and usefulness of all the 10 ideas.

Selection-evaluation consistency. The selection-evaluation consistency examines whether participants selected ideas that they had evaluated as the most creative, by comparing participants’ creativity evaluation of the most creative idea with that of the other nine ideas. Moreover, the same comparisons on the originality and the usefulness evaluation indicate whether participants relied on originality or/and usefulness when selecting the six ideas out of the 18 ideas. For example, if
participants evaluate the selected ideas identically original but more original than the unselected ideas, it means they mainly refer to originality when selecting creative ideas.

Results

Selection effectiveness. To examine selection effectiveness, a one-sample t-test was conducted for each condition, with the expert-rated creativity of the most creative idea as the test variable, and the average expert-rated creativity of all the 10 ideas as the test value. The results showed that using either the choosing strategy ($M = 2.62, SD = 1.15; t = 0.36, p = .72$) or the elimination strategy ($M = 2.99, SD = 1.11; t(39) = 1.70, p = .098$), the most creative idea was not significantly different from the total idea set ($M = 2.69, SD = 0.99$) in creativity.

Similar analyses were also conducted on originality and usefulness, and the results were similar to those of creativity. For originality, the most creative idea selected by people either using the choosing strategy ($M = 2.83, SD = 1.21; t = 0.60, p = .55$) or the elimination strategy ($M = 3.21, SD = 1.16; t = 1.44, p = .16$) was not more original than the average idea ($M = 2.94, SD = 1.03$). For usefulness, the most creative idea selected by people either using the choosing strategy ($M = 3.26, SD = 0.45; t = 0.13, p = .90$) or the elimination strategy ($M = 3.23, SD = .31; t = 0.76, p = .46$) was not more useful than the average idea ($M = 3.27, SD = 0.75$).

Selection-evaluation consistency. Selection-evaluation consistency was examined with a 2 (Selection Strategy [choosing, elimination]) × 2 (Participant-rated Creativity [of the most creative idea, of the other ideas]) mixed model ANOVA (see Table 1). The analysis showed no significant main effect of within-subjects factor creativity ($F(1, 79) = 1.37, p = .25, \eta^2_p = .017$), no significant main effect of between-subjects factor selection strategy ($F(1, 79) = 0.94, p = .33, \eta^2_p = .012$), and no
significant creativity × selection strategy interaction effect ($F(1, 79) = 0.09, p = .76, \eta_p^2 = .001$). Specifically, participants in both conditions evaluated the most creative idea not significantly more creative than the average idea.

Similar analyses were also conducted on originality and usefulness. The analysis on originality showed no significant main effect of originality ($F(1, 79) = 0.24, p = .63, \eta_p^2 = .003$), no significant main effect of selection strategy ($F(1, 79) = 1.83, p = .18, \eta_p^2 = .023$), and no significant originality × selection strategy interaction ($F(1, 79) = 2.62, p = .11, \eta_p^2 = .032$). Participants in both conditions evaluated the most creative idea not significantly more original than the average idea. The analysis on usefulness also showed a marginally significant main effect of usefulness ($F(1, 79) = 3.11, p = .082, \eta_p^2 = .038$), but no significant main effect of selection strategy ($F(1, 79) = 0.34, p = .56, \eta_p^2 = .004$), and no significant usefulness × selection strategy interaction ($F(1, 79) = 0.23, p = .63, \eta_p^2 = .003$). Similar to creativity and originality, participants in both conditions evaluated the most creative idea not significantly more useful than the average idea.

### Table 1
Descriptive Statistics for Selection-evaluation Consistency

<table>
<thead>
<tr>
<th>Condition</th>
<th>Variable</th>
<th>Choosing ($n = 41$)</th>
<th>Elimination ($n = 40$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Creativity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Most creative idea</td>
<td>3.27 (1.32)</td>
<td>3.18 (1.34)</td>
</tr>
<tr>
<td></td>
<td>Other ideas</td>
<td>3.13 (0.33)</td>
<td>2.94 (0.40)</td>
</tr>
<tr>
<td></td>
<td>Originality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Most creative idea</td>
<td>3.20 (1.55)</td>
<td>3.73 (1.41)</td>
</tr>
<tr>
<td></td>
<td>Other ideas</td>
<td>3.40 (0.49)</td>
<td>3.34 (0.69)</td>
</tr>
<tr>
<td></td>
<td>Usefulness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Most creative idea</td>
<td>3.49 (1.40)</td>
<td>3.48 (1.38)</td>
</tr>
<tr>
<td></td>
<td>Other ideas</td>
<td>3.28 (0.40)</td>
<td>3.11 (0.48)</td>
</tr>
</tbody>
</table>

Note. The table reports means, with standard deviations in parentheses.
Chapter 3 - Selection Strategy and Creative Idea Selection

Table 1

Descriptive Statistics for Selection-evaluation Consistency

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choosing</td>
<td>Elimination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(n = 41)</td>
<td>(n = 40)</td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>3.27 (1.32)</td>
<td>3.18 (1.34)</td>
<td></td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.13 (0.33)</td>
<td>2.94 (0.40)</td>
<td></td>
</tr>
<tr>
<td>Originality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>3.20 (1.55)</td>
<td>3.73 (1.41)</td>
<td></td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.40 (0.49)</td>
<td>3.34 (0.69)</td>
<td></td>
</tr>
<tr>
<td>Usefulness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>3.49 (1.40)</td>
<td>3.48 (1.38)</td>
<td></td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.28 (0.40)</td>
<td>3.11 (0.48)</td>
<td></td>
</tr>
</tbody>
</table>

Note. The table reports means, with standard deviations in parentheses.

Experiment 2a

Method

Materials

Idea evaluation task. In the idea evaluation task, participants had to rate all the ideas first on creativity, then on originality, then on effectiveness, and finally on feasibility on a 5-point scale (e.g., 1 = not at all creative, 5 = very much creative).

Dependent Variables

As in Experiment 1, the Selection effectiveness and the Selection-evaluation consistency were used in the current experiment.
Chapter 3 - Selection Strategy and Creative Idea Selection

**Results**

**Selection effectiveness.** One-sample t-tests (see Table 2 for descriptive statistics) showed that the most creative idea in both the choosing ($t(40) = 3.97, p < .001$) and the paired comparison condition ($t(41) = 11.88, p < .001$) was more creative than the total idea set ($M = 2.96, SD = 0.70$). One-sample t-tests on originality, effectiveness, and feasibility showed that the most creative idea in the choosing condition was more original ($t(40) = 3.75, p = .001$), more effective ($t(40) = 4.14, p < .001$), and slightly more feasible ($t(40) = 1.85, p = .072$) than the idea set (for originality, $M = 2.78, SD = 0.78$; for effectiveness, $M = 3.05, SD = 0.60$; for feasibility, $M = 3.27, SD = 0.52$), whereas the most creative idea in the paired comparison condition was more original ($t(41) = 13.47, p < .001$), more effective ($t(41) = 15.13, p < .001$), and more feasible ($t(41) = 19.29, p < .001$) than the idea set.

**Selection-evaluation consistency.** A 2 × 2 mixed model ANOVA (see Table 2 for descriptive statistics) showed a significant main effect of between-subjects factor selection strategy ($F(1, 81) = 5.34, p = .023, \eta_p^2 = .062$), a significant main effect of within-subjects factor creativity ($F(1, 81) = 209.37, p < .001, \eta_p^2 = .72$), and a significant selection strategy × creativity interaction effect ($F(1, 81) = 4.61, p = .035, \eta_p^2 = .054$). Participants in both conditions evaluated the most creative idea more creative than the other nine ideas.

