THE EFFECT OF ZOOM FATIGUE ON CONSUMERS' GROUP CREATIVE PERFORMANCE

Radboud Universiteit

MASTER'S THESIS

June 13th, 2021

Amy Voogt

s1042267

Amy.Voogt@student.ru.nl

Page count: 44 pages

Supervisor: Nina Belei

Second examiner: Simone Ritter

Online creative performance

Master of Marketing Management

Radboud University Nijmegen

Abstract

The aim of this study is to provide new insights into the effect of Zoom fatigue on group creative performance. The moderator variable schema violation is used to test whether the relationship between Zoom fatigue and group creative performance could be influenced. The research question in this study is: *To what extent can Zoom fatigue be mitigated to positively influence group creative performance within an online co-creation context?*

To answer the research question, an online experiment is conducted among students via Zoom. In the experiment, participants were asked to perform a creative co-creation task, in which they generated and selected ideas for the task. First, this has been done individually and after as a group. The participants filled in a survey at the end of the session, including questions about Zoom fatigue, the experience of the session and demographic data. The generated and selected ideas of the participants were coded, scored and, together with the survey data, analysed using ANCOVA analyses and regression analyses. No significant results were found in the expected direction. However, a significant difference is found between a high level of Zoom fatigue and creative performance, which indicates that a high level of Zoom fatigue resulted in a high creative performance than a medium level of Zoom fatigue. Hence, no support has been found for the hypotheses in this study.

To conclude, the findings indicate that there is no negative relationship between Zoom fatigue and group creative performance. Besides, adding a schema violation to an online co-creation setting does not influence the relationship between Zoom fatigue and creative performance. Thus, this study shows that Zoom fatigue cannot be mitigated to positively influence group creative performance by adding a schema violation in an online co-creation setting.

Keywords: **Zoom fatigue, group divergent creative performance, group convergent creative performance, co-creation, schema violation.**

Table of Content

H1. Introduction

Consumers have a vast selection of products these days. Compared with 20 years ago, the choices are limitless in the 21st century (Hillebrand, 2020). Because of this, consumers are more critical on companies and their products. Social media plays a large role in this; consumers require more transparency, have more access to information, and gain more power in markets. This results in pressure on business to consumer (B2C) companies, a shift towards experiences, and a more participatory culture (Hillebrand, 2020). Consumers interact more with each other, with consumer communities and with companies (Hillebrand, 2020). The need for more interaction between companies and consumers can be fulfilled by more collaboration between the two parties. Companies that use consumer co-creation to innovate and develop their products or services, create value by allowing consumers to co-construct the product or service to suit their context (Hillebrand, 2020). Thus, co-creation becomes more and more critical for both companies as well as for consumers.

Co-creation itself requires active or passive participation, interest, and intrinsic motivation from the participants. Creativity and creative performance play a vital role in this process. Usually, companies organize co-creation sessions to be able to interact optimally with consumers. These sessions can be done on a national level in which companies ask consumers to send their input and ideas. However, more often, co-creations are similar to events or brainstorm sessions, where creativity and motivation are the most critical drivers of the sessions' performance. But, the COVID-19 pandemic changed the working environment as we knew it before; this also applies to co-creation.

Without underestimating, COVID-19 changed the life of every individual around the globe. The pandemic's impact is immense and will still have a massive effect on our everyday life in the coming years. Not only has the pandemic harmed the health of almost 100 million people worldwide, but it also has a massive negative financial and social impact (WordoMeter, 2021).

The lockdown also resulted in a new way of working. Working from home is the new way of working of these days, leading to a significant increase in the number of users of video conferencing platforms (Stone, 2020). Many companies around the world use video conferencing platforms like Zoom, Microsoft Teams and Cisco WebEx. Together, the media platforms have approximately 675 million users a day in 2020 (Stone, 2020). This forced way of working online has advantages as well as disadvantages. Reduced travel costs and less time in meetings are benefits for both companies and employees (Cranford, 2020). However,

working online negatively influences our interaction and communication with other people (Sklar, 2020). Research shows that it is challenging for humans to communicate, absorb information, and stay focused during conversations via video calls (Fosslien & Duffy, 2020). On average, people are more drained from looking at a computer screen all day than from an average workday at the office. This phenomenon is called *'Zoom Fatigue'* (Fosslien & Duffy, 2020).

Companies and employers' next question is how Zoom fatigue affects participants' productivity and creativity, especially in co-creation, which is essential for companies.

1.1. Problem Statement

Generally, co-creation is used occasionally within companies. During this process, companies and consumers work together to create and develop abstract or concrete ideas within the new product development (from now NPD) process, referred to as the idea generation phase (Kylliäinen, 2019). Within the first part of the NPD process, consumers or employees are asked to participate in a brainstorming or creative session to develop possible solutions for perceived or actual problems, opportunities, or innovations. The participants are mostly challenged to work together, brainstorm, and provide creative input for the organisation within a physical setting (Kylliäinen, 2019). However, due to the COVID-19 pandemic, these physical meetings, and generally all physical interaction with consumers, are forced to hold online via Zoom or another conference platform. Still, the boundary condition of idea generation remains constant. Crucial for a successful idea generation project is creativity (Kylliäinen, 2019)

Much research has been done on group and individual *creative performance* within idea generation sessions (Wang, Schneider, & Valacich, 2015). However, few studies have explored the online environment's influence on the participants' creative performance during virtual idea generation meetings. Additionally, few studies have been done to discover the effect of Zoom fatigue on the creative performance of individual and group performance.

Nonetheless, research shows that fatigue itself negatively influences consumers' creative performance (De Clercq & Pereira, 2020). The assumption is that this also applies to the online context. Therefore, in this study, the assumption is made that Zoom fatigue has a negative effect on creative performance; however, no empirical evidence has been found yet to support this claim.

Another important aspect of this problem is how to stimulate creative performance via an online working environment since no research has been done into this online context.

1.2. Research Relevance

Co-creation is essential for companies' customer orientation and market focus. Research shows that the more customer and market-oriented a company is, the more successful innovations a company has (Hillebrand, 2020). Additionally, focusing on customers' current needs and customers' future needs is essential to generate successful innovative products or services (Hillebrand, 2020). Moreover, innovativeness is crucial for companies to survive (Hillebrand, 2020). Therefore, successful co-creation is of importance for companies to stay innovative and to be able to survive.

For successful co-creation, creativity is the foremost important factor (Kylliäinen, 2019). Almost all co-creation sessions involving consumers depend on the creative performance of the participants. For the total creative performance, both individual creative performance as well as group creative performance matter. Therefore, companies' need is to find practical methods to stimulate all participants' creative performance and enable consumers to integrate content from the social environment to generate novel and innovative ideas. These methods occur in the existing literature. However, the shift to the online context has not yet been made in the literature. By transferring it into the online context, human-machine interaction influences the way of working and communicating. Thus, the question is to what extent interacting via an online environment affects consumers' creative performance? More specifically, what effect does Zoom fatigue has on creative performance? The challenge is how this can be improved by stimulating creative performance and how Zoom fatigue can be mitigated.

Concluding, a gap exists in the current literature, although the need to stimulate creative performance in the online environment increases. This leads to the following research question:

"To what extent can Zoom fatigue be mitigated to positively influence group creative performance within an online co-creation context?"

This research question contributes to the literature by generating insights into how creative performance can be influenced in an online environment. To be able to answer the question, a quantitative approach is used. An experiment is required to execute stimulating factors of creativity and measure participants' creative performance. These experiments test the existing literature about stimulating creative performance, but then in an online environment. The method selected must be similar to existing literature experiments that have been tested in

an offline, physical environment. Therefore, this study is closely linked to existing studies about stimulating creative performance (Ritter et al., 2012).

This research can eventually contribute to some companies' problems when they intend or perform co-creation sessions with participants, which are forced to hold online due to the COVID-19 pandemic (Markman, 2020). Moreover, it contributes to the existing literature of stimuli that influence creative performance in an online environment (Ritter et al., 2012; Ritter & Goclowska, 2020).

1.3. Research structure

This research paper consists of several chapters describing the approach for the study, its results and conclusion. In the second chapter, the theoretical background is discussed, which outlines the relevant theories. The studied variables (i.e., Zoom fatigue, schema violations, individual creative performance, and group creative performance) are examined more in-depth. Within this chapter, the goal is to understand the studied phenomenon and the identified problem. To be able to do that, the conceptual model is presented. In the third chapter, the methodology used is discussed. In the fourth chapter, the results from the analyses are elaborated on. After, in the fifth chapter, a conclusion and discussion are given. Finally, in chapter six, an overview of the limitations and implications for future research are given. The appendixes contain more details regarding the methodology and results.

H2. Theoretical Background

In this paragraph, the theoretical background of the research is discussed in more depth. The key concepts and relevant theories are addressed regarding the identified problem. First, co-creation is discussed in detail. Second, creative performance is elaborated on. Next, a theoretical overview of the online context and the resulting problems is addressed. Lastly, a conceptual model is provided.

