

THE INFLUENCE OF GOAL PURSUIT ON CREATIVE THOUGHT

By

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A Thesis Submitted to The Honors College

In Partial Fulfillment of the Bachelors degree
With Honors in

Neuroscience and Cognitive Science

THE UNIVERSITY OF ARIZONA

S E P T E M B E R 2 0 2 0

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Abstract

Thinking is a ubiquitously human process which occurs even when we have no task to engage in. A large proportion of the content of task-unrelated and “task-absent” thoughts are thought to be composed of unfulfilled goals or current concerns (Nikles, 1998; Smallwood, 2010). These thoughts may be accompanied by efforts to tackle these current concerns. Mental contrasting is a cluster of 3 categories of mental processing underlying different degrees of attempt to solve a problem. These degrees consist of 1) envisioning a goal, 2) recognizing the obstacles present in accomplishing the goal, and 3) creating steps to overcome the necessary obstacles to achieving the goal. Each subsequent step entails the previous step. Our study poses the question: does goal oriented thought increase levels of creativity? Here we ran participants through two tasks. First participants voiced aloud all of their stimulus dependent and stimulus independent thoughts for 10 minutes. This task was used to analyze participant’s levels of goal-oriented thought. Next participants voiced aloud answers to an open-ended question. This task was used to measure creativity in the form of fluency. A negative relationship was found between envisioning a goal and creativity scores. No relationship was found between recognizing obstacles present in goal achievement. The relationship between creating steps to achieve a goal and creativity scores was suggestive of a positive relationship but results were not significant. However, this trend is promising for preliminary data with a low sample size.

Introduction

Creativity

The bulk of creativity research to date encompasses personality correlates with creativity (e.g., Barron et al., 1981) and research investigating how to improve or foster creativity (e.g., Parnes et al., 1967). Creativity research has yet to thoroughly investigate whether or not creativity has any relationship with our thoughts. Some literature has begun to emerge suggesting that mind wandering helps catalyze creativity (e.g., Baird et al., 2012; Leszczynski et al., 2017; Zedelius & Schooler, 2015, 2016).

Baird and colleagues conducted a study demonstrating solutions for a creative problem (in the form of an unusual uses task) could be generated during a break filled with an undemanding task, which has been known to stimulate mind wandering, compared to breaks filled with demanding tasks, rest, or no breaks (Baird et al., 2012). The interesting thing about this study is that results indicated that a period of rest, which may encompass stimulus independent or task unrelated thoughts did not generate creative solutions to the task. This result in particular suggests that there needs to be more work focusing on task-unrelated thought and its relationship to creative problem solving.

Another experimental study by Leszczynski and colleagues (2017) investigates the costs and benefits of mind wandering. Behavioral costs were measured by prolonged reaction times in sustained attention tasks. Benefits were observed in increased performance on creative problem solving and daily routine planning tasks.

Zedelius and Schooler reported that an increased individual tendency to mind wander was positively related to creative problems generating by way of sudden insight experience, or “aha” moments as opposed to gradually arriving at a problem using an analytic strategy (Zedelius &

Schooler, 2015). A literature review done by Zedelius and Schooler suggest mind wandering may be a source of creative insight or inspiration (Zedelius & Schooler, 2016).

Mind wandering about topics unrelated to one's task or current circumstance can readily impair performance (Smallwood & Schooler, 2015) and can even produce dysphoria (Killingsworth & Gilbert, 2010; Smallwood et. al., 2007). While mind wandering imposes a negative impact on attention-based task performance, it has also been associated with enhancing future planning (e.g., Stawarczyk et al., 2007). It has been suggested by Klinger that one advantage to mind wandering may be creative problem solving (Klinger, 1999). Furthermore, indirect evidence suggests there is a relationship between task-unrelated thought and creative incubation (Baird et al., 2012).

It should be noted that the definition of mind wandering varies in the literature. It has been defined as task-independent thought (Smallwood & Schooler 2015), while others have categorized it on an even more broad level as stimulus independent and task-unrelated thoughts (SITUT's) (Stawarczyk et al., 2007). Still other definitions have focused more on defined mind wandering in terms of freely-moving "spontaneous" thought (Christoff, Irving, Fox, Spreng, & Andrews-Hanna, 2016).