Similar analyses were also conducted on originality, effectiveness, and feasibility. The analysis on originality showed a significant main effect of originality ($F(1, 81) = 89.09, p < .001, \eta_p^2 = .52$), but no significant main effect of selection strategy ($F(1, 81) = 1.86, p = .18, \eta_p^2 = .022$), and no significant originality × selection strategy interaction ($F(1, 81) = 0.80, p = .37, \eta_p^2 = .010$). Participants in both
conditions evaluated the most creative idea more original than the other ideas. The analysis on effectiveness showed a significant main effect of effectiveness ($F(1, 81) = 167.48, p < .001, \eta^2_p = .67$), a marginally significant main effect of selection strategy ($F(1, 81) = 3.03, p = .086, \eta^2_p = .036$), but no significant effectiveness $\times$ selection strategy interaction ($F(1, 81) = 1.82, p = .18, \eta^2_p = .022$). Participants in both conditions evaluated the most creative idea more effective than the other ideas. The analysis on feasibility showed a significant main effect of feasibility ($F(1, 81) = 71.74, p < .001, \eta^2_p = .47$), but no significant main effect of selection strategy ($F(1, 81) = 0.28, p = .60, \eta^2_p = .003$), and no significant feasibility $\times$ selection strategy interaction ($F(1, 81) = 0.03, p = .87, \eta^2_p < .001$). Similar to originality and effectiveness, participants in both conditions evaluated the most creative idea more feasible than the other ideas.
Chapter 3 - Selection Strategy and Creative Idea Selection

Table 2

Descriptive Statistics for Selection-evaluation Consistency

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th>Choosing (n = 41)</th>
<th>Paired comparison (n = 42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creativity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>4.22 (0.94)</td>
<td>4.64 (0.53)</td>
<td></td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.05 (0.44)</td>
<td>3.07 (0.39)</td>
<td></td>
</tr>
<tr>
<td>Originality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>3.95 (1.09)</td>
<td>4.24 (0.91)</td>
<td></td>
</tr>
<tr>
<td>Other ideas</td>
<td>2.98 (0.54)</td>
<td>3.06 (0.55)</td>
<td></td>
</tr>
<tr>
<td>Effectiveness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>4.20 (1.08)</td>
<td>4.52 (0.63)</td>
<td></td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.01 (0.35)</td>
<td>3.06 (0.43)</td>
<td></td>
</tr>
<tr>
<td>Feasibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>4.10 (0.94)</td>
<td>4.05 (0.88)</td>
<td></td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.30 (0.47)</td>
<td>3.21 (0.42)</td>
<td></td>
</tr>
</tbody>
</table>

Note: The table reports means, with standard deviations in parentheses.

Experiment 2b

Method

Materials

Idea evaluation task. The idea evaluation task was similar to the evaluation task used in Experiment 2a.

Dependent Variables

We examined the effect of selection strategy on the Selection effectiveness and the Selection-evaluation consistency, as in Experiment 1 and 2a.
Results

Selection effectiveness. One-sample t-tests (see Table 3 for descriptive statistics) showed that using either the choosing strategy ($t(50) = 3.94, p < .001$) or the paired comparison strategy ($t(50) = 5.36, p < .001$) in the first selection task, the most creative idea was more creative than the total idea set ($M = 2.96, SD = 0.85$). Similar analyses on originality, effectiveness, and feasibility showed that the most creative idea selected by either using the choosing or the paired comparison strategy in the first selection task was more original (for choosing, $t(50) = 5.42, p < .001$; for paired comparison, $t(50) = 5.66, p < .001$), more effective (for choosing, $t(50) = 3.16, p = .003$; for paired comparison, $t(50) = 5.26, p < .001$), and more feasible (for choosing, $t(50) = 2.86, p = .006$; for paired comparison, $t(50) = 4.29, p < .001$) than the idea set (for originality, $M = 2.90, SD = 0.78$; for effectiveness, $M = 3.26, SD = 0.70$; for feasibility, $M = 3.32, SD = 0.67$).

Selection-evaluation consistency. A $2 \times 2$ mixed model ANOVA (see Table 3 for descriptive statistics) showed a significant main effect of within-subjects factor creativity ($F(1, 81) = 587.20, p < .001, \eta_p^2 = .85$), but no significant main effect of between-subjects factor selection strategy ($F(1, 81) = 0.057, p = .81, \eta_p^2 = .001$), and no significant creativity $\times$ selection strategy interaction effect ($F(1, 81) = 1.78, p = .19, \eta_p^2 = .017$). Specifically, participants in both conditions evaluated the most creative idea more creative than the average idea.

Similar analyses were also conducted on originality, effectiveness, and feasibility. The analysis on originality showed a significant main effect of originality ($F(1, 100) = 83.28, p < .001, \eta_p^2 = .45$), a significant main effect of selection strategy ($F(1, 100) = 4.98, p = .028, \eta_p^2 = .047$), but no significant originality $\times$ selection strategy interaction effect.
strategy interaction \((F(1, 100) = 2.72, p = .135, \eta^2_p = .022)\). Same as creativity, participants in both conditions evaluated the most creative idea more original than the average idea. Moreover, participants using the choosing strategy in the first selection task generally rated ideas more original than those using the paired comparison strategy. The analysis on effectiveness showed a significant main effect of effectiveness \((F(1, 100) = 147.70, p < .001, \eta^2_p = .60)\), but no significant main effect of selection strategy \((F = 0.37, p = .55, \eta^2_p = .004)\), and no significant effectiveness × selection strategy interaction \((F(1, 100) = 2.66, p = .11, \eta^2_p = .026)\). Participants in both conditions evaluated the most creative idea more effective than the average idea. The analysis on feasibility also showed a significant main effect of feasibility \((F(1, 100) = 13.36, p < .001, \eta^2_p = .12)\), but no significant main effect of selection strategy \((F(1, 100) = 1.40, p = .24, \eta^2_p = .014)\), and no significant feasibility × selection strategy interaction \((F(1, 100) = 1.81, p = .18, \eta^2_p = .018)\). Similar to creativity, originality, and effectiveness, participants in both conditions evaluated the most creative idea more feasible than the average idea.
Table 3

Descriptive Statistics for Selection-evaluation Consistency

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th>Choosing-first (n = 51)</th>
<th>Paired-comparison-first (n = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creativity</td>
<td>Most creative idea</td>
<td>4.65 (0.56)</td>
<td>4.58 (0.60)</td>
</tr>
<tr>
<td></td>
<td>Other ideas</td>
<td>2.96 (0.35)</td>
<td>3.07 (0.32)</td>
</tr>
<tr>
<td>Originality</td>
<td>Most creative idea</td>
<td>4.35 (1.00)</td>
<td>4.89 (1.37)</td>
</tr>
<tr>
<td></td>
<td>Other ideas</td>
<td>3.04 (0.39)</td>
<td>2.95 (0.35)</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Most creative idea</td>
<td>4.12 (0.89)</td>
<td>4.33 (0.84)</td>
</tr>
<tr>
<td></td>
<td>Other ideas</td>
<td>3.10 (0.40)</td>
<td>3.00 (0.49)</td>
</tr>
<tr>
<td>Feasibility</td>
<td>Most creative idea</td>
<td>3.69 (1.24)</td>
<td>3.99 (0.95)</td>
</tr>
<tr>
<td></td>
<td>Other ideas</td>
<td>3.42 (0.44)</td>
<td>3.41 (0.51)</td>
</tr>
</tbody>
</table>

Note. The table reports means, with standard deviations in parentheses.

Experiment 3

Method

Materials

Idea evaluation task. The idea evaluation task was the same task as in Experiment 2a and 2b.

Dependent Variables

In the current experiment, idea selection and evaluation performance was measured by the same variables in Experiment 1, 2a and 2b.
Chapter 3 - Selection Strategy and Creative Idea Selection

**Results**

**Selection effectiveness.** One-sample t-tests showed that using no matter the choosing strategy ($t(156) = 9.32, p < .001$), the elimination strategy ($t(175) = 11.10, p < .001$), or the paired comparison strategy ($t(169) = 12.55, p < .001$), the most creative idea was more creative than the idea set ($M = 2.96, SD = 0.70$).