2.1. Co-creation in the Idea Generation Phase

Idea generation is the first phase within the NPD process and exists of idea generation and idea selection (Cooper, 1983). The NPD-process is the essence and process of activities and gates and is also named the stage-gate model (Figure 1). The model is helpful for organisations since it provides structure, efficiency, speed and reduced costs (Sethi & Iqbal, 2008). A drawback of the model is that it does not allow very radical innovations because of the lack of predicting knowledge (Sethi & Iqbal, 2008).

The gates are the evaluation phases that are used as 'go and no go' decision steps. Additionally, the activities are divided into technical activities and marketing activities. The idea generation phase does not fit within one of these categories but can be both or one of these two. An idea can come from internal sources like the R&D department or de manufacturing department. It can also emerge from an organisation's external source, from competitors, research institutes, and consumers.

Figure 1: New Product Development process (Hillebrand, B, 2020)

2.1.1. Co-creation by customer participation

This research focuses on consumers as the source for new product ideas, which is also named *co-creation*. Co-creation is "*the practice of developing systems, products or services through collaboration with customers, managers, employees, and other company stakeholders"* (Prahalad & Ramaswamy, 2004, p. 8). A co-creation session is generally organised by companies in the idea generation phase of the NPD process. During co-creation, consumers and companies collaborate to generate innovative product ideas jointly.

Co-creation is essential for companies these days, particularly in manufacturing companies (Prahalad & Ramaswamy, 2000). As described in chapter 1, it allows a company to co-construct the product or service to suit the consumers' context (Prahalad & Ramaswamy, 2004). An example of such a successful co-creation product within the manufacturing industry is the 'Maak de Smaak-Battle' of the chips brand Lays in the Netherlands. They started a competition in 2010 in which consumers could send their ideas to the company for new chips flavours. After consumers have sent in around 675.000 flavours, Lays produced the top 3 and sold them temporarily in the Dutch supermarkets. This way, consumers got the chance to buy and try the most popular flavours. Next, the winning flavour was selected by the market. This flavour has been produced and released. The consumer, who invented the flavour, won a price of €25.000 (Pepsico, 2012).

By using co-creation, consumers can feel more involved with the brand and therefore brand equity can be improved (Prahalad & Ramaswamy, 2004). Research shows that companies that use customer participation within the NPD process have higher NPD financial performance. Thus, co-creation is significantly positively related to NPD's financial performance (Chang & Taylor, 2016).

Moreover, research shows that customer participation can maximise its relationship with its customers (Chang & Taylor, 2016). However, customer participation does not affect a company's relationship with customers with a less positive connection (Chang & Taylor, 2016). Besides, customer participation positively increases the speed of introducing new ideas into the market (Chang & Taylor, 2016). Remarkable in this study is that customer participation does not influence the innovativeness of the NPD. Chang and Taylor (2016) provide this insight because consumers are more likely to develop incremental innovations than radical innovations since existing products bias consumers and often know which 'out of the box' innovations could be of use.

Research by Fang (2008) confirms that no significant relationship exists between customer participation as co-developers on innovativeness. Interesting is that Fang (2008) shows that there is a significant positive relationship between using customers as an information source and the speed of introducing new ideas to the market. However, this relationship does not exist between using customer participation as co-developers on the speed of introducing new ideas to the market. Additionally, Fang (2008) tested the relationship between customer participation as an information source on innovativeness in a context where distributors and retailers are highly connected. This relationship resulted in being significantly negative (Fang, 2008).

In conclusion, research contradicts the effect of co-creation within the idea generation phase on NPD performance. However, research shows that using co-creation within idea generation positively influences NPD's financial performance and can improve the existing, positive relationship between customer and company. Moreover, this effect seems to be most relevant for manufacturing companies.

2.1.2. Structuring co-creation

Generating new product ideas with consumers can be done in various ways; by focus groups, talking with consumers and conducting surveys. Co-creation works explicitly to generate incremental innovations, which are *minor changes to existing products using current technologies* (Song & Thieme, 2009, p. 47). These minor changes and improvements can be more easily developed by people than whole new products that do not yet exist. Therefore, asking consumers' input for radical, innovative ideas can result in some problems. Radical innovations are "*defined as fundamental changes in new products that represent revolutionary changes in technology and require a high degree of knowledge*" (Song & Thieme, 2009, p. 49). These radical and often more creative ideas lie in consumers' unconscious minds, and people often are not aware what kind of product or service they require. A quote from Steve Jobs relates to this problem; "*A lot of times, people do not know what they want until you show it to them*" (Smith, 2019, p. 1). Thus, the challenge for companies is to derive both incremental and radical ideas from consumers.

The literature shows that co-creation can have different structures. First, it can be individually, where consumers can provide input individually and are not influenced by others. This also includes individual idea generation similar to the previous example of Lays. Secondly, it can have a hybrid structure, in which individuals first work independently and afterwards work together. Lastly, it can have a team structure, in which individuals work together as a group (Girotra, Terwiesch, & Ulrich, 2010). Research shows that a hybrid structure is significantly better (measured as the quality of the best ideas) than the ideas generated by a group structure (Girotra et al., 2010). Additionally, Girotra et al. (2010) research show that a hybrid structure also works better for the idea selection phase.

Structuring co-creation is essential to generate successful ideas. However, apart from the structure, the creativity of the participants is even more important. Innovation and generating ideas cannot be done without some sort of creativity (Hillebrand, 2020).

2.2. Creative performance

2.2.1. Creativity and Cognitive Flexibility

Creativity has been defined in more than 100 different ways in the literature (Said-Metwaly, Van den Noortgate, & Kyndt, 2017). The first explicit definition, called the standard definition of creativity, seems to have been written by Stein (1953, p. 311); "*A creative work is a novel work that is accepted as tenable or useful or satisfying by a group in time".* The article by Stein (1953) is relatively dated; however, many researchers have critically evaluated this definition over time (Runco & Jaeger, 2012). Moreover, the definition of creativity has been adjusted over time and is currently defined in large part of the literature similar to *the production of ideas, products or procedures that are novel or original and potentially useful or practical* (Gilson & Madjar, 2011; Reiter-Palmon, 2017; Zhou & Oldham, 2001). Based on this definition, creative performance is defined as the result of creativity.

The existing literature has defined cognitive flexibility as one of the primary essential creativity abilities (Ritter et al., 2014). "*Cognitive flexibility is defined as the ability to break old cognitive patterns, overcome functional fixedness, and, thus, make novel associations between concepts"* (Ritter et al., 2014, p. 145). Therefore, increasing cognitive flexibility is essential to be able to influence creative performance. In addition, the importance of creative performance in co-creation within the idea generation phase is relevant to discuss in more detail.

2.2.2. Creativity in innovation

Innovation involves generating creative ideas. Creativity is mainly essential in the first part of the NPD process, which are the invention stages. The invention stages in the literature have been defined as the stages where novel ideas are generated (i.e., idea generation phase, concept development and concept testing) (Cropley, Kaufman, & Cropley, 2011).

A division has been made in some of the literature between creativity and innovation. Research by West (2002) suggests that creativity and innovation are two separate things. The author states that: "*Creativity is the development of ideas, while innovation is the application of ideas*" (West, 2002, pp. 346-347). However, other researchers emphasize an overlap between innovation and creativity (Cropley et al., 2011; Haner, 2005). They state that creativity within innovation is the generation of ideas, and innovation is implementing these ideas (Cropley et al., 2011; Haner, 2005). Evident in the literature concerning creativity within innovation processes is the importance and the need for creativity. Many studies highlight that creativity and innovation are the foundation of organisations' competitive advantages and survival (Acar,

Tarakci, & van Knippenberg, 2019; Reiter-Palmon, 2017). Therefore, the aim is to stimulate creativity within the co-creation process, as stated in the research question.

2.2.3. Divergent and convergent creativity

Within the literature, creativity is thought to comprise of two measurable cognitive processes that are crucial to creativity. These processes are divergent and convergent thinking (Zhang, Sjoerds, & Hommel, 2020). The two cognitive processes can be examined separately; however, the two are often interwoven and mutually exclusive. More specifically, divergent and convergent work together and complement each other (Gu, 2021). Divergent thinking represents a thinking style involved in the idea generation phase, while convergent thinking is involved in the idea selection phase (Gu, 2021).

Research by Zhang et al. (2020, p. 1) states that *divergent thinking represents a style of thinking that allows idea generation, in a context where the selection criteria are relatively vague and more than one solution is correct. Divergent thinking, therefore, involves flexibility of the mind.* Divergent thinking is considered to be a spontaneous, free-flowing and non-linear process (Gu, 2021). From a neurological perspective, divergent thinking fits associative thought. More specifically, it tends to be intuitive and to unearth associations between items or object that share features and are correlated in a way (Goldschmidt, 2016). Divergent thinking can be expressed along the dimensions of fluency, flexibility and originality of a task (Massimiliano, 2015). Divergent thinking can be measure using these dimensions. In chapter 2.3.1., these dimensions will be further elaborated on.