Additionally, there is a small amount of research suggesting that deliberate mind wandering may help facilitate creative performance (Agnoli et al., 2018). This study in particular builds off of research discussing differences in intentional and unintentional mind wandering (Seli, Carriere, & Smilek, 2015). Deliberate mind wandering occurs when attention is intentionally shifted from a task to internal thoughts and feelings. Spontaneous mind wandering occurs when one's thoughts shift from a current task or situation to one's inner thoughts and feelings unintentionally (Agnoli et al., 2018; Carriere, Seli, & Smilek, 2015).

While all this research suggests that when presented with an obstacle, mind wandering may help aid in creative problem solving, there has yet to be any research focusing on the implications of goal-oriented thought on creative performance. Here we postulate the differences in thought processes of individuals with higher levels of creative thought.

Types of Thought

There are three ways in which thoughts can be categorized on a most basic level. Thoughts can be on task, off task, or happened in a constant where one has no task. On task thoughts consist of thoughts focused on a task at hand. Off task thoughts entail thoughts deviating from a task. No-task thoughts are thoughts occurring in the absence of a task.

Task unrelated thought occurs when attention is allocated towards one's internal thoughts as opposed to a current task, situation, or something else in the external environment (Antrobus, 1968; Teasdale et al. 1995; Christoff et al., 2009; Smallwood & Schooler, 2006, 2015). It is thought that a large portion of the content people think about during periods of task-unrelated thought comprise of *current concerns*, or goals individual organisms have (Nikles, 1998; Smallwood, 2010).

Current Concern

Eric Klinger proposed the *Current concern theory* which refers to an organism's goal-specific state; from the time a goal becomes committed to the fulfillment or abandonment of said goal (Klinger, 1971, 1975, 1977; Nikles, 1998). Klinger proposed that goal pursuit, no matter how often interrupted, must have some point of origin and endpoint (Klinger, 1971, 1975, 1977; Nikles, 1998). Each current concern refers to a different goal. An individual may have multiple

current concerns at any given time. Historically, current concern has been used as a way to partly quantify and study motivational thought and behavior (Klinger & Cox, 2004).

Seeing as current concern is so broadly defined in the literature, we needed to operationalize our own definition of current concern in order to study it more effectively. Considering current concern by definition comprises unfulfilled goals, it is necessary to further define what a goal is. For the purposes of this study, goal-oriented thoughts have been defined as future oriented thinking stemming from motivational input to complete a task or series of tasks (Klinger & Cox, 2004; Klinger, 1977; Oettingen et al., 2013).

One way to study the progression of these goals is by looking at a type of thought process called mental contrasting. Mental contrasting is a type of thought process which entails thinking more critically about the methods needed to accomplish a particular goal. Research on mental contrasting, suggests that skilled problem-solving and behavioral changes are more likely to occur during mental contrasting (Oettingen et al., 2013).

Mental Contrasting

Mental contrasting (MC) is a type of thought process which entails a series of steps. The first step requires an individual to first envision their desired future (MC1). The following step requires said individual to recognize all the obstacles which stand in their way (MC2). The final step entails all previous steps. It requires the individual to recognize the steps they will need to take in order to overcome obstacles from step two (MC3).

Research suggests that mind wandering in the form of mental contrasting leads to skilled problem solving (Oettingen et al., 2013). Since research also suggests mind wandering may lead to more creative thought, it is conceivable that individuals who utilize mind wandering in the

form of mental contrasting engage in more creative like problem solving. It may be the case that deliberate mind wandering in the form of mental contrasting could lead to thoughts which would help find novel solutions relevant to an individual's goals.