Similar analyses on originality, effectiveness, and feasibility showed that the most creative idea selected by using each of the three strategies was more original (for choosing, $t(156) = 9.08, p < .001$; for elimination, $t(175) = 10.13, p < .001$; for paired comparison, $t(169) = 12.41, p < .001$), more effective (for choosing, $t(156) = 10.77, p < .001$; for elimination, $t(175) = 11.64, p < .001$; for paired comparison, $t(169) = 11.87, p < .001$), and more feasible (for choosing, $t(156) = 4.96, p < .001$; for elimination, $t(175) = 3.34, p = .001$; for paired comparison, $t(169) = 9.40, p < .001$) than the idea set (for originality, $M = 2.78, SD = 0.78$; for effectiveness, $M = 3.05, SD = 0.60$; for feasibility, $M = 3.27, SD = 0.52$).

**Selection-evaluation consistency.** Selection-evaluation consistency was examined with a 3 (Selection Strategy [choosing, elimination, paired comparison]) × 2 (Participant-rated Creativity [of the most creative idea, of the other ideas]) mixed model ANOVA (see Table 4). The analysis showed a significant main effect of between-subjects factor selection strategy ($F(2, 500) = 7.25, p < .001, \eta_p^2 = .028$), a significant main effect of within-subjects factor creativity ($F(1, 500) = 493.02, p < .001, \eta_p^2 = .50$), and a significant selection strategy × creativity interaction effect ($F(2, 500) = 35.19, p < .001, \eta_p^2 = .12$). Simple analysis showed that participants in all the three conditions evaluated the most creative idea more creative (for choosing,
Chapter 3 - Selection Strategy and Creative Idea Selection

\[ F(1, 500) = 224.11, p < .001; \] for elimination, \( F(1, 500) = 301.38, p < .001; \] for paired comparison, \( F(1, 500) = 37.58, p < .001 \) than the other ideas.

Similar analyses were also conducted for originality, effectiveness, and feasibility. The analysis on originality showed a significant main effect of selection strategy \( (F(2, 500) = 4.60, p = .011, \eta^2_p = .018) \), a significant main effect of originality \( (F(1, 500) = 450.70, p < .001, \eta^2_p = .47) \), and a significant originality \times selection strategy interaction \( (F(2, 500) = 21.55, p < .001, \eta^2_p = .079) \). Simple analysis showed that participants in all the three conditions evaluated the most creative idea more original (for choosing, \( F(1, 500) = 181.77, p < .001; \) for elimination, \( F(1, 500) = 262.28, p < .001; \) for paired comparison, \( F(1, 500) = 50.73, p < .001 \) than the other ideas. The analysis on effectiveness showed a significant main effect of selection strategy \( (F(2, 500) = 4.84, p = .008, \eta^2_p = .019) \), a significant main effect of effectiveness \( (F(1, 500) = 286.61, p < .001, \eta^2_p = .36) \), and a significant effectiveness \times selection strategy interaction \( (F(1, 81) = 16.32, p < .181, \eta^2_p = .061) \). Simple analysis showed that participants in all the three conditions evaluated the most creative idea more effective (for choosing, \( F(1, 500) = 122.08, p < .001; \) for elimination, \( F(1, 500) = 169.78, p < .001; \) for paired comparison, \( F(1, 500) = 27.64, p < .001 \) than the other ideas. The analysis on feasibility showed a significant main effect of feasibility \( (F(1, 500) = 7.53, p = .006, \eta^2_p = .015) \), a marginally significant main effect of selection strategy \( (F(2, 500) = 2.54, p = .080, \eta^2_p = .010) \), and no significant feasibility \times selection strategy interaction \( (F(2, 500) = 1.60, p = .20, \eta^2_p = .006) \). Simple analysis showed that participants in the choosing condition evaluated the most creative idea more feasible \( F(1, 500) = 7.61, p = .006 \) than the
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other ideas; this difference was not significant for the elimination condition ($F(1, 500) = 2.76, p = .097$) and the paired comparison condition ($F(1, 500) = 0.08, p = .77$).

Table 4

Descriptive Statistics for Selection-evaluation Consistency

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choosing ($n = 157$)</td>
</tr>
<tr>
<td>Creativity</td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>4.39 (0.79)</td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.11 (0.59)</td>
</tr>
<tr>
<td>Originality</td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>4.16 (0.92)</td>
</tr>
<tr>
<td>Other ideas</td>
<td>2.99 (0.61)</td>
</tr>
<tr>
<td>Effectiveness</td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>4.23 (0.95)</td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.34 (0.62)</td>
</tr>
<tr>
<td>Feasibility</td>
<td></td>
</tr>
<tr>
<td>Most creative idea</td>
<td>3.99 (0.97)</td>
</tr>
<tr>
<td>Other ideas</td>
<td>3.77 (0.56)</td>
</tr>
</tbody>
</table>

*Note.* The table reports means, with standard deviations in parentheses.
CHAPTER 4

Creativity: Intrapersonal and Interpersonal Selection of Creative Ideas
Chapter 4 - Intrapersonal and Interpersonal Idea Selection

Abstract

Creative idea selection—the selection of the most creative idea(s) from available ideas—is important yet little studied. Previous research found that people desire creativity but they are poor at selecting creative ideas. Creative idea selection can be performed by the idea generator (i.e., intrapersonal selection) or by another person (i.e., interpersonal selection). In the current research, we examined whether these two types of selection lead to different levels of performance. During the experiment, each participant generated six creative ideas to solve a societal problem. Thereafter, two selection tasks—intrapersonal selection and interpersonal selection—were performed. During intrapersonal selection, the idea generator selected the most creative idea from his/her own ideas; during interpersonal selection, another person made the selection from the same ideas. We found no effect of intrapersonal and interpersonal selection on idea selection performance: The idea selected by intrapersonal selection was as creative as the one selected by interpersonal selection. Moreover, we replicated the earlier finding that people perform suboptimally at creative idea selection: The idea selected by either intrapersonal or interpersonal selection is not more creative than an average idea.

Keywords: Creativity; Idea selection; Intrapersonal selection; Interpersonal selection; Selection performance
Chapter 4 - Intrapersonal and Interpersonal Idea Selection

Introduction

As the world is becoming increasingly competitive, it is hungry for creativity. Individuals, companies, and organizations often find themselves in serious need of creative ideas—ideas that are both original and useful (e.g., Runco & Jaeger, 2012)—to succeed. They try all means to have ideas generated, hoping to select the most creative ideas for implementation. Until now, practitioners have developed various techniques (e.g., brainstorming, Osborn, 1953) to facilitate the generation of creative ideas, and researchers have extensively studied creative idea generation and its enhancement (for reviews, see e.g., Baas, De Dreu, & Nijstad, 2008; Shalley & Gilson, 2004; Shalley, Zhou, & Oldham, 2004). However, before implementing creative ideas into practice, these ideas must be recognized and selected from all the ideas produced during the idea generation phase. Whereas creative idea selection has been recognized as essential in the creative process (e.g., Basadur, et al., 2000; Finke, et al., 1992; Lubart, 2001; Runco & Vega, 1990; Simonton, 2003), it is little studied (for exceptions, see e.g., De Buisonjé, et al., 2017; Faure, 2004; Putman & Paulus, 2009; Rietzschel, et al., 2006, 2010, 2014; Ritter, et al., 2012; Zhu, Ritter, Müller, & Dijksterhuis, 2017). The current research aims to expand this research field by investigating how two types of selection—intrapersonal and interpersonal selection—may influence creative idea selection performance.

The idea selection process can either be performed by the individual(s) or group(s) who generated the ideas, or by individual(s) or group(s) not involved in the generation process. In the existing literature, idea selection by the person or group who has generated the ideas is called *intrapersonal* idea selection, whereas the selection from ideas generated by someone else is called *interpersonal* idea selection (e.g., Runco & Smith, 1992; Runco & Vega, 1990). These two ways of selection...
frequently happen in people’s daily lives. For example, when a researcher needs to design a new study, he/she may first generate ideas, and then select the best idea from the available options. Interpersonal selection usually happens in group-work settings—specific individuals are responsible for generating ideas, and others select ideas that have the potential to be pursued further. For example, a designer or an engineer generates ideas for potential future products, and the manager selects which ideas are further developed. Do intrapersonal and interpersonal selection of the most creative idea lead to different levels of performance? Thus far, only a few studies have investigated interpersonal and intrapersonal idea selection. However, in most of these studies, the two ways of selection were not compared with each other but studied separately (for exceptions, Berg, 2016; Faure, 2004; Watts, et al., 2017).