The idea selection phase relies more on convergent thinking. "*Convergent thinking represents a style of thinking that allows finding single solutions to a well-defined problem, which requires more persistence and focus"* (Zhang et al., 2020, p. 1). Convergent thinking occurs when selecting ideas. It also represents the capacity to find the correct answer to a given problem (Gu, 2021). In general, consumers are not particularly good at selecting the best ideas from many ideas (Paulus, Coursey, & Kenworthy, 2019). The reason given in the literature for consumers not to be very successful in selecting the best ideas is cognitive overload. This can occur when many ideas are shared, and when collaboration is needed to select the best ideas (Paulus et al., 2019). However, for a successful NPD process of a company, selecting the best ideas is therefore crucial.

Measuring convergent creativity can be done on an individual level; however, some studies show that groups are better at selecting ideas than individuals (Rietzschel, Nijstad, &

Stroebe, 2006). At the same time, research by Reiter-Palmon, Herman, and Yammarino (2008) states that whether or not a group outperforms an individual depends on the context and only holds when coordination requirements are minimized. The main reason for this is that groups can elaborate on all ideas and make a more weighted consideration when time is limited (Reiter-Palmon et al., 2008). In the study at hand, the aim is to focus on group creative performance. Therefore, divergent thinking is measured on a group level in the idea generation phase. Besides, convergent thinking is measured in the idea selection phase on a group level.

2.3. Assessing creative performance

This study aims to measure the influence of Zoom fatigue on divergent and convergent group creative performance. To explore the effect and if this effect can be influenced by changing the online environment, measuring creative performance is essential.

Before studying which measurement methods have been used in the existing literature, it is essential to select what level of creative performance is aimed to be measured. The relevant study of Batey (2012) is used since similar or equal approaches are found in other literature reviews (Said-Metwaly et al., 2017). The New Heuristic Framework of Batey (2012) has broken it down into four categories (see figure 2): individual creative performance, group creative performance, organisational creative performance, and culture creative performance (Batey, 2012). It may differ per level of creative performance which methods are useful.

Zoom fatigue is a phenomenon that occurs on an individual level. In addition, it can affect group assignments when working together in groups via the online environment. Therefore, in the study at hand, the focus is on its effect on a group level. Moreover, group creative performance can be linked to divergent thinking since it will be assessed in the idea generation phase, while convergent thinking will be assessed in the idea selection phase (Gu, 2021).

The next factor to be considered before selecting a measurement method is; what is aimed to be analysed? Research by Batey (2012) suggests four categories (Figure 2): Trait, process, press and product. Analysing the trait includes the characteristics of the participants (i.e., how intelligent are the participants, are the participants aggressive). Personality refers to the traits that influence a person's typical thinking pattern, behaving and feeling (Batey, 2012). The process approach focuses more on how creativity is produced within the process (i.e., time is spent by individuals or teams, the interaction process of the team). The press approach focuses more on the environment in which the task is performed and is most suitable for

measuring organisational creative performance (i.e., the team's circumstances, the environment the organisation works in). Additionally, analysing product level involves the quality and creativity of the generated idea (i.e., the creativity of the idea, originality of the idea).

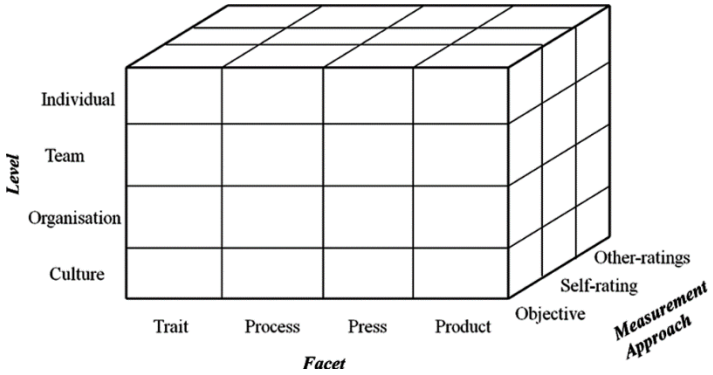

Figure 2: New Heuristic Framework Batey (2012)

Interesting in the literature review of Said-Metwaly et al. (2017) is that the process approach is the most used (52,58% out of a sample of 152 studies). However, for the study at hand, product is the most relevant to be measured because, by measuring on a product level, divergent and convergent creativity can be assessed.

Lastly, Batey (2012) provides three measurement approaches within its model (see figure 2). His research states that creativity can be measured by other ratings (i.e., surveys in which participants are asked to rate other participant's ideas) and self-rating (e.g., surveys in which participants are asked to rate their ideas). However, the most common and valid form is the objective form since it relies on objective data (Batey, 2012).

2.3.1. Assessing divergent creativity

One of the widely used and well-validated measurement methods for measuring divergent creativity on a product level is to score participants' responses for the dimension's fluency, flexibility, and originality. To test divergent thinking, participants can be asked to answer a question with as many different ideas as possible within a specific timeframe (Batey, 2012; Ritter et al., 2012). An example of such a question may be: "What things have a green colour?" or "What makes a sound". This approach is named the alternate uses task (AUT) in the literature, commonly used in studies to measure divergent creativity (Dumas, Organisciak, & Doherty, 2020; Massimiliano, 2015).

Fluency can be measured by counting the total number of adequate responses of the participants to a task (Massimiliano, 2015). The more ideas a participant generates, the more creative s/he can be defined (Rietzschel, De Dreu, & Nijstad, 2007). Flexibility can be measured

by the number of category shift in responses. The more a participant can switch between categories, the higher the flexibility score, and thus, the more creative the answers are (Massimiliano, 2015). Originality can be measured by the novelty and rarity of responses (Dumas et al., 2020). Three approaches exist for measuring originality: human raters, text-mining models, and the total number of times others generate an idea.

The human rater approach is an approach in which researchers are asked to rate each generated response using a 7-point scale (i.e., 1 = "*totally ordinary*", 7 = "*maximally novel*").

The second approach, the text mining models, in which the participants' responses are compared with different publicly available text-mining systems. The study of (Dumas et al., 2020) provided the following example for this method: *is bank more associated with river or money?*

The third approach is to measure originality based on the total times that the specific idea has been generated by other individuals or groups (Benedek, Mühlmann, Jauk, & Neubauer, 2013). If more than two groups mention an idea, the idea can be scored as a zero. When mentioned by one other group, the idea can be scored as one. Finally, when an idea is mentioned by none of the other groups, the idea can be scored as a two (Benedek et al., 2013).

To increase the reliability and validity of this measurement method, the generated ideas can be assessed using the Consensual Assessment Technique (CAT) (Baer & McKool, 2009; Gu, 2021; Said-Metwaly et al., 2017). In this method, expert raters work independently in rating participants' ideas using the dimensions, whereafter the reliability is calculated by comparing the expert's ratings. To measure creative performance, the ratings of each dimension can be combined (Gu, 2021).

2.3.2. Assessing Convergent Thinking

In the literature, one method to measure convergent thinking is widely used. This method is the remote associates test (RAT), which can be used after measuring divergent thinking with the AUT approach. Using the RAT involves the participants generating a fourth word when given three words. For example, when given the words blue, cake and cottage, the participants could generate the word 'cheese' (Gu, 2021).

Zhu, Ritter, Müller, and Dijksterhuis (2017) used another measurement method to measure convergent creativity; the selection task, in which participants are asked to select the most creative ideas from a list of ideas (Gu, 2021). The authors used the following dimensions to measure convergent creativity: *creativity of the selected ideas, originality of the selected*

ideas, the usefulness of the selected ideas, number of the optimal ideas selected, and the selection effectiveness (Zhu et al., 2017, p. 182). In the study at hand, the participants will be asked to select the top three best ideas. In addition, the focus is on the product level and not on the process level. Therefore, the creativity of the selected ideas, originality of the selected ideas, and the usefulness of the selected ideas are sufficient dimensions to be measured. In addition, originality and usefulness represent sub-dimensions of creativity (Zhu et al., 2017).

Zhu et al. (2017) state that an idea is considered creative when being both original and useful. Moreover, an idea is considered original when being *relatively new and untested, and the more original an idea is, the higher the uncertainty perception of risk, likelihood of social rejection, and doubts about whether the idea can be realized* (Zhu et al., 2017, p. 118). An idea can be defined as useful when a product or idea can meet the consumer's need (Moldovan, Goldenberg, & Chattopadhyay, 2011).

Creativity, originality and usefulness can be measured by rating the three best-selected ideas generated by the participants based on a 7-point scale (i.e., *1* = "*not at all creative/original/useful*" , *7* = "*very much creative/original/useful*") (Zhu et al., 2017).

To increase reliability, a detailed description of all points of rating scales can be used (Rietzschel et al., 2007). Besides, the average of the creativity, originality and usefulness of multiple raters can be calculated to form the respective scores for each idea by using the CAT (Gu, 2021). To measure creative performance, the ratings can be combined (Gu, 2021).