Our study poses the question: does goal oriented thought increase levels of creativity? We hypothesize that the propensity to engage in level 3 MC will be predictive of greater creativity scores and that only engaging in levels 1 or 2 MC will not benefit creativity. We do not predict MC levels 1 or 2 will aid in creative problem solving because individuals are not fully taking the time to engage in thinking that can lead to overcoming obstacles so they can actualize their goals. It may be possible that engaging only in MC level 1 would be more indicative of spontaneous mind wandering as opposed to deliberate mind wandering since all an individual is doing is recognizing a goal. No further thought is dedicated to that goal. Likewise, level 2 may potentially be more indicative of more spontaneous as opposed to deliberate mind wandering since the individual does not remain focused on which steps will be necessary to overcome the obstacles of the goal. While it may still be beneficial for creativity, deliberate mind wandering is thought to be more predictive of more creative problem solving (Agnoli et al., 2018).

Methods

Participants

A total of 94 individuals participated in the experiment with a mean age of 19.5. There were 55 females and 39 males **undergraduates from the University of Arizona** who participated in the study. Twelve of the participants were recruited through the Neuroscience department's servlist for cash rewards of twenty dollars. The remaining students were granted class credits in fulfillment with requirements for an introductory psychology course. A total of

14 participants were excluded from the analysis for the following reasons: non-native speakers had difficulty understanding instructions (n=4), some participants did not accurately follow instructions (n=6), participation of minors (n=2), background noise was too loud to understand a participant (n=1), and a computer malfunction (n=1). These circumstances caused deletion of these data points. Thus our study contains (n=94) while we only have (n=80) data points.

Procedure

Think Aloud

Participants were left alone in a room with minimal external stimuli. They were instructed to voice aloud any and every thought that came to their mind. It was specified that thought could be of varying types, such as one's inner voice, focusing on something in the external environment such as a noise, or focusing on an internal sensation such as an itch. Participants were instructed to avoid censoring themselves as much as possible. Participants were reassured that the room was soundproof, and no one would be able to hear them while they perform the task. A small microphone was placed on the collar of their shirts. This portion of the experiment lasted for 10 minutes. A one-minute practice was performed in the presence of an experimenter to ensure the participant followed instructions. Following the practice, participants were corrected for mistakes when applicable, and then left to perform the task on their own.

Coding of Goal-Oriented Thought

Goal-oriented thought data was collected from the **Think Aloud** task. All voice recordings of participants transcribed verbatim into text files. Three independent raters broke

down the transcripts into individual thoughts following a specifically designed protocol. There was good inter-rater reliability for the number of thoughts found in each transcript (Cronbach alpha = .97, $CI_{95}=[.95; .99]$) as well as the average length of a thought, in number of words, per participant (Cronbach alpha = .86, $CI_{95}=[.81; .91]$).

It should be noted that before being able to analyze mental contrasting, we first had to consider the definition for goal-oriented thought. Aforementioned, in this study, we define a goal-oriented thought as a future-oriented thought stemming from motivational input to complete a task or series of tasks. This is significant considering MC level 1 requires the presence of a goal-oriented thought. A goal oriented-thought may range anywhere from “*I need to drink more water*” to “*I want to travel*” or “*I want to get better sleep*”. However, not all thoughts identified goals, and some individuals identified far more goals than others.

Level 1 MC would simply be the mentioning of a goal, such as “*I want to get better sleep*”. All thoughts under this category were rated with a 1 to indicate such. An example of level 2 MC would be the mention of the goal, “*I want to get better sleep,*” and an additional mention of obstacles which currently stand in the participant’s way. In this particular example, “*I'm like physically draining my body and like I'm going to work for like five hours, like I'm not constantly in one place... I'm like doing all this stuff and then like after that ... like I should like pass out right? But no, I'm like energized and I feel awake... When like I don't do anything like, that's when I want to pass out and sleep*” Here the participant identifies an erratic sleep schedule. This is caused by the obstacle that despite a busy schedule they are finding it difficult to sleep. Additionally, another obstacle is that when the participant does not have a busy day, they feel very sleepy. All thoughts under level 2 MC were rated a 2.