Research on interpersonal idea selection has consistently observed that people perform sub-optimally at selecting from other’s ideas—their selections are not even better chance level. In other words, people tend to select ideas that are not more creative than the average creativity of the available ideas, and this takes place in both individual (Rietzschel, et al., 2010, 2014) and group interpersonal idea selection (Faure, 2004). That being said, researchers have studied how the performance of interpersonal creative idea selection can be improved, and several means have been shown to be effective, such as inducing self-affirmation, promotion focus, and positive affect before idea selection (De Buisonjé, et al., 2017), using intuition rather than extensive deliberation during idea selection (Zhu, et al., 2017), and using paired comparison strategy for creative idea selection (Zhu, Ritter, & Dijksterhuis, 2018).

Research on intrapersonal idea selection has observed incompatible findings on whether people can perform optimally at making selections from their own ideas. Some researchers (Putman & Paulus, 2009; Rietzschel, et al., 2006; Study 1 in
Rietzschel et al., 2010) found that people select ideas that are not more creative than
the average creativity of the ideas generated, whereas Silvia (2008) found that
generally people can discern their most original ideas—their choices of the most
creative ideas covariate strongly with judges' ratings of the ideas. A positive relation
between idea generation and idea selection has been observed—people who generate
more creative ideas perform better at selecting their most creative ideas (Silvia, 2008).
Moreover, a number of studies aimed to stimulate intrapersonal idea selection
performance. Unconscious thought (Ritter, et al., 2012) and reactivating a creative
task during sleep by means of a conditioned odor (Ritter, Strick, Bos, Van Baaren, &
Dijksterhuis, 2012) have a positive effect on intrapersonal idea selection performance.
Other manipulations, however, have shown no beneficial effects on idea selection
performance. These manipulations include asking people to generate and select ideas
as nominal groups (in which members perform tasks individually) or interactive
groups (in which members perform tasks interactively, Faure, 2004; Rietzschel et al.,
2006), providing criteria (i.e., a good idea is both original and feasible) or no criteria
for a good idea, and instructing people to make the selection by following one of three
different procedures: directly selecting the best idea, marking ideas good enough
before the final selection, or crossing off ideas not good enough before the final
selection (Rietzschel et al., 2010).

Anecdotal evidence has shown that both intrapersonal and interpersonal idea
selection can be difficult under certain circumstances. Some cases show that people
somehow cannot recognize the value or the uses of their own ideas, whereas later
these ideas are discerned to be highly valuable and profitable and adopted by other
people. A famous example is Xerox’s and Apple’s different attitudes towards the
graphical user interface (GUI) technology (Xerox, n.d.). In 1973, Xerox released the
first true personal computer, the Alto, with the GUI as its main interface. Back then, the GUI was very innovative and had great commercial potential. However, without fully recognizing this, Xerox did not target the personal computer market and sell the Alto. In 1979, Steve Jobs saw the Alto and the GUI. Being amazed he said, Xerox “just had no idea what they had.” Soon Apple incorporated GUI into their personal computer Lisa. They commercialized it and made GUI known to the world. However, some other cases show that people can easily spurn other’s ideas, which eventually become big successes. For example, the KFC recipe was rejected more than 1000 times until it was accepted; JK Rowling received many rejections before the Harry Potter success; Sylvester Stallone’s Rocky was rejected numerous times but finally became one of the most successful movies in history.

Although both interpersonal and intrapersonal selection take place frequently in real-life settings, only a few studies have been conducted to study their difference. Faure (2004) compared interpersonal and intrapersonal idea selection in group settings. In her research, participants generated ideas as nominal groups or interactive groups. Thereafter, half of the groups selected the three best ideas from ideas of their own group; whereas the other half made the selection from ideas of another group. Idea selection performance was established by assessing the number of original ideas selected (an idea was counted as original if it was rarely generated), the average effectiveness (how well can an idea solve the problem) and average practicality (how easily can an idea be implemented). The effect of intrapersonal and interpersonal selection was not found on the originality or the feasibility, but on the effectiveness of the selected ideas. Groups selecting from their own ideas select ideas that are more effective than those selecting from others’ ideas. Besides, individuals selecting from another group are more satisfied with the selected ideas as well as the group they
work with, compared with individuals selecting from own group. Watts and colleagues (2017) investigated the effect of idea source (i.e., ideas are generated by oneself or by others) on idea selection. In their study, participants first generated nine ideas for an advertising campaign or reviewed nine pre-generated peer ideas. Thereafter, they selected ideas from the initial list of ideas and also generated new ideas for making a final campaign. Idea selection performance was established by assessing the number of initial ideas retained for final campaigns. The researchers found that idea source does not affect idea selection performance—people retain identical numbers of ideas from their own ideas and from others’ ideas. Berg (2016) conducted a field study not about idea selection, but about a related domain: forecasting. In that study, Berg investigated how creators’ and managers’ roles may influence creative forecasting accuracy—how accurately people can predict the success of novel ideas. In this study, a hundred online videos of circus acts were collected. The creators of these videos and managers in the circus arts industry forecasted the success of the videos, which was measured by audience success—how much the audience liked and supported these ideas. Creative forecasting accuracy was indicated by how participants’ predictions were different from audience success. It was found that when forecasting their own ideas, creators are not more accurate than managers. In summary, previous research has not found the effects of intrapersonal and interpersonal selection on both group and individual selection performances.

As far as we know, the three aforementioned studies are the only ones that investigate the difference between intrapersonal and interpersonal selection. Moreover, for individual idea selection, it is unknown whether intrapersonal and interpersonal selection will lead to the selection of ideas with different creativity, as creativity of selected idea(s) was not used as a dependent variable in previous studies.
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(Berg, 2016; Watts et al., 2017). Creativity of selected idea(s) is an important indicator of idea selection performance, especially when people are seeking creative ideas to solve problems. In the current research, we aim to investigate how intrapersonal and interpersonal selection may influence individuals’ performance of creative idea selection—indicated by the creativity of the selected idea.

We propose that both intrapersonal and interpersonal idea selection have pros and cons. In intrapersonal selection, idea creators have a strong sense of idea ownership and they tend to identify themselves with their ideas (Pierce, Kostova, & Dirks, 2001). An enhanced psychological ownership of ideas may motivate people to defend their ideas (Baer & Brown, 2012), which may cause biased and inaccurate evaluations of ideas (e.g., overestimating mainstream ideas’ creativity), and thereby impair the selection of the most creative idea. In comparison, interpersonal idea selection is more objective because selectors are usually merely observers of these ideas. Being more objective may help idea selectors to evaluate more accurately and make better selections. This effect may even be intensified when the selectors have never thought about the problem and solutions before, in that they can be surprised and impressed by the most original ideas, and thereby choose these ideas. On the other hand, because interpersonal idea selectors were not involved in the idea generation process themselves, they may not have complete information about the ideas (e.g., their effectiveness), which is likely to cause misunderstanding and then lead to false evaluations and selections. Besides, taking the role as judges and decision makers in interpersonal idea selection, idea selectors may become too critical and under-evaluate other’s ideas. Previous research has shown that deliberative processing impairs creative idea evaluation and selection (Zhu et al., 2017). In comparison, idea generators are more familiar and informed with their own ideas...
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(Berg, 2016; Watts et al., 2017) and they may be less critical during selection, which may lead to the selection of more original ideas.

In sum, each selection method has its pros and cons compared to the other strategy, therefore, the current research is exploratory rather than confirmative about the effect of intrapersonal versus interpersonal selection on creative idea selection performance.