2.4. Zoom Fatigue

Maybe we all experienced that communicating via the online environment is different from face-to-face communication. But why is this so different? A few factors have been found in the literature that makes '*computer-mediated communication'* (CMC) different from face-to-face communication. First of all, body language is limited. Most of the times, during video communication, you only see someone's face or part of their body (Nadler, 2020). The importance of body language has been discussed in the literature for many years. Research shows that almost 55% of our communication works via non-verbal communication (Phutela, 2015). A large part of this communication is being lost by CMC. Also, the tone of voice, sounds and eye contact can be interpreted differently through CMC (Jena Lee, 2020; Morris, 2020; Nadler, 2020). Besides, people tend to judge how much to speak and when it is appropriate to speak within the video conference (Morris, 2020).

Another critical difference in communicating via video-conference services is to be able to see yourself all the time. Because the camera is on, it is like looking in the mirror. This makes us hyper-aware of ourselves, our appearance, and our facial expressions all the time (Fosslien & Duffy, 2020), which is assumed to have a negative influence on concentration and leads to more mental fatigue. This phenomenon is referred to as '*Zoom fatigue'*. Nadler (2020, p. 1) defines Zoom fatigue as: "*Part of a larger experience with computer-mediated communication exhaustion which has emerged as a common negative experience prolonged use of CMC platforms*". Research by Jena Lee (2020, p. 2) defines it as: "*Zoom fatigue describes the tiredness, worry, or burnout associated with overusing virtual platforms of communication".* As highlighted in all literature concerning Zoom fatigue, exhaustion, tiredness, stress, and even burnout-related symptoms are common symptoms of this phenomenon. This could affect co-creation sessions because co-creation sessions are done entirely online, meaning that participants are part of computer-mediated communication for extended periods (e.g., one hour up to the whole day). Logically, this could harm the performance of an online co-creation session. This phenomenon is relatively new; not much research has been done into the relationship between Zoom fatigue and creativity.

2.4.1. Influence of Zoom fatigue on creativity

Since no research has been done to explore the effect of Zoom fatigue on creative performance, existing literature describing the effects of fatigue itself on creative performance is used.

First, the effect of CMC on people's creativity is explored. Surprisingly, research by Chao et al. (2020) shows that CMC achieved higher creativity in fluency, flexibility, and originality than face-to-face communication. Additionally, studies in the past support the result that CMC positively influences production and communication efficiency for creative performance (Chao et al., 2020; Y. Wu, Chang, & Sha, 2016). The explanation given for this is that CMC offers more relaxing, anonymous and less tense facial expression than face-to-face communication (Chao et al., 2020). However, their research has been done in the context of education. Other research studies found that in NPD, face-to-face communication is more effective for creative potential than CMC (Chao et al., 2020; Tang, 2019; Tichavsky, Hunt, Driscoll, & Jicha, 2015). Unfortunately, all of these studies have been done in a different context. They focus more on process than on product measurement and focus more on learning ability and creative potential than on creative performance. Nonetheless, it shows CMC's

influence compared with face-to-face communication on the cognitive ability of consumers and the importance of exploring the relationship.

Second, since the literature does not provide a clear relationship between CMC's effect on creative performance, the effect of fatigue itself on creative performance can be explored. Unfortunately, not much research has explored the direct effect of mental fatigue on creativity. In the study at hand, the focus is on the mental tiredness due to fatigue. Nonetheless, fatigue itself can be defined as multiple things. First, it is closely linked to insomnia and tiredness. Research by De Clercq and Pereira (2020) showed a direct negative effect of people's insomnia on creative behaviour. Furthermore, research shows that this effect is more negligible for children than adults (C. H. Wu, Cheng, Ip, & McBride-Chang, 2005).

Contradicting in the existing literature is the study by Davis and Fichtenholtz (2019). They focused on whether mental fatigue would have a positive effect on participants creative performance. Surprisingly, they found precisely the opposite; the study results showed that mentally fatigued participants significantly outperformed non-fatigued participants in creative performance, which indicates that mental fatigue has a positive effect on creativity (Davis & Fichtenholtz, 2019). This insight is unexpected, but at the same time, this study has the closes link to this study since the variables and the context that has been used are pretty similar.

These findings highlight the importance of studying the effect of Zoom fatigue on creative performance due to the lack of literature concerning this relationship. Besides, the relevance of stimulating creative performance, as being done in the offline context, by using stimuli will be explored. However, because the existing literature concerning Zoom fatigue is relatively pessimistic about the problems that can arise from it, the assumption in this study will still be that Zoom fatigue has a negative effect on consumers' creative performance.

2.4.2. Measuring Zoom fatigue

Zoom fatigue is a relatively new phenomenon. Therefore, few academic researchers studied how Zoom fatigue can be measured. One measurement scale found in the existing literature is the Zoom Exhaustion & Fatigue Scale (ZEF-scale) by Fauville, Luo, Muller Queiroz, Bailenson, and Hancock (2021). This scale provides a valid and reliable measure for Zoom fatigue which focuses on nine constructs adapted from the Multidimensional Fatigue Inventory. The constructs are (1) General Fatigue, (2) Physical fatigue, (3) Mental fatigue, (4) Reduced motivation, (5) Reduced activity, (6) Visual fatigue, (7) Vocal fatigue, (8) Emotional fatigue and (9) Social fatigue (Fauville et al., 2021).

In the study at hand, only a few are of interest since the task focuses on a specific online setting that the participants cannot directly influence. Only the co-creation initiator can change the online 'office' environment in a session. Specifically, some constructs can only be affected by leaving the Zoom session or turning off the webcam, for example (Fauville et al., 2021).

General fatigue refers to the experience of being tired, which is essential to include in the study and can be influenced by changing the online environment. Physical fatigue refers to physical sensation related to tiredness. Thus, it focuses on how much a person feels physically able to less due to physical symptoms such as back pain (Fauville et al., 2021). Since this study focuses more on the mental part of fatigue which can be influenced by changing the online office environment, the physical aspect is less interesting. This is the reason that the third construct is essential to include, which is mental fatigue. Mental fatigue refers to the cognitive symptoms related to fatigue (Fauville et al., 2021). The fourth construct, reduced motivation, refers to being less active due to a lack of motivation. This construct focuses on the feeling of doing things; therefore, it refers to a mental aspect (Fauville et al., 2021). Reduced activity refers to the physical part of the tendency to be less active; however, it concerns the mental aspect of doing things. For example, when feeling too tired to do much (Fauville et al., 2021). The sixth construct, visual fatigue, is defined as the visual consequences of being tired. For example, when vision becomes blurrier (Fauville et al., 2021). Because this also is a physical result of tiredness, this construct is not easy to influence by changing the online environment. The same holds for vocal fatigue related to speaking and the consequences of speaking and throat from fatigue (Fauville et al., 2021). This can, for example, be avoided by speaking less, which is not an option in the study at hand. Emotional fatigue is essential to include in the study since it refers to the mental state of feeling overwhelmed and drained, which can result in moodiness and irritations (Fauville et al., 2021). The last construct, social fatigue, refers to the feeling of wanting to be alone. Since this also refers to a physical result due to fatigue, it is not easy to influence (Fauville et al., 2021).

The ZEF-scale can be combined with the CIS-scale, which has been developed by (Vercoulen, Alberts, & Bleijenberg, 1999). The CIS-scale intends to measure subjective fatigue and behavioral aspects related to fatigue. It uses a 7-point Likert scale to measure four dimensions: (1) Severity of fatigue, (2) Concentration, (3) Motivation, and (4) Physical activity. The CIF-scale has high validity and reliability and can be combined with the ZEF-scale to improve Zoom fatigue measurement (Vercoulen et al., 1999).

The ZEF-scale and the CIF-scale combined fit the study at hand more; however, some improvements ensure an even better fit. Based on the Zoom fatigue literature, five constructs

seem the most suitable for this research (1) Delay verbal responses, (2) Lack of mutual gaze, (3) Awareness of own facial expressions, (4) Drained feeling and (5) Productivity (Jena Lee, 2020; Nadler, 2020; Sklar, 2020). These five constructs are intended to measure Zoom fatigue and therefore are named Zoom fatigue markers.

2.5. Stimulating creative performance

Much research has been done to analyse the effect of different factors on individual creative performance and group creative performance (Martens, 2008; Ritter & Ferguson, 2017). For example, research confirms the influence of colour on stimulating individuals' and groups' creativity (Lichtenfeld, Elliot, Maier, & Pekrun, 2012). Additionally, sounds and views of nature and landscapes significantly positively influence consumers' creative ability (Juyoung Lee, Park, Tsunetsugu, Kagawa, & Miyazaki, 2009; Ritter & Ferguson, 2017).

Furthermore, research shows that highly creative individuals significantly more often experienced unusual and unexpected events throughout their lives. For example, the existing literature has linked living abroad and early parental loss to more creative people in general (Ritter et al., 2012). The underlying reason the literature provides for this phenomenon is that unexpected experiences and changes in life can stimulate cognitive flexibility, and in addition to that, creative ability (Ritter et al., 2012). Hence, an unexpected experience can push people out of the bubble of normality and everyday life. It forces people to embrace new and uncommon ideas, which increases creative performance. Thus, past research has linked creative performance to unusual and unexpected experiences (Ritter et al., 2012; Ritter & Goclowska, 2020). These unexpected experiences are called '*schema violations'* and *'diversifying experiences'* (Ritter et al., 2012; Ritter & Goclowska, 2020). Moreover, the intensity of such schema violations has been found to influence cognitive flexibility (Małgorzata Anna Gocłowska, Damian, & Mor, 2018).