An example of level 3 MC would be first mentioning both MC levels 1 and 2, and then describing steps to overcome these obstacles. Taking the example from the participant with sleep difficulties, we can observe the statement *“I guess I should try doing a set time schedule... I should start waking up routinely at a time, and see like if that helps like, if I, if I have a set schedule like my body will like adapt to that.”* Here the participant describes a potential solution to addressing both of their obstacles. A more routine sleep schedule may be able to help them sleep despite the business of their day. Note that level 3 MC can only be reached if both levels 1 and 2 MC are mentioned. All thoughts under level 3 MC were rated a 3.

Any thoughts that did not contain MC were rated a 0. An example of a thought not containing MC would be *“Everything is very empty in here. I feel there’s probably nothing in the file cabinets.”* These thoughts contain no future oriented thought nor motivational input to complete a task or series of tasks.

Each thought was provided a MC rating based on the above mentioned guidelines. For each participant, the length of all thought at each MC level was added and divided by the total number of words generated in the transcript, providing a numerical value that is the proportion of the entire thinking time dedicated to each of the MC categories.

Think Aloud Creativity

Following the think aloud, participants performed a creativity task. They were left alone for another 10 minutes with the instructions of answering two open-ended questions which would appear on the computer screen after the experimenter left the room. Participants had five minutes to answer each question. They were instructed to voice their responses aloud just as with the previous task. For the purposes of this study, we focused on just one question, *‘How would*

you make money with 100 rubber bands?' This question was an alternative uses-like task. If they found themselves thinking of content not related to the question, they were instructed to voice this aloud as well and once they realized they were off topic, to try and redirect their thoughts back to the task at hand. After the five minutes were up, a beep would sound, signaling to the participant to end their thoughts and begin working on the next question which would appear on the screen. The same microphone as in the previous task recorded their thoughts.

Coding of Creativity

Just as with the Think Aloud data, all voice recordings from the **Think Aloud Creativity** task were transcribed verbatim into text files before being coded. The Think Aloud Creativity portion of transcripts were broken down into the following categories: Pondering, Idea, Incomplete, Inappropriate, and Mind Wandering. Each transcript was coded while listening to the original audio file of each participant.

The Pondering category encompasses all thoughts generated in an attempt to answer the prompt, which were not a direct answer to the prompt. All aspects of their thoughts appeared to be working on finding a solution to the problem but had not yet come up with an answer. An example of a pondering segment from a transcript would be *“Um, I don't really know. I'm trying to think what could you do with rubber bands. Eh I've kind of exhausted all my resources.”*

The Idea category of thought encompasses a clear response with sufficient description to satisfactorily answer the prompt. The Idea is a candidate answer to the prompt.

Incomplete thoughts consist of any ideas proposing an answer to the prompt that fail to provide enough details for the coders to clearly understand what the idea is and thus evaluate the

quality of the idea. It is any idea too vague or general to understand exactly what it is. An example would be “*Uh you can make some kind of innovative tool to use in the house with the rubber band and sell it that way.*”

Inappropriate thoughts are candidate ideas which are not satisfactory answers to the prompt. They are ideas that fail to answer the probe. An example would be “*Uh you can also use them as a distraction. They are a distraction in themselves. So maybe you can pass the time if you have a boring job. You just pass the time at work with a 100 rubber bands.*” Since this participant describes a situation in which money is already being made irrespective of the rubber band, the answer fails to address the prompt correctly.

Mind Wandering thoughts correspond to the subjects’ generation of content which does not adhere to the prompt or doesn’t seek any solution to the prompt. While Mind Wandering may be prompted by an effort made to find a solution, it turns into a tangent thought which strays away from answering the prompt directly. An example of a Mind Wandering thought would be “*I would try to sell rubber bands on a movie set for costume design or something. Like the rubber man. This would actually make a great movie. I could totally see Nicolas Cage Starring in it.*” Note that the underlined portion would be considered Mind Wandering.

When coding for the **Think Aloud Creativity** portion of the experiment, all ideas were measured by coders in terms of originality on a scale from 1-5 with 1 being not at all original and 5 being extremely original. It should be noted that in order to help us measure creativity in this study we used the standard definition of creativity. Creativity is something that is both novel and useful (Runco & Jaeger, 2012; Barron 1995). The originality scores were used to help quantify individual’s levels of novelty in their answers, compared to other participants in the study.