Method

Participants and Design

Ninety-four people gave informed consent to participate in the current study. The participants were recruited via the online Radboud Participation System (SONA). They were rewarded with either course credit or money (€10).

Participants were paired and a 2 × 2 mixed design was used in the current experiment. The between-subjects factor is problem. In the current experiment, two societal problems were used in the idea generation task—the neighborhood problem and the exercise problem. In the idea generation task, each participant had to generate ideas for one of the two problems and his/her partner had to generate ideas for the other problem. The within-subjects factor is selection type. After idea generation, each participant had to perform two idea selection tasks—intrapersonal selection and interpersonal selection. In intrapersonal selection, a participant had to select the most creative idea from his/her own ideas; in interpersonal selection, he/she had to select the most creative idea from his/her partner’s ideas.

Three participants failed to generate enough ideas or understandable ideas as instructed, so they were excluded from the final analyses. In total, ninety-one (70 female, 21 male) participants aged between 18 to 36 years ($M = 22.37, SD = 3.26$) were included in the analyses. Among the included participants, three participants
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failed to make the selection from their own ideas as instructed and another five participants failed to make the selection from their partners’ ideas. However, for these participants, their performances of the other selection task were still included in the final analyses.

Procedure

Participants were paired at the entrance of the lab and they were simultaneously led to two individual cubicles. They were first presented with two societal problem scenarios. Thereafter, the computer program randomly assigned one participant to a problem and his/her partner another problem, and they had to generate six ideas to solve their own problems. Afterwards, the experimenters checked and improved the intelligibility (e.g., correcting wrongly spelled words and improving the grammar) of the generated ideas. In the meantime, participants completed several questionnaires and had a rest. Thereafter, each participant performed two idea selection tasks—intrapersonal and interpersonal selection. The order of the two idea selection tasks was counterbalanced. After the selection process, participants answered a post-experimental questionnaire as well as some demographic questions. Finally, they were rewarded, thanked, and dismissed.

Materials

Idea generation task.

Two problem scenarios were used in the idea generation task. They were presented as below.

Neighborhood

Exercise

“Stressful and time-consuming activities (e.g., busy jobs) can lead to unhealthy eating patterns. Moreover, many everyday activities (e.g., sitting behind a computer or desk for hours during work or school) prevent people from being physically active. In addition, people often also spend their free time behind a computer or television. Therefore, people might lack sufficient exercise to maintain a healthy lifestyle. This unhealthy lifestyle does not only cause people to become overweight, but also other health related issues.”

In the beginning of the idea generation task, participants were presented with both problem scenarios. Thereafter, one participant in a pair was randomly assigned to one of the two problems, and he/she was asked to generate six creative ideas to solve this problem within five minutes. Meanwhile, his/her partner was asked to generate six creative ideas to solve the other problem. Participants were told that a creative idea should be both original and useful. They were also told to provide a brief explanation for each of their ideas during the idea generation task.

In a divergent thinking task, people are normally encouraged to generate as many ideas as possible. In a pretest we found almost all participants were able to generate six ideas within five minutes. Therefore, in the current study, we restricted participants to generate six creative ideas, to make sure all the participants selected from the same number of ideas in the following idea selection task.

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8 The questionnaires and relevant variables, analyses, and results can be found in the supplemental materials.
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“These days, there are fewer social interactions among residents in neighborhoods. For instance, people are unlikely to know who lives three doors down from them. In addition, there are fewer interactions between people while they are grocery shopping—this further reduces neighborhood interactions, as this is where small talk is often exchanged. Nowadays, people seem to be more individualistic, which could lead to social isolation and serious problems for some (e.g., depression, stress, and loneliness).”

Exercise

“Stressful and time-consuming activities (e.g., busy jobs) can lead to unhealthy eating patterns. Moreover, many everyday activities (e.g., sitting behind a computer or desk for hours during work or school) prevent people from being physically active. In addition, people often also spend their free time behind a computer or television. Therefore, people might lack sufficient exercise to maintain a healthy lifestyle. This unhealthy lifestyle does not only cause people to become overweight, but also other health related issues.”

In the beginning of the idea generation task, participants were presented with both problem scenarios. Thereafter, one participant in a pair was randomly assigned to one of the two problems, and he/she was asked to generate six creative ideas\(^9\) to solve this problem within five minutes. Meanwhile, his/her partner was asked to generate six creative ideas to solve the other problem. Participants were told that a creative idea should be both original and useful. They were also told to provide a brief explanation for each of their ideas during the idea generation task.

\(^9\) In a divergent thinking task, people are normally encouraged to generate as many ideas as possible. In a pretest we found almost all participants were able to generate six ideas within five minutes. Therefore, in the current study, we restricted participants to generate six creative ideas, to make sure all the participants selected from the same number of ideas in the following idea selection task.
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**Idea selection tasks.**

After the idea generation task, each participant performed two idea selection tasks. In each task the participant was asked to select the most creative idea from the idea pool presented. During one selection task, the participant was presented with his/her own ideas generated to solve one societal problem. During the other selection task, the participant was presented with the ideas generated by his/her partner to solve the other societal problem.

**Dependent Variables**

First, per societal problem, the ideas generated by all participants were gathered in one big pool. Ideas that were identical or similar were regarded as redundant ideas and were consolidated into one idea, while non-redundant ideas were kept as before. Thereafter, two trained raters rated all ideas on creativity and on its three sub-dimensions—originality, effectiveness, and feasibility—on a 10-point Likert scale (e.g., 1 = *not at all creative*, 10 = *very much creative*). Intraclass Correlations Coefficients (ICC), using a two-way random model and consistency method, were performed to indicate the agreement between the raters (Koo & Li, 2016). Good ICCs were found for creativity and its three sub-dimensions (ICCs are .82, .87, .81, and .81 for creativity, originality, effectiveness, and feasibility, respectively).

**Idea selection.**

Idea selection performance was measured by five different variables: the *creativity of the selected idea*, the *originality of the selected idea*, the *effectiveness of the selected idea*, the *feasibility of the selected idea*, and the *selection effectiveness*. All the variables were based on the ratings of the two trained raters.
The *selection effectiveness*, that is, whether participants selected better than chance level, was measured by comparing the rated creativity, originality, effectiveness, and feasibility of the selected idea with the mean rated creativity, originality, effectiveness, and feasibility of the six generated ideas.

**Results**

**Idea Generation**

**Creativity of generated ideas.** An independent samples t-test was conducted on the creativity of the generated ideas, with problem statement as independent variable. The analysis showed a significant effect of problem statement. The generated ideas for the neighborhood problem were rated significantly more creative than the ideas generated for the exercise problem, as shown in Table 1.

**Originality, effectiveness, and feasibility of generated ideas.** Independent samples t-tests (see Table 1) were conducted on the originality, the effectiveness, and the feasibility of the generated ideas. The analysis on originality showed that the generated ideas for the neighborhood problem were significantly more original than the ideas generated for the exercise problem. The analyses on effectiveness and feasibility showed no effects of problem statements. The ideas generated for the two different problems did not differ significantly in effectiveness and feasibility.
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Table 1

Descriptive Statistics for Creativity, Originality, Effectiveness, and Feasibility of the Generated Ideas

<table>
<thead>
<tr>
<th>Variable</th>
<th>Neighborhood (n = 43)</th>
<th>Exercise (n = 44)</th>
<th>t(85)</th>
<th>p</th>
<th>Cohen’s d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creativity</td>
<td>6.05 (0.38)</td>
<td>5.87 (0.34)</td>
<td>2.30</td>
<td>.024</td>
<td>0.50</td>
</tr>
<tr>
<td>Originality</td>
<td>5.53 (0.89)</td>
<td>4.88 (0.64)</td>
<td>3.91</td>
<td>&lt; .001</td>
<td>0.84</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>6.66 (0.37)</td>
<td>6.67 (0.44)</td>
<td>0.18</td>
<td>.86</td>
<td>0.02</td>
</tr>
<tr>
<td>Feasibility</td>
<td>6.29 (0.66)</td>
<td>6.11 (0.58)</td>
<td>1.35</td>
<td>.18</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Note. n = 87. The table reports means, with standard deviations in parentheses.