An example of a schema violation is the following situation: Imagine coming to an idea generation brainstorm session for new product innovation for the brand Chocomel (Chocomel, n.d.). You probably expect to come into a room, get a coffee (or Chocomel, of course), and listen to the brand's introduction told by the manager. After that, there is an introduction of the participants, and an explanation of today's session, whereafter you as a group start to get to know each other and start the brainstorm meeting. Instead of your expectation, which probably suits the situation mentioned above, you walk into the room, and there is a goat in the middle of the room. Probably, you did not expect that. Nobody is offering you something to drink, and

there are no seats in the room. The introduction consists only of an instruction to come up with a name for this animal, based on its appearance. After you named the goat, the brainstorm session for Chocomel begins.

This situation is unexpected but likely results in higher creative performance since the goat's unexpected appearance stimulates the brain to be more creative (Ritter et al., 2012; Ritter & Goclowska, 2020).

No research has been done into the possibility of using schema violations online and their effect on participants' creative performance. Therefore, this study will use schema violations to stimulate creative performance in an online setting. Assumed is an increase in Zoom fatigue leads to less divergent creative performance, which leads to H1a:

H1a: The appearance of Zoom fatigue in an online co-creation session leads to less divergent creative performance.

In addition, the assumption can also be made that this effect also holds for convergent creative performance, which leads to H1b:

H1b: The appearance of Zoom fatigue in an online co-creation session leads to less convergent creative performance.

After, this direct effect will be tested by adding a moderator: schema violation. The assumption is that this will stimulate creative performance. Thus, it is assumed that when adding a schema violation to the conceptual framework, the relationship between Zoom fatigue and group divergent and convergent creative performance is affected. This relationship is expected to negatively influence the relationship between Zoom fatigue and divergent and convergent creative performance. Thus, adding more schema violation weakens the relation between Zoom fatigue and creative performance. In conclusion, adding a moderator leads to H2a and H2b:

H2a: Adding schema-violations to an online co-creation session has a negative effect on the relationship between Zoom fatigue and group divergent creative performance.

H2b: Adding schema-violations to an online co-creation session has a negative effect on the relationship between Zoom fatigue and group convergent creative performance.

2.6. Conceptual framework

The literature study into the different variables has led to a growing demand for answers concerning this theme. To be able to study these variables and their relationships, a conceptual framework is made. Here, the variables 'Zoom fatigue', 'creative performance' and 'schema violations' are included. This all will be studied within an online co-creation session on a group level while focusing on the idea generation phase and idea selection phase of the NPD process.

In the conceptual framework, Zoom fatigue is the independent variable. Further, two dependent variables will be used; divergent creative performance and convergent creative performance. The relationship between Zoom fatigue and divergent and convergent creative performance is assumed to be negative. Moreover, this study will investigate the effect of the moderator variable, schema violation. This relationship is expected to negatively influence the relationship between Zoom fatigue and divergent and convergent creative performance. Thus, adding more schema violation weakens the relation between Zoom fatigue and creative performance, which leads to the conceptual framework, as shown in Figure 3.

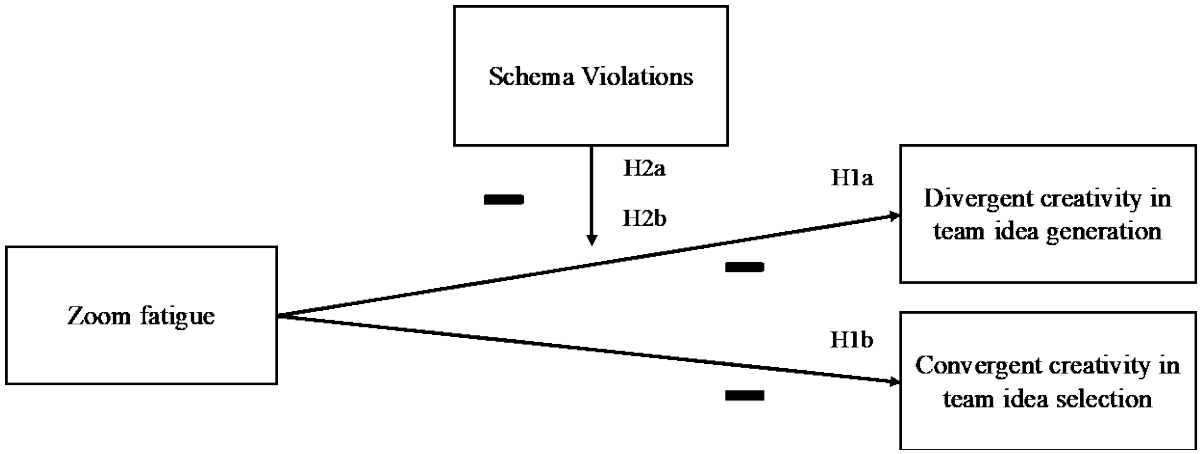

Figure 3: Conceptual Framework

H3. Methodology

In this chapter, a detailed description of how the study at hand is conducted is given. First, the experiment design is discussed, followed by the details of the sample, data sources and measures. Next, the measurement method, including the data analysis procedure, is elaborated on. Finally, limitations of the research project and how research ethics will be addressed are indicated. The methodology is designed in collaboration with two other researchers from Radboud University that perform a similar research design.

3.1. Experiment design

A quantitative research method is used to gather data about the effect of Zoom fatigue on creative performance. An online experiment is designed to test the formulated hypotheses in which the relationship between Zoom fatigue and group creative idea generation and idea selection is being tested. Also, the effect of adding a stimulus (i.e., schema violation) will be tested in a between-subjects factorial design (J. Hair, 2014).

The experiment consisted of 16 Zoom session with a duration of 50 - 60 minutes. Eight sessions were conducted without stimuli and eight with stimuli. Each session included four or five participants. Five participants per co-creation session are chosen not to include too many participants, resulting in a chaotic session; however, five will be enough to collaborate during the idea selection. Besides, by planning the session with five participants, potential fallouts can be anticipated. This way, sessions with only four participants can continue when participants cancel last minute or lose their internet connection. In total, five out of 16 sessions were held with four participants. All the others had five participants.

During the session, all participants were asked to perform a co-creation task which is devised and carried out in advance. The experiment aimed to compare the group's creative performance with schema violation and the group without schema violation. Every participant has, independent of the schema violation, participated in the individual divergent idea generation task, individual idea selection task, group divergent idea generation and group convergent idea selection task. A survey was sent out to the participants at the end of the session to measure the level of Zoom fatigue, the awareness of the stimuli and to gather demographic data of participants. Besides, the participants were being asked to send their brainstorm notes to the researchers via email.

The experiment is held in Dutch so that Dutch participants could express themselves in their native language, and no language barriers exist. One session is done in English, with international students who spoke English well.

In order to use all functions of Zoom and to start a 60 minute during session, Zoom Pro was purchased by the researchers. This way, the host of the Zoom meeting (the researchers) were able to mute the participants when needed and could use the function of recording the session, which was essential for the data analysis.

3.1.1. Sample

In total, 75 people participated in the study. The aim was to include 120 participants in the study. However, 75 turned out to be the limit for this study. The sample consists of Dutch students who follow an MBO, HBO or WO study. The harm of a smaller sample size is that it is more difficult to determine if the analyses' outcome are accurate findings. Besides, a smaller sample size increases the change of a type II error, in which the null hypothesis is incorrectly accepted (J. Hair, 2014).

The researchers recruited participants. Marketing tools, such as posters and social media canals, have been used to recruit as many participants as possible. First of all, the researchers invited fellow students from Radboud University and other familiar people who currently follow a study. An invitation was used to invite these familiar people and fellow students. The invitation was sent out in Dutch. The invitation is designed with 'happy feeling' colours and should evoke enthusiasm and interest in the experiment (see appendix 1). Secondly, social media was used in order to invite more people. Furthermore, to stimulate participation in the experiment, Bol.com gift cards are given away after the experiment. In total, three times a gift card of €20 was randomly awarded to the participants.

3.1.2. Task design

The task is designed to fit the target group (i.e., students). Besides, the task needed to be challenging enough for the participants to work on for 40 – 50 minutes (a specific timetable is elaborated on in chapter 3.1.4.). Therefore, the following case was designed:

On the 17th of November, it is International Students Day. Radboud University wants to treat all its students. Therefore, The University will send all of its students a gift. The participants are asked to come up with creative ideas for what this gift should be. The gift can be anything, although it must meet a few conditions:

- *The gift has to fit within a budget of a maximum of €25 per box (excluding sending costs).*
- *The box needs to be sent to the students by mail.*
- *The packaging may not be bigger than a box similar to a shoebox (around 30cm x 19cm x 12cm)*
- *The gift needs to be packed in an efficient and fun way*
- *The product/products within the box may not break, spoil, leak, or be damaged.*
- *The gift should not have any sexual or discriminate aspects*
- *The gift needs to fit the target group: Students of Radboud University (Both International and Dutch)*

These requirements were explained to the participants and were also provided in the Zoom chat so that the participants could look back at them.