Usefulness was measured by whether or not a thought was categorized as an idea. Some thoughts were notably original but did not adhere to the prompt.

Each idea was labeled with a short phrase or simple title describing the basic premises of the idea. For example, if a participant described creating and selling a rubber band ball, this idea would be titled 'rubber band ball'. This helped keep track of potential repeated ideas so they were not counted twice. The overall creativity score for participants was based on the number of ideas multiplied by its originality rating.

Results

Think Aloud Descriptive Statistics

Mental contrasting was coded for by a single rater. Future studies will need to have multiple raters. All but two participants had thoughts that were not engaged in any sort of MC ($n = 78$). Most of the sample had thoughts that were about mentioning some goals ($n = 66$), consistent with the notion that spontaneous thought may be related to future thinking. However, much fewer participants listed obstacles to overcome ($n = 31$) and even less thought about ways to overcome those obstacles ($n = 16$).

Proportion wise, participants spent on average most of their thinking time on non-goal-oriented content (68% of the content generated). They spent an average of 26% of their transcript on MC level 1, and about the same amount of transcript, 17%, on MC level 2 and MC level 3.

Descriptive Statistics of the Scoring of the MC Data Transcripts

<i>Participants engaging in:</i>	N
MC Level 0	78
MC Level 1	66
MC Level 2	31
MC Level 3	16

Table 1

Table 1 shows the number of participants who engaged in each level of mental contrasting respectively.

Descriptive Statistics of the Levels of Mental Contrasting Data

Participants engaging in	N	Mean	SD
MC Level 0	78	0.68	0.21
MC Level 1	66	0.26	0.17
MC Level 2	31	0.17	0.16
MC Level 3	16	0.16	0.14

Table 2

Table 2 shows the mean, SD, and median of the number of participants who engaged in each level of mental contrasting respectively. The mean represents the proportion of thoughts fitting that category. By looking at the standard deviation we can see that there is a low variance. We can see that the average portion of thoughts in the MC levels 2 and 3 are substantially lower in number to those in the MC level 0 category.

Think Aloud Creativity Descriptive Statistics

Three different raters were used to rate transcripts from the **Think Aloud Creativity** portion of the study (see *Table 1*). Inter-rater reliability between raters was excellent when assessing creativity using all ideas (Cronbach alpha = .92, CI.95 [.89 ; .95]. The mean creativity score for all ideas was 13.08 with a standard deviation of 7.73.

Descriptive Statistics of the Scoring of the Creativity Data Transcripts

	Ideas	Pondering	Incomplete	Inappropriate	Mind Wandering	Total Number of Thoughts
Rater 1	445 (544)	399	19	26	141	1129
Rater 2	453 (612)	433	28	69	225	1367
Rater 3	384 (511)	391	31	55	205	1193

Table 3

Table 3 shows the number of thoughts in the creativity dataset belonging to each of the scoring categories. Numbers in parentheses under the ‘Ideas’ category show repeated ideas, while the number above the parentheses represents the number ideas not including repetitions.

Fluency was calculated based on how many ideas each participant generated. Fluency has a mean= 13.2 and an SD= 7.8. This data is normally distributed.

Overall Results

The relationship between creativity and mental contrasting was assessed by individual linear regressions between each level of mental contrasting and creativity (see *Figure 1*).