Idea Selection

Creativity of selected idea. A 2 (Problem [neighborhood, exercise]) × 2 (Selection Type [intrapersonal, interpersonal]) mixed model ANOVA was conducted on the creativity of the selected idea. The analysis showed no significant effect of selection type, $F(1, 85) = 0.014, p = .91, \eta_p^2 < .001$, no significant problem × selection type interaction, $F(1, 85) = 0.77, p = .38, \eta_p^2 = .009$, but a significant effect of problem, $F(1, 85) = 4.06, p = .047, \eta_p^2 = .046$. As shown in Table 2, the selected idea for the neighborhood problem was more creative than the selected idea for the exercise problem. However, no difference between intrapersonal and interpersonal selection was found on the creativity of the selected idea.

Originality, effectiveness, and feasibility of selected idea. Three 2 × 2 mixed model ANOVAs were also conducted on the originality, the effectiveness, and the feasibility of the selected idea (see Table 2). The analysis on originality showed
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no significant effect of selection type, $F(1, 85) = 0.72, p = .40, \eta^2_p = .008$, no significant problem $\times$ selection type interaction, $F(1, 85) = 2.34, p = .13, \eta^2_p = .027$, but a significant effect of problem, $F(1, 85) = 11.54, p = .001, \eta^2_p = .119$. The selected idea for the neighborhood problem was more original than the selected idea for the exercise problem. The analysis on effectiveness revealed no significant effect of selection type, $F(1, 85) = 0.99, p = .32, \eta^2_p = .012$, no significant problem $\times$ selection type interaction, $F(1, 85) = 0.34, p = .56, \eta^2_p = .004$, and no significant effect of problem, $F(1, 85) = 2.22, p = .14, \eta^2_p = .025$. The analysis on feasibility also showed no significant effect of selection type, $F(1, 85) = 1.53, p = .22, \eta^2_p = .018$, no significant problem $\times$ selection type interaction, $F(1, 85) = 0.20, p = .65, \eta^2_p = .002$, and no significant effect of problem, $F(1, 85) = 0.80, p = .37, \eta^2_p = .009$. Thus, no difference between intrapersonal and interpersonal selection on the originality, the effectiveness, or the feasibility of the selected idea.

Table 2

*Descriptive Statistics for Creativity, Originality, Effectiveness, and Feasibility of the Selected Idea*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Neighborhood (n = 43)</th>
<th>Exercise (n = 44)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intrapersonal selection</td>
<td>Interpersonal selection</td>
</tr>
<tr>
<td>Creativity</td>
<td>6.17 (0.71)</td>
<td>6.07 (0.84)</td>
</tr>
<tr>
<td>Originality</td>
<td>6.24 (1.92)</td>
<td>5.69 (1.78)</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>6.52 (0.89)</td>
<td>6.70 (0.81)</td>
</tr>
<tr>
<td>Feasibility</td>
<td>5.83 (1.63)</td>
<td>6.09 (1.35)</td>
</tr>
</tbody>
</table>

*Note.* n = 87. The table reports means, with standard deviations in parentheses.
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Selection effectiveness. Selection effectiveness, namely, whether participants were able to select better than chance level, was examined with 2 (Problem [neighborhood, exercise]) × 2 (Creativity [of selected idea, of all ideas]) mixed model ANOVAs for both intrapersonal and interpersonal selection. The analysis for intrapersonal idea selection showed no significant main effect of creativity, $F(1, 85) = 0.038, p = .85, \eta_{p}^{2} = .001$, no significant effect of problem × creativity interaction, $F(1, 85) = 2.54, p = .12, \eta_{p}^{2} = .029$, but a significant main effect of problem, $F(1, 85) = 6.61, p = .012, \eta_{p}^{2} = .072$. The analysis for interpersonal idea selection also showed no significant main effect of creativity, $F(1, 85) < 0.001, p = .99, \eta_{p}^{2} < .001$, no significant effect of problem × creativity interaction, $F(1, 85) = 0.055, p = .82, \eta_{p}^{2} = .001$, and no significant main effect of problem, $F(1, 85) = 2.49, p = .12, \eta_{p}^{2} = .028$. This showed that the idea selected, either by interpersonal selection or intrapersonal selection, was not more creative than the average creativity of the idea pool generated.

Similar analyses were also conducted on originality, effectiveness, and feasibility. The analysis on originality for intrapersonal selection showed a marginally significant main effect of originality, $F(1, 85) = 3.29, p = .073, \eta_{p}^{2} = .037$, a significant effect of problem × originality interaction, $F(1, 85) = 4.43, p = .038, \eta_{p}^{2} = .050$, and a significant main effect of problem, $F(1, 85) = 17.65, p < .001, \eta_{p}^{2} = .17$. Simple effects analysis showed that for the neighborhood problem, the idea selected by intrapersonal selection was more original ($F(1, 85) = 7.58, p = .007$) than an average idea; however, for the exercise problem, the idea selected by intrapersonal selection was not more original ($F(1, 85) = 0.04, p = .84$) than an average idea. The analysis for interpersonal idea selection showed no significant main effect of
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originality, \( F(1, 85) = 0.56, p = .46, \eta^2 = .007 \), no significant effect of problem \times\) originality interaction, \( F(1, 85) = 0.020, p = .89, \eta^2 < .001 \), but a significant main effect of problem, \( F(1, 85) = 8.18, p = .005, \eta^2 = .088 \). This showed the idea selected by interpersonal selection is generally not more original than an average idea.

The analysis on effectiveness for intrapersonal idea selection showed no significant main effect of effectiveness, \( F(1, 85) = 0.011, p = .92, \eta^2 < .001 \), no significant main effect of problem, \( F(1, 85) = 1.76, p = .19, \eta^2 = .020 \), but a marginally significant effect of problem \times\) effectiveness interaction, \( F(1, 85) = 3.25, p = .075, \eta^2 = .037 \). The analysis for interpersonal idea selection showed no significant main effect of effectiveness, \( F(1, 85) = 1.81, p = .18, \eta^2 = .021 \), no significant main effect of problem, \( F(1, 85) = 0.50, p = .48, \eta^2 = .006 \), and no significant effect of problem \times\) effectiveness interaction, \( F(1, 85) = 0.74, p = .39, \eta^2 = .009 \). Generally, the idea selected by either the intrapersonal or the interpersonal selection was not more effective than the generated ideas.

The analysis on feasibility for intrapersonal selection showed a significant main effect of feasibility, \( F(1, 85) = 11.53, p = .001, \eta^2 = .12 \), but no significant main effect of problem, \( F(1, 85) = 0.71, p = .40, \eta^2 = .008 \), and no significant effect of problem \times\) feasibility interaction, \( F(1, 85) = 0.001, p = .97, \eta^2 < .001 \). The analysis for selection from other’s ideas showed a marginally significant main effect of feasibility, \( F(1, 85) = 3.66, p = .059, \eta^2 = .041 \), but no significant main effect of problem, \( F(1, 85) = 1.59, p = .21, \eta^2 = .018 \), and no significant effect of problem \times\) feasibility interaction, \( F(1, 85) = 0.29, p = .59, \eta^2 = .003 \). Generally, the selected idea
was generally less feasible than the generated idea set.

Discussion

The current study investigated whether intrapersonal and interpersonal selection influence the performance of creative idea selection. Our results showed no effect of selection type—the most creative idea selected by intrapersonal selection and that selected by interpersonal selection were not different in creativity or originality, effectiveness, and feasibility. Moreover, the selected idea by either intrapersonal selection or interpersonal selection was not more creative, original, and effective, than the average idea. It was generally less feasible that the average idea.