3.1.3. Schema Violation

As described in chapter 2.5. creative performance can be stimulated using schema violation. The schema violation can trigger people to step out of normality which positively influences cognitive performance. In this experiment, the schema violation used were animals (Alpacas) participating in the Zoom session. The alpacas were visible to the participants as any other participant. Half of the Zoom sessions (8 out of 16) were held, including this schema violation.

The alpaca was visible in the group part of the session. Thus, when the individual part, in the beginning, was done, the alpacas showed up in the Zoom session. The animals were named 'Tom & friends' and sometimes came close to the camera. This way, it appeared similar to a human participant in terms of size in the visible picture. The sound of the animal was muted because the experiment only tests for visual stimuli. The reason for this is that sound may be interpreted differently (e.g., soft or harder) by each participant and in the study at hand, it is not aimed to test both sound and visual stimuli, but only visual.

To include the alpaca as a schema violation, a local farmer was contacted to film its animals for 15 minutes and was recorded in advance. The recording is looped to be able to have a 40-minute video minimally. While recording, various close-ups of the alpaca have been filmed to look similar to a human participant in terms of size in the Zoom screen.

3.1.4. Session set up

Students signed up for the experiment and received a Zoom link for the session they were going to participate in. This link was sent to their email one day in advance of the session. When the participant clicked on the links, s/he was placed in the waiting room. The host was already present in the Zoom session, and once all participants have entered the waiting room, the participants were admitted into the Zoom session.

A detailed script is made in order for all hosts to perform precisely the same experiment. Each host followed the script and did not deviate from it. The script can be found in appendix 2. Below, an overview of the session is provided.

First of all, the sessions started with a word of welcome; whereafter the following technical introductions are given to the participants:

- *The participants will have to turn on their camera during the entire session.*
- *The participants have to activate gallery view in Zoom so that all participants are visible on one screen and everyone sees similar Zoom frames.*
- *The Zoom window has to cover the entire computer screen.*
- *The host will mute the participants during the individual idea generation. During the group idea generation and idea selection, the participants have to unmute themselves.*
- *The participants may not mute the Zoom session volume.*
- *The participants should place a pen and a notebook or several pieces of paper in front of them and write down their front name and last name at the top.*
- *The participants' phones should be silent; however, they should keep their phones close because they will need them at the end of the session.*

The host explained how these settings could be adjusted and asked whether everyone succeeded before continuing the session. The instructions were sent in the Zoom chat so that the participants can read them once again if they wanted to. The host explained in detail how the participants could open the Zoom chat.

Once all participants successfully adjusted the Zoom settings, the introduction of the co-creation task was given as described in chapter 3.1.2.. The task description was sent in the chat. Participants were given the option to ask questions after the introduction of the task. The host answered these; however, if the participants ask questions concerning the alpaca, the following answer was always given: *This is part of the experiment and can be elaborated on at the end of the session. Please, accept that your question cannot be answered right now*.

The host was muted during both the individual idea generation, the group idea generation session and the group idea selection, except for urgent questions, technical support and updates concerning time.

The sessions consisted of three parts which began after the technical instructions:

1. Divergent idea generation – individually (used as a baseline)
2. Convergent idea selection – Individually (used as a baseline)
3. Divergent idea generation – group
4. Convergent idea selection – group

Divergent idea generation – individually (used as a baseline)

The participants got ten minutes to write down their individual ideas on the paper in front of them. This way, the participants got enough time to come up with as many ideas as possible, and still, there remained enough time for the rest of the session. Ten minutes is long enough, not too long and did not leave room for participants to be distracted or leave their seats, which is essential for the Zoom fatigue to strike up. The host set a timer for ten minutes and alerted the participants when there was only one minute left and when the ten minutes ended. The participants were asked to stop writing. The reason to let participants write down their brainstorm ideas on paper was to stimulate a 'normal' brainstorm session. Besides, the Zoom screen needed to remain at a full screen during the entire session to strike up Zoom fatigue. Therefore, a survey platform such as Qualtrics has not been used to gather the individual and group brainstorm ideas. The participants have been asked to send a picture of their brainstorm papers via email to the researchers. After all data collection, these were manually inserted into a digital database.

Convergent idea selection – individually (used as a baseline)

The convergent idea selection phase started after ten minutes of individual brainstorming. Participants were instructed to select their three best ideas. The host explicitly mentioned that no new ideas could be created and that they have to select their three best ideas that were already on their brainstorm paper. The ranking of the ideas has been written down as a number in front of the ideas.

Divergent idea generation - group

The host explained what the next 20 minutes entailed; group brainstorming (i.e., divergent creativity in group structure). Before this part of the session began, one of the participants was

made responsible as the team leader. S/he was instructed to write down all ideas that were generated by the team. Besides, the host asked the team leader to write down the part of the session (i.e., group brainstorm) at the top of the paper. The participants were allowed to talk now and exchange their thoughts and generate ideas together. The host timed this session of twenty minutes and reminded the participants when there were only five minutes left.

Convergent idea selection - group

Next, the idea selection part started. In this part of the session, the participants had ten minutes to select the three best ideas from the generated ideas. The host clearly mentioned that no new ideas could be generated; it is only about selection. Again, the team leader of the participants was instructed to write down the ranking of the ideas. The part of the session (i.e., group selection) had to be written down at the top of the paper.

Before the idea selection began, the host checked if the participants had any questions. Once everything was clear, the host set a timer for ten minutes and alerted the participants when five minutes have passed. When the ten minutes ended, the participants were asked to stop discussing, and the ranking needed to be written on paper by the team leader.

Once the person responsible has ranked the selected ideas, the participants were asked to take a photo of the brainstorm papers with their phones. Besides, the team leader needed to take a picture of the group brainstorm session and its ranking. The participants send these pictures via email to thesisexperiment2021@gmail.com. This email address was sent in the Zoom chat. The students got a few minutes to take pictures and sent these, after which the host asked whether everyone succeeded.

Once everyone succeeded in taking and sending these pictures, the host asked the participants to fill in a short survey. The survey link was sent in the chat. The survey contained questions concerning general information about the session, Zoom fatigue, awareness of the schema violation, demographics, and a debrief description. The complete survey is provided in appendix 4.

The host thanked the participants once again for their participation and allowed them to send any further questions via email. After filling in the survey, the co-creation session ended. The participants then left the session.

3.2. Measurement method

3.2.1. Measurement concepts

Within this experiment, five concepts are measured: individual divergent creative performance (used as a baseline), individual convergent creative performance (used as a baseline), group divergent creative performance, group convergent creative performance and Zoom fatigue. Divergent and convergent individual creative performance is measured during the individual idea generation part of the session. Next, divergent creative performance is measured in a group structure. Besides, convergent creative performance is measured in group structure during the idea selection phase. At the end of the session, a survey was sent out to the participants in which Zoom fatigue will be measured.

Divergent creativity comprises three dimensions: flexibility, originality and fluency. As described in chapter 2.3.1., these dimensions can be measured using a 7-point scale and by comparing groups. Convergent creativity also comprises three dimensions: creativity, originality and usefulness. As described in chapter 2.3.2., these dimensions can also be measured using a 7-point scale.

Zoom fatigue is measured by the ZEF scale by Fauville et al. (2021), the CIS-scale by Vercoulen et al. (1999) and adjusted for this specific study. A combination of these scales better encompasses the definition of Zoom fatigue in the context of the study at hand. The five dimensions that are measured by 18 items are (1) Delay verbal responses, (2) Lack of mutual gaze, (3) Awareness of own facial expressions, (4) Drained feeling and (5) Productivity. A more detailed description of the measurements is provided in appendix 3.

3.2.2. Survey

The survey is created with the program Qualtrics. This program offers a clear layout, ease of use and consistency in navigation and is offered via Radboud University (Qualtrics, n.d.). After data collection, the generated and selected ideas from the task have been manually coded and inserted into the dataset by the researchers. All data is exported to IBM SPSS statistics. Then, all data has been prepared for analysis which is elaborated on in chapter 3.2.1..

3.2.3. Data analysis strategy

Both dependent variables in the conceptual model are measured using dimensions. The average of the dimensions reflects the construct (i.e., divergent creative performance and convergent creative performance). Therefore, the dependent variables are of metric measurement level (J.

Hair, 2014). The moderator in the model, schema violation, is a categorical variable. More specifically, schema violation is a dichotomous variable (i.e., schema violation or no schema violation). The independent variable Zoom fatigue is measured using 18 items on a 7-point Likert scale.