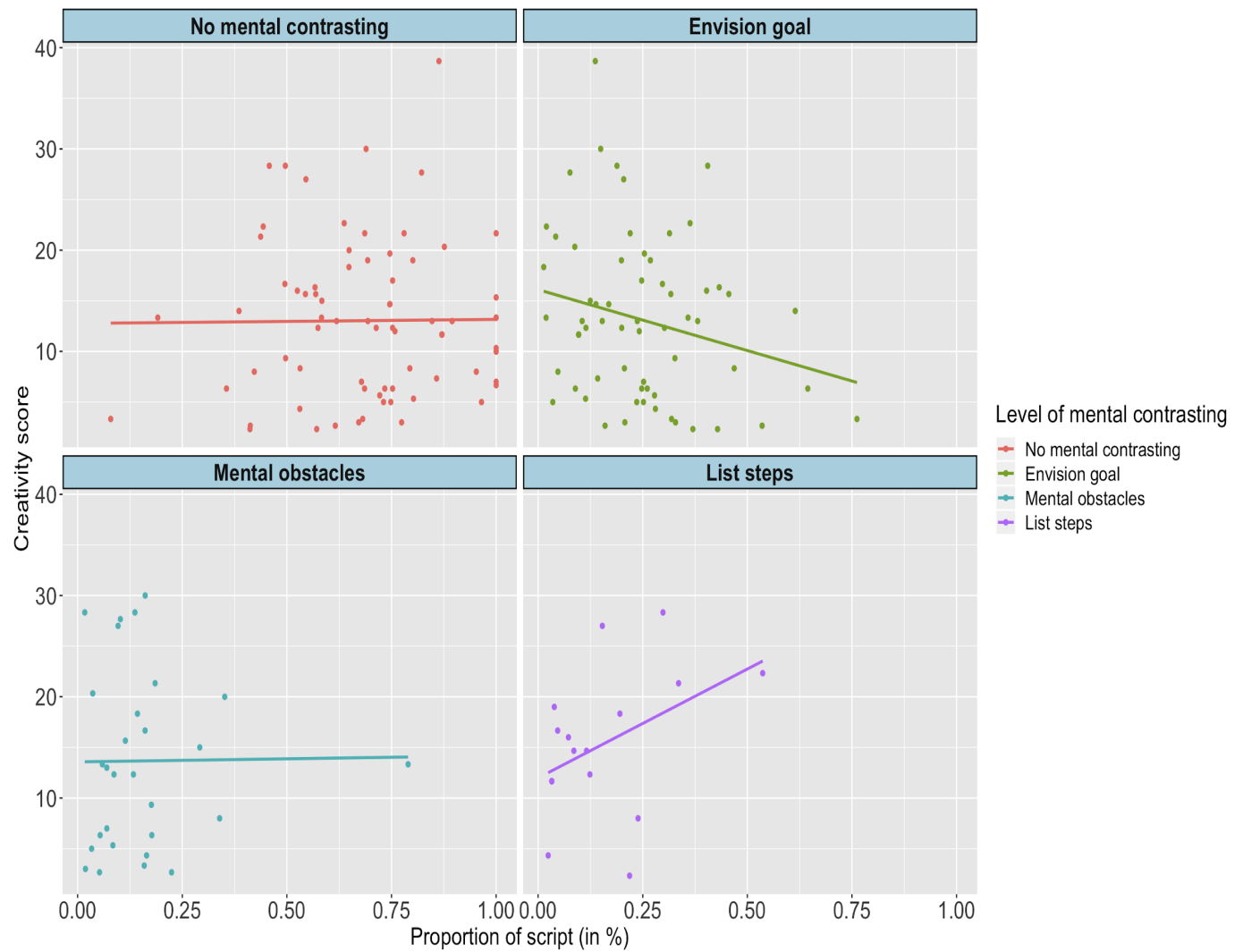


Figure 1

Figure 1 contains creativity scores in terms of fluency for the y-axis of each graph. The x-axis of each graph refers to the percentage of the portion of thought fitting the MC category. For the top left graph, the x-axis represents the portion of the transcripts in which there was no mental contrasting. Individuals whose data points land on the 100% portion of the x-axis in the orange graph don't engage in mental contrasting at all during the entirety of the **Think Aloud** task.