Moreover, our research, together with earlier relevant research (Berg, 2016; Watts et al., 2017), suggest that intrapersonal and interpersonal selection may not affect idea selection performance. In this research, researchers used diverse measures of idea selection performance, but they did not observe the effects of intrapersonal and interpersonal selection. For example, Berg (2016) found that creators’ and managers’ roles did not affect their accuracy in forecasting the success of novel ideas. Watts and colleagues (2017) found that selecting from ideas generated by own or by peers did not influence the number of ideas selected for refinement. In the current research, we found intrapersonal and interpersonal selection did not differ in the creativity of the selected idea. Therefore, although intrapersonal and interpersonal selection seem quite different, the existing evidence did not show they lead to different levels of performance when selecting the most creative idea.

Moreover, in line with earlier findings (Faure, 2004; Putman & Paulus, 2009; Rietzschel et al., 2006, 2010, 2014; Ritter et al., 2012), we found that people are poor at selecting the most creative idea—they are not able to select an idea more creative than an average idea, for both intrapersonal and interpersonal selection. All this
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evidence show that people somehow cannot select the most creative idea(s). This reminds us of the importance of studying the creativity bias phenomenon—people desire creativity but tend to reject creative ideas and select mainstream ideas (Mueller, et al., 2011). So far, the creativity bias has been little studied (Rietzschel et al., 2010; Zhu et al., 2017), and hence, little is known about its underlying mechanisms. Given the importance of creative idea selection, more research should be devoted to study creative idea selection and its enhancement in the future.

The current research has several limitations based on which we provide suggestions for future research. First, we intended to compare the idea selection performance of idea generators’ with that of those who did not generate ideas for selection, however, we used a within-subjects design that might contaminate the interpersonal idea selection—all participants took part in idea generation before interpersonal selection. This idea generation process may have enabled the participants to take a perspective of an idea generator when he/she selected ideas him/herself. In comparison, a between-subjects design should be able to avoid the effect of idea generation on interpersonal idea selection, which is recommended for future research.

Second, to simplify the experimental design, we did not include some factors that are often involved in realistic situations of creative idea selection, which limited the generalizability of our findings. For example, participants in the current experiment were university students, whereas in many real-life settings, interpersonal idea selection takes places when people who generate ideas and those who make decisions have distinct roles (e.g., engineers versus managers) or different levels of expertise (e.g., junior researchers versus senior researchers). These factors are likely to influence the relationship between intrapersonal and interpersonal selection and

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creative idea selection. Future research might take these factors into consideration. Finally, we speculated about several factors that may mediate the effect of interpersonal and interpersonal selection on idea selection performance, such as the sense of idea ownership and idea familiarity; however, these factors were not measured in the current experiment. Therefore, future research may consider measuring these factors to acquire firm evidence for the better understanding of why there is no difference between interpersonal and intrapersonal idea selection.

Our research has practical implications. People may prefer intrapersonal selection over interpersonal selection, or vice versa. Some people may believe intrapersonal selection is better, as an idea generator knows more about the history of his/her own ideas than an observer; others may favor interpersonal selection because an observer can be more objective in idea evaluation and selection. However, more confidence in either way of selection is still not backed up by scientific data. In the current research, we showed that intrapersonal selection did not differ from interpersonal selection in the creativity of the selected idea. Our findings, together with previous relevant findings (Berg, 2016; Watts et al., 2017), challenges people’s ingrained preference for intrapersonal or interpersonal selection.

Rather than improving idea selection performance by focusing on intrapersonal versus interpersonal selection, people can adopt certain strategies or approaches beneficial for selecting creative ideas. Thus far, researchers have found several means to facilitate interpersonal creative idea selection. For example, Zhu and colleagues (2017) studied the role of processing mode in creative idea selection, and they found that following intuition or gut feelings leads to the selection of more creative ideas compared with extensive deliberation. Rietzschel and colleagues (2014) investigated the effect of selection instruction on idea selection performance. They
compared selection performance under two different instructions for selecting the best idea: based on ideas’ originality versus based on participants’ own experiences. It was found that instructions fostering originality improved creative idea selection performance relative to instructions fostering personal experiences.

To conclude, we found that intrapersonal and interpersonal selection did not affect the performance of creative idea selection. People failed to select the most creative idea from their own idea pool, as well as from other people’s idea pool. Given that individual idea selection (either intrapersonal or interpersonal) happens frequently in various settings, we urge further research to study the relationship between intrapersonal and interpersonal selection and creative idea selection, as well as the enhancement of idea selection performance.
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SUMMARY
In modern society, individuals’ and organizations’ survival and success rely heavily on creativity. The importance of creativity has been universally acknowledged, and research on creativity has soared in the past decades. Before creative ideas are applied, two steps are usually performed. First, ideas have to be generated and second, the best idea(s) among the generated ideas have to be selected. Interestingly, most creativity research has mainly focused on idea generation, while idea selection has been largely ignored. As said, the selection of creative ideas is a necessary step for innovation, since for successful innovation people need to effectively select the most creative ideas from a pool of available ideas. This dissertation aimed to broaden our understanding of creative idea selection.

Empirical research suggests that people often tend to select mainstream ideas for implementation at the cost of creative ideas. This phenomenon can be observed in our daily lives and has been validated by empirical research. However, the mechanisms underlying idea selection, let alone the techniques used to improve people’s performance in creative idea selection, are still underexplored. In this dissertation, I focused on three factors that may influence creative idea selection performance: processing mode, selection strategy, and selection type.

Idea selection is a decision-making process under conditions of high uncertainty. When making decisions, people commonly process information by using two distinct modes: intuitive processing and deliberative processing. In Chapter 2, I investigated the role of processing mode in creative idea selection. In two experiments, participants had to select the most creative ideas from a pool of ideas. During the selection, participants were either instructed to make their selection intuitively or deliberatively. The key findings were that intuitive processing outperforms deliberative processing in creative idea selection, and intuitive processing leads to the
selection of creative ideas, whereas deliberative processing leads to the selection of mainstream ideas. In addition, under intuitive processing, people rely on both originality and usefulness but mainly on originality when selecting creative ideas; under deliberative processing, they rely merely on usefulness. These findings suggest that people intuitively favor creative ideas but they deliberatively reject them and select mainstream ideas. Thus, people should consider the role of intuitive processing rather than deliberative processing when they select creative ideas.

There are several strategies that individuals can employ to select the most creative ideas, such as choosing (i.e., selecting the most creative idea by choosing it directly), elimination (i.e., selecting the most creative idea by a stepwise removal of the less creative ones), and paired comparison (i.e., a series of choices made among pairs of ideas). Previous research on idea selection uses choosing as the only selection strategy, without knowing whether it is effective for selecting creative ideas. In Chapter 3, I studied the influence of selection strategies on creative idea selection. In four studies, participants selected the most creative idea from a pool of ideas by using one of the three strategies listed above and their selection performance was compared. Moreover, a meta-analysis was conducted based on the data from the four experiments. The results suggested that the paired comparison strategy outperforms the choosing and the elimination strategies in creative idea selection. These findings provide the first evidence that selection strategy affects idea selection performance and a paired comparison strategy is recommended for creative idea selection.

During creative idea selection, the most creative idea can be selected by either the person who generated the ideas (i.e., intrapersonal selection) or by another person (i.e., interpersonal selection). In Chapter 4, I examined whether these two types of idea selection lead to differences in selection performance. Participants first generated
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ideas, from which the most creative idea was then selected by both the idea generator and by another participant. Their selection performance was compared and results showed no effect of intrapersonal and interpersonal selection on creative idea selection performance. In addition, both intrapersonal and interpersonal selection led to the selection of mainstream ideas. These findings support earlier findings demonstrating that people perform sub-optimally in selecting creative ideas.

In conclusion, through a series of studies, my findings expand the research field of creative idea selection by examining the influence of three factors on creative idea selection: processing mode, selection strategy, and selection type. These findings suggest that processing mode and selection strategy influence idea selection performance, whereas selection type might not. Moreover, I identified two means to facilitate creative idea selection: intuitive processing and the paired comparison strategy.
146 ideas, from which the most creative idea was then selected by both the idea generator and by another participant. Their selection performance was compared and results showed no effect of intrapersonal and interpersonal selection on creative idea selection performance. In addition, both intrapersonal and interpersonal selection led to the selection of mainstream ideas. These findings support earlier findings demonstrating that people perform sub-optimally in selecting creative ideas.