To measure divergent and convergent creative performance, all participant's ideas needed to be coded and scored. For divergent creative performance, this is done by fluency (in absolute numbers), flexibility (in absolute numbers) and originality (individual ideas compared with individuals and groups between groups) (see appendix 3 for detailed description) (Dumas, Organisciak, & Doherty, 2020; Massimiliano, 2015). For convergent creative performance, this is done by creativity (7-point scale), usefulness (7-point scale) and originality (7-point scale) (Zhu et al., 2017). After the convergent scores were checked and adjusted by two other researchers, the data could be exported into SPSS.

Before the analysis can begin, factor analysis was essential to transform the items of Zoom fatigue into factors (J. Hair, 2014). The use of factor analysis enables the 18 items of Zoom fatigue to be translated into factors. After transforming the items Zoom fatigue into factors, a MANCOVA is used to compare group means (J. Hair, 2014). A MANCOVA is the most suitable analysis because the conceptual model includes two dependent variables and one covariate. The main effect of Zoom fatigue on divergent and convergent group creative performance is assumed to exist. Performing a MANCOVA analysis provides the possibility to assess the effect of the moderator variable schema violation on the main effect. This test shows whether the group with schema violation significantly differs from the group without schema violation. Lastly, regression analysis is used to analyze linear relationships between variables.

3.3. Ethics

It is essential to address some elements regarding research ethics for the study at hand. The participants cannot stay anonymous because the written paper ideas had to be linked to the participants in the data. However, the researcher handles this information with care following the data collection issues that Radboud University provided. First, data gathering is minimized and encompasses the idea that collection is limited to achieving the research project's goals (RadboudUniversity, 2021). Secondly, the data is only retained for as long as necessary. Thus, this follows the rules of the data retention period (RadboudUniversity, 2021).

H4. Results

In the preceding chapter, the methodology of the study was discussed. After performing all the experiments, the data is analysed in this chapter. Furthermore, hypotheses are tested. The sample size and descriptive data of the study are described. Next, the analyses and corresponding assumptions are elaborated on. Four types of analyses are used: (1) Factor analysis, (2) Compare means tests, (3) Linear regressions analysis and (4) MANCOVA/ ANCOVA.

4.1. Data descriptives

Respondents were approached via the social network of the researchers, social media, and the Radboud University network. Participants could sign in on the experiments. The researchers mostly did not assign the participants to an experiment group. It resulted in groups that knew each other and other groups that were not familiar with each other.

In total, 75 respondents participated in the study (N = 75). As described in chapter 3.1.1., the goal of the experiments was to reach 120 participants in the study. Therefore, the power of the study is harmed. However, the sample size is still large enough to conduct the analyses (J. Hair, 2014). No cases were excluded since no missing data has been found. The final dataset consists of 75 cases (26 men, 49 women) and 18 groups, including four or five participants each (37 with stimuli / 38 without stimuli).

Descriptive statistics of the data were assessed. The age of the participants ranged from 18 to 29 years old (M= 23.2). Approximately 50% of the respondents fall between 22 and 25 years of age. Most of the respondents were highly educated (54.7% WO/ University) in the direction of Economy and Business (48%). The majority of the respondents did not participate long in an online conference call before the experiment (72% between 0 and 30 minutes). The descriptive statistics are summarized in Table 1.

Surprisingly, no participants who participates relatively many minutes in Zoom meetings scored high on Zoom fatigue. This indicates that there is no relationship between minutes in Zoom and Zoom fatigue (see Table 2).

Table 1: Demographics

Demographic		**Frequency**	**Percentage**
Gender	(0) *Male*	26	34.7%
	(1) *Female*	49	65.3%
Age	*≤ 21 years old*	15	20%

	22- 24 years old	43	57.3%
	≥ 25 years old	17	22.7%
Educational level	(1) *MBO*	2	2.7%
	(2) *HBO / University of applied sciences*	32	42.7%
	(3) *WO / University*	41	54.7%
Educational Direction	(2) *Economy and business*	36	48%
	(3) *Natural sciences*	3	4%
	(4) *Formal sciences*	8	10.7%
	(5) *Health care*	9	12%
	(6) *Art and culture*	2	2.7%
	(7) *Education*	3	4%
	(8) *Law*	4	5.3%
	(9) *Language and communications*	3	4%
	(10) *Technology*	1	1.3%
	(11) *Other, namely*	6	8%
Minutes in online meetings	(1) *0 – 30 minutes*	54	72%
	(2) *30 – 60 minutes*	10	13.3.%
	(3) *60 – 90 minutes*	3	4%
	(4) *90 – 120 minutes*	2	2.7%
	(5) *more than 2 hours*	6	8%

Table 2: Cross table Minutes in Zoom - Zoom fatigue

Minutes in Zoom meetings * Zoom fatigue

			Zoom fatigue			Total
			Low	*Medium*	*High*	
Minutes in Zoom meetings	*0 – 30 minutes*	Count	12	38	4	54
		Percentage	16%	50.7%	5.3%	72%
	30 – 60 minutes	Count	2	6	2	10
		Percentage	2.7%	8%	2.7%	13.3%
	60 – 90 minutes	Count	1	2	0	3
		Percentage	1.3%	2.7%	0%	4%
	90 – 120 minutes	Count	1	1	0	2
		Percentage	1.3%	1.3%	0%	2.7%
	more than 2 hours	Count	1	5	0	6
		Percentage	1.3%	6.7%	0%	8%

In the survey, questions have been asked regarding the experiences during and after the session: educational (M= 4.20), interesting (M= 5.45), challenging (M= 5.07) and pleasant (M= 6.07). This indicates that participants mainly experienced the sessions as pleasant.

Remarkable is that almost all of the participants in the stimuli sessions noticed the presence of the animals (100%), the type of animal (100%), and the name of the animals (97.3%). This indicates that all participants in the stimuli sessions consciously noticed and processed the presence of the stimuli. The experiences descriptives and experiences regarding the stimuli are summarized in Table 3 and Table 4.

Table 3: Descriptives experiences

Experiences (7-point scale)	**Mean**	**Median**	**Mode**	**Std. Deviation**
Educational	4.2	4	5	1.395
Interesting	5.45	6	6	1.166
Challenging	5.07	6	6	1.417
Pleasant	6.07	6	6	.741

Table 4: Descriptives experiences for schema violation groups

Experiences Stimuli (7-point scale)	**Mean**	**Median**	**Mode**	**Std. Deviation**
Amazed by presence animal	5.73	6	7	1.427
Shocked by presence animal	3.22	3	2	1.601
Often watched animal	4.97	5	6	1.691
Adding the animal made the session more interesting	3.92	3	3	1.656
Adding the animal broadened my mindset	3.03	3	4	1.142
Adding the animal made it easier to 'think out of the box'	3.3	3	4	1.331

4.2. Analyses

4.2.1. Factor analysis

Factor analysis is required to use Zoom fatigue in further analyses. Zoom fatigue is measured by 18 items divided into five factors (1) Delay verbal responses, (2) Lack of mutual gaze, (3) Awareness of own facial expressions, (4) Drained feeling and (5) Productivity. The factor analysis tested on which factors the items load. Also, it showed which items needed to be removed (J. Hair, 2014). An overview of the items can be found in appendix 5.

Before conducting the factor analysis, three items were reversed (4_4_Very_focused, 5_4_Contribution and 5_5_Productive). Analysing the data of these items indicated that respondents did not notice that item 4_4_Very_Focused was asked in a reversed way. Due to invalid data, this item could not be reversed and has been excluded from the dataset. Thus, the factor analysis is conducted with 17 items.

First, the assumptions have been tested. The KMO measure of simple adequacy is met (KMO = .694, p > .05). Also, Bartlett's test of Sphericity shows that the variables are correlated (Bartlett's test of Sphericity = .000, p <.001) (J. Hair, 2014). Next, the number of factors is determined. SPSS output showed that five factors had an eigenvalue above 1. Thus, the factor analysis can extract five factors corresponding with the number of factors determined previously. The rotation method used is oblimin rotation (factor 4 correlation value > .32) (J. Hair, 2014).

The first Pattern Matrix showed cross loaders on item 1_1_Slower_Responding, item 1_2_Difficult_Responding and item 3_3_Tired_of_facial_expressions (see appendix 5). The first item to exclude in the analysis was 3_3_Tired_of_facial_expressions since it had the lowest difference between loadings (J. Hair, 2014). Excluding this item resulted in two cross loaders: item 1_1_Slower_Responding and 1_2_Difficult_Responding. Item 1_1_Slower_Responding had the smallest difference between loadings; therefore, this item was excluded. Excluding item 3_3_Tired_of_facial_expressions and 1_1_Slower_Responding resulted in zero cross-loadings. All items now load significantly on one out of the five factors (loadings > .5) (J. Hair, 2014). However, some items load differently than expected. Therefore, new and more suitable names have been assigned to the five factors Table 5.