Our results confirmed our hypotheses about MC levels 1 and 2. Our results did not confirm hypothesis about MC level 3, however, they did indicate a promising trend for future research. While MC level 3 seems suggestive of individuals having greater levels of creativity, the results were not significant ($b = 20.02$, $t(13) = 1.48$, $p = 0.16$, $r^2 = 0.1446$). This may be due to the small sample size, particularly of individuals engaging in MC level 3. The purple graph in *Figure 1* shows that there is a positive relationship between listing the steps of achieving a particular goal and creativity scores. As shown in the orange plot in *Figure 1*, the proportion of non-mental contrasting thought bore no relationship with creativity ($b = 0.67$, $t(70) = 0.14$, $p > 0.05$, $r^2 = 0$). The green plot in *Figure 1* shows the relationship between MC level 1 and creativity. Here we can see a negative relationship between envisioning a goal and creativity scores which barely missed significance ($b = -13.06$, $t(59) = 0.14$, $p = 0.052$, $r^2 = 0.06$). However, as the blue plot in *Figure 1* demonstrates, the relationship between MC level 2 and creativity scores was non-existent ($b = 0.60$, $t(27) = 0.05$, $p > 0.05$, $r^2 = 0$). Engaging in mental contrasting at level 3, that is, problem solving out loud, shows somewhat of a promising relationship with creativity. Conversely, just mentioning one's current concerns without engaging with them seemed to be detrimental to creativity.

These results are promising for preliminary data with a low sample size; as well as the availability of only one rater for mental contrasting data. Further studies will need to be done in order to confirm these results.

Discussion

The goal of this study was to investigate thought processes of individuals with higher levels of creative thought. More specifically, this study aims to begin uniting research suggesting that mind wandering is indicative of goal-oriented thought as well as creative thought to see if there is indeed a relationship between the two. We predicted that engaging in level 3 MC would be indicative of higher levels of creativity due to the fact that individuals who are thinking critically about steps they will need to take to overcome obstacles may be engaging in more deliberate mind wandering as opposed to individuals only engaging MC levels 1 or 2.

We found that the extent to which participants had non-goal-oriented thought was not predictive of creativity scores. In fact, no relationship was present between the absence of mental contrasting and creativity scores. Interestingly, engaging in MC level 1 was detrimental to creativity scores in this dataset. These results warrant further investigation in future studies. Engaging in MC level 2 had no relationship with creativity scores. While engaging in level 3 MC showed positive impact on creativity scores, these results were not significant. The evidence is not sufficient to claim that engaging in level 3 MC increases creativity, but it does suggest that there may be a positive relationship. Further studies with greater sample sizes will need to be conducted to confirm these results. Our results suggest that if the propensity to engage in MC during periods of mind wandering benefits creativity, it will only be to the extent that individuals

engage actively in problem solving, that is go beyond merely mentioning what their goal is or what they need to overcome to consider concretely how to overcome.

Limitations and Future Direction

The **Think Aloud** task preceded the **Think Aloud Creativity** task, which may have impacted participants' creativity scores. It may be beneficial for future studies to consider altering the order of creativity tasks so as to account for a potential ordering effect.

Not only was the sample of individuals small for this study, but the sample of thoughts reaching MC levels 2 and 3 were particularly small. An unfortunate by-product of capturing spontaneous thought is that we cannot control content. In particular, the small number of MC level 3 thoughts present in this dataset suggest it may be difficult to find a larger number of individuals who engage in MC level 3 in the first place. This means that we need a larger sample size to reach a sufficient number of participants engaging in MC3.

This study may help give rise to a variety of studies investigating how different types of thought influence creativity. It is important to recognize that everyone is capable of and frequently uses creative thought in a variety of forms throughout their day. Aside from thinking of novel and useful solutions to problems, creativity aids us in future thinking and planning (Mooneyham & Schooler, 2013; Stawarczyk et al., 2007). This ability to think of future scenarios, which is associated with mind wandering is a humanly ubiquitous experience (Mooneyham & Schooler, 2013). Could it be the case that our individual levels of creativity are impacted by our own mind wandering thought patterns? What if creative thought lies more within the way we habitually think on a day to day basis? If this is the case, it may be the case that anyone can learn to harness greater levels of their own creativity by practicing thought

processes such as mental contrasting. Considering how important creative thinking is for our day to day life, investigating how we think about our goals on a day-to-day basis may impact our creative problem-solving skills could dramatically benefit the lives of everyone.

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