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Samenvatting

In de moderne maatschappij hangt het voortbestaan en het succes van zowel individuen als organisaties sterk af van creativiteit. Het belang van creativiteit is universeel bevestigd en onderzoek naar creativiteit is de laatste decennia sterk toegenomen. Voordat creatieve ideeën worden toegepast, worden normaliter twee stappen doorlopen. De eerste stap is het genereren van ideeën, daarna volgt in de tweede stap het selecteren van het beste idee uit de gegenereerde ideeën. Interessant genoeg heeft onderzoek zich tot op heden hoofdzakelijk gericht op het genereren van ideeën, terwijl het selecteren van de beste idee vooral genegeerd is. Zoals genoemd is het selecteren van creatieve ideeën een stap die genomen moet worden voor innovatie, aangezien succesvolle innovatie het meest creatieve idee zo effectief mogelijk geselecteerd moet worden uit een verzameling ideeën. Dit proefschrift heeft als doel ons begrip over het selecteren van creatieve ideeën te verbreden.

Empirisch onderzoek suggereert dat mensen de neiging hebben om vooral 'mainstream' ideeën te kiezen voor implementatie die ten koste gaan van creatieve ideeën. Dit fenomeen kan worden geobserveerd in ons dagelijks leven en is gevalideerd door empirisch onderzoek. De mechanismen die ten grondslag liggen aan ideeënselectie echter, evenals technieken om ideeënselectie van mensen te verbeteren, zijn nog onderbelicht. Deze thesis focust op drie factoren die invloed kunnen hebben op het selecteren van creatieve ideeën: verwerkingsmodus, selectie strategie en selectie type.

Ideeënselectie is een beslissingsproces onder omstandigheden van hoge onzekerheid. Wanneer mensen beslissingen maken doen ze dat vooral met twee verschillende modi: intuïtieve verwerking en deliberatieve verwerking. In hoofdstuk 2 wordt de rol van verwerkingsmodus in creatieve ideeënselectie onderzocht. In twee experimenten moesten participanten het meest creatieve idee uit een verzameling
ideeën selecteren. Tijdens het selecteren werden participanten geïnstrueerd om hun keuze te baseren op hun intuïtie of juist een weloverwogen keuze te maken. De belangrijkste bevindingen in de onderzoeken waren dat intuïtieve selectie beter was in het selecteren van het meest creatieve idee vergeleken met deliberatieve selectie, en dat intuïtieve selectie resulteert in het selecteren van creatieve ideeën waar deliberatieve selectie juist tot het selecteren van mainstream ideeën leidt. Hiernaast werd ook gevonden dat bij intuïtieve verwerking mensen zowel letten op originaliteit en bruikbaarheid, maar vooral op originaliteit bij het selecteren van creatieve ideeën; bij deliberatieve verwerking letten ze alleen op bruikbaarheid. Deze bevindingen suggereren dat mensen intuïtief de voorkeur geven aan creatieve ideeën, maar dat ze deze deliberatief verwerpen en juist mainstream ideeën kiezen. Om deze reden zouden mensen dus de voorkeur moeten geven aan intuïtieve verwerking boven deliberatieve verwerking als ze de meest creatieve ideeën willen selecteren.

Er zijn verschillende strategieën die mensen kunnen gebruiken om het meest creatieve idee te selecteren, zoals ‘kiezen’ (i.e., het direct selecteren van het meest creatieve idee), ‘eliminatie’ (i.e., het meest creatieve idee selecteren door stap-voor-stap de minst creatieve ideeën te verwijderen) en het ‘vergelijken van paren’ (i.e., een serie van keuzes tussen paren van ideeën). Eerder onderzoek naar ideeënselectie heeft alleen de kiesstrategie onderzocht zonder dat duidelijk is of dit leidt tot effectieve selectie van creatieve ideeën. In hoofdstuk 3 wordt daarom onderzocht of selectiestrategieën invloed hebben op creatieve ideëenselectie. In vier experimenten selecteerden participanten het meest creatieve idee uit een groep ideeën middels een van de drie bovengenoemde selectie strategieën en werden hun prestaties vergeleken. De resultaten lieten zien dat het vergelijken van paren beter is dan zowel ‘kiezen’ als ‘eliminatie’ om het meest creatieve idee te selecteren. Deze bevindingen vormen het
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eerste bewijs dat selectiestrategie invloed heeft op ideeënselectieprestaties en geven aan dat het vergelijken van paren aan te raden is voor het selecteren van creatieve ideeën.

Tijdens het selecteren van creatieve ideeën kan het meest creatieve idee geselecteerd worden door de persoon die de ideeën heeft bedacht (i.e., “intrapersoonlijke selectie”) of door een ander persoon (i.e., “interpersoonlijke selectie”). In hoofdstuk 4 werd onderzocht of deze twee typen van ideeënselectie tot verschillen in selectieprestaties leiden. Participanten genereerden eerst ideeën waaruit vervolgens het meest creatieve idee werd geselecteerd door zowel die persoon zelf als door een andere participant. Er werden geen verschillen gevonden tussen deze vormen van ideeënselectie. Verder leidden zowel intra- als interpersoonlijke selectie tot het selecteren van mainstream ideeën. Deze bevindingen zijn in overeenstemming met eerdere resultaten die laten zien dat mensen suboptimaal presteren bij het selecteren van het meest creatieve idee.

Ter conclusie, het onderzoeksveld van creatieve ideeënselectie is middels een reeks studies uitgebreid door te onderzoeken wat de invloed is van drie factoren op creatieve ideeënselectie: verwerkingsmodus, selectiestrategie en selectietype. De bevindingen suggereren dat verwerkingsmodus en selectiestrategie invloed hebben op ideeënselectieprestaties, maar selectietype mogelijk niet. Daarnaast zijn twee manieren gevonden om creatieve ideeënselectie te faciliteren: intuïtief verwerken en het vergelijken van paren.
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Qian, my beloved girl, you never know what you have meant to me. In the past seven years, you have been loving, supporting, and inspiring me. Though we lived thousands of miles apart, your love has been in my heart and warming me in my worst time. Thank you for marrying me. I feel immensely grateful to have you in my life. Thank you, our baby-to-come, for choosing us. We cannot wait to see you, especially your mother, for you have been naughtily discomforting her body. Doing PhD really challenged me, but, your mother and I have the faith to get the “PhD” degrees in nurturing and educating you.
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Biography

Yuxi Zhu was born on May 2, 1988, in Zibo, China. At the age of 18, he went to Qingdao to study Oceanography, and he obtained his Bachelor degree from the Ocean University of China in 2010. In the summer of 2008, he volunteered to serve for Beijing Olympics Games, and he was honored “the outstanding volunteer”. In August 2009, he took part in the Third Chinese Arctic Expedition of 2009 and studied the formation of mist in Ny-Ålesund at the Arctic Yellow River Station of China, Svalbard. In 2009, his interest in Psychology was kindled, so he decided to switch to Psychology. In 2010, he began to study Psychology at Southwest University of China, Chongqing, and obtained his master degree in 2013. In his master project, he studied the influence of various colors on the performance of creative idea generation, under the supervision of Prof. Dr. Hao Zhang.

In 2013, Yuxi received the scholarship for PhD study from the China Scholarship Council and started his doctoral research at Radboud University, Nijmegen, The Netherlands. In his PhD project, he studied creative idea selection under the supervision of Prof. Dr. Ap Dijksterhuis and Dr. Simone Ritter. His research was collected in his dissertation entitled “From creativity to innovation: Understanding and enhancing creative idea selection”. Also, he co-supervised two research master theses on creative idea selection. Since December 2017, he is a visiting scholar at the College of Psychology and Sociology, Shenzhen University, Shenzhen, China.

In 2017, he was married to Qian Li, and they are waiting for their baby to come.