Table 5: Factor Loadings

Factors	**(1) Communicational effort**	**(2) Productivity**	**(3) Drained feeling**	**(4) Exhaustion**	**(5) Awareness facial expressions**
Items	*1_2* *2_1* *2_2* *2_3* *3_4*	*4_4* *4_5*	*4_1* *4_2* *4_3*	*5_1* *5_2* *5_3*	*7_1* *7_2*

Next, in the reliability analysis, Cronbach's alphas were conducted for each of the five remaining constructs, which mostly indicate good reliability (>.8, see appendix 5) (J. Hair,

2014). The Cronbach's alphas did not increase substantially when items were deleted. Therefore, the items as displayed in Table 5 is the final result of the factor analysis.

The items needed to be combined in order to form the construct Zoom fatigue. Therefore, it was essential to check correlations between the factors. Factors that do not correlate with the others could not be combined into Zoom fatigue. The correlation analysis showed that factor 2 Productivity does not correlate with any of the other factors. The remaining factors all correlate significantly with each other. This can be substantiated by theory. The items of fatigue marker 4 Productivity, intended to measure the participants' experience regarding productivity in the experiments, which seemed relevant to measure in advance. However, these items did not come from the ZEF or the CIF scale, which declares the lack of correlation with the other items (Fauville et al., 2021; Vercoulen et al., 1999).

The correlation analysis shows that factor 2 Productivity cannot be included when measuring Zoom fatigue. Thus, factor 1, 3, 4 and 5 can be combined into Zoom fatigue. Factor 2 is excluded from the study since it is no valid variable; it does not measure what was intended to measure.

The complete factor analysis can be found in appendix 5.

4.2.2. Analyses results

No significant differences were found in the independent samples T-test. The analysis has been done with the variables:

- Gender – Zoom fatigue
- Gender – Group idea generation & Individual idea generation
- Gender – Group idea selection & Individual idea selection
- Schema violation – Zoom fatigue
- Schema violation - Group idea generation & Group idea selection

Surprisingly, no significant differences have been found between groups without schema violation (M= 38, SD= 16.117) and groups with schema violation (M= 37, SD= 12.404) and group idea generation t(73)= -1.195, p= .236 <.05). In addition, no significant difference has been found between groups without schema violation (M= 38, SD= 4.885) and groups with schema violation (M=32, SD=5.440) and group idea selection, t(68) = .634, p= .528 >.05). Thus, adding the schema violation has no direct effect on group idea generation and no direct effect on group idea selection. Unexpectedly, there is a significant difference in the idea generation dimension usefulness t(68)= -2.072, p= .044 <.05). Groups without schema violation

scored significantly higher (M= 38, SD= .883) on group idea selection usefulness than groups with schema violation (M= 32, SD= 1.481). Thus, groups without schema violation score better on the usefulness of their selected ideas than groups with schema violation.

No significant differences have been found between respondents who scored high on Zoom fatigue (valid= 6) and the schema violation group (M= 2, SD= .000), compared to the groups without schema violation (M= 2, SD= .000). More specifically, the group means are equal.

A summary of the compare means test can be found in Table 6 Table 7.

Table 6: Compare means tests for Gender

Independent Samples Test for Gender (male / female)

	Levene's Test for Equality of Variances			t-test for Equality of Means				
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*
Gender - Zoom fatigue	Equal variances assumed	.131	.719	.365	73	.716	.048	.131
Gender - Group idea generation	Equal variances assumed	.3.790	.055	1.338	73	.185	4.666	3.487
Gender - Individual idea generation	Equal variances assumed	1.789	.185	1.074	73	.286	2.000	1.863
Gender - Group idea selection	Equal variances assumed	.001	.975	1.023	68	.310	1.307	1.278
Gender - Individual idea selection	Equal variances assumed	3.455	.067	-.722	68	.473	-1.204	1.667

Table 7: Compare means tests for Schema Violation

Independent Samples Tests for Schema Violation (No / Yes)

	Levene's Test for Equality of Variances			t-test for Equality of Means				
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*
Schema Violation - Group idea generation	Equal variances assumed	2.669	.107	-1.195	73	.236	-3.976	3.327

Schema Violation - GG Fluency	Equal variances assumed	3365	.071	-1833	73	.071	-3851	2101
Schema Violation - GG Flexibility	Equal variances assumed	1.544	.218	-.694	73	.490	-.748	1078
Schema Violation - GG Originality	Equal variances assumed	16789	.000	.594	73	.554	.203	.341
	Equal variances not assumed			.598	62263	.552	.203	.339
Schema Violation - Group idea selection	Equal variances assumed	.118	.732	.634	68	.528	.783	1.235
Schema Violation - GS creativity	Equal variances assumed	1.705	.196	1.758	68	.083	1.069	.608
Schema Violation - GS Originality	Equal variances assumed	.162	.689	.495	68	.622	.332	.671
Schema Violation - GS Usefulness	Equal variances assumed	6376	.014	-2160	68	.034	-.618	.286
	Equal variances not assumed			-2.072	48678	.044	-.618	.298

The MANCOVA-analysis of Zoom fatigue on group idea generation and group idea selection under control for schema violation could not be conducted since the assumption of homogeneity has been violated (Box's test p=.000 <.001) (J. Hair, 2014). The underlying reason for this problem seemed to be the kurtosis of the dependent variable group idea selection (kurtosis= 4.019). The descriptive of the variable show that five respondents have a score of 12 on this variable, which is an outlier compared to the rest of the respondents (M= 39.81, SD= 8.971); the observation lies an abnormal distance from the other values (Table 8).

Table 8: Frequencies group idea selection

Group idea selection Frequencies

		Frequency	Percent
Valid	12	5	6.7
	36	10	13.3
	37	13	17.3
	39	10	13.3
	40	5	6.7
	42	4	5.3

	43	5	6.7
	46	4	5.3
	47	9	12.0
	50	5	6.7
	51	5	6.7
Total		75	100.0

The coding scheme of group idea selection shows that one group only selected one best idea and not three (they choose to do this on purpose). This results in a very low score on creativity (valid= 4, M= 12.53, SD= 3.383), originality (valid= 3, M= 11.16, SD= 3.468) and usefulness (valid= 5, M= 16.12, SD= 3.217). Therefore, the analysis is conducted without these five cases (N= 70). To get around the problem of two different sample sizes for idea generation and idea selection, two ANCOVA analyses have been conducted to test the moderator effect of schema violation on the relation of Zoom fatigue on group idea generation and group idea selection.

For the first ANCOVA, Zoom fatigue, schema violation and group idea generation have been used. The assumptions for this analysis are met (normality, Levene's test > .05, IV are mutually exclusive and no correlations between the IV) (J. Hair, 2014). The analysis shows a significant main effect of Zoom fatigue on group idea generation (*Zoom fatigue, F(2, 69)= 5.07, p=.009 < .05*). However, the direct effect of the moderator schema violation is non-significant *(schema violation, F(1, 69)= .155, p = .695 > .05*). The interaction effect of Zoom fatigue and schema violation is non-significant (*Zoom fatigue * schema violation, F(2, 69)= .118, p=.888 > .05*). Thus, only Zoom fatigue significantly affects group idea generation (adjusted R squared =.086); this effect does not differ under control for schema violation (no schema violation/schema violation).

The second ANCOVA analysis has been conducted with group idea selection as the dependent variable. Because the problem of kurtosis is solved earlier, all the assumptions are met (normality, Levene's test > .05, IV are mutually exclusive and no correlations between the IV) (J. Hair, 2014). The analysis shows a non-significant main effect of Zoom fatigue on group idea selection (*Zoom fatigue, F(2, 64)= .032, p=.968 > .05*). Thus, there is no direct effect of Zoom fatigue on group idea selection. The moderator effect also doesn't have a significant effect (*schema violation, F(1, 64)= 1.312, p= .256 > .05*). Finally, the interaction effect is non-significant (*Zoom fatigue * schema violation, F(2, 64)= .621, p= .540 > .05*)

The complete ANCOVA analyses can be found in appendix 6.

Finally, the analysis for Zoom fatigue on group idea generation has been tested for the stimuli experiences variables (see Table 4). However, no significant effects have been found for each of the variables ($p > .05$). The same analysis is done for the effect of Zoom fatigue on group idea selection under control of the stimuli experiences variables (see Table 4). However, no significant effects have been found for each of the variables ($p > .05$).

Lastly, regression analyses have been used to analyse linear relationships in the data. First, the relationship between individual idea generation and group idea generation has been conducted. Before running the analysis, several assumptions had to be met. The assumptions were normality of the error term, linearity of the variate, multicollinearity and homoscedasticity (J. Hair, 2014). Using descriptives, plots, VIF and Tolerance statistics confirms that the assumptions had been met (VIF <10, Tolerance >.1) (see appendix 7). The regression analysis shows that the model is significant (*$F(1, 73)= 16.799, p= .000 <.001$*). The adjusted R^2 shows that individual idea generation explains 17.6% of the model (adjusted $R^2= .176$), which is quite low. Thus, the model is significant and individual idea generation is a good predictor for group idea generation. The unstandardized coefficient shows that one unit change of individual idea generation means an increase of .813 in group idea generation ($B= .813$, $p= .000 < .001$). Thus, individual idea generation significantly predicts group idea generation. So, the better an individual is in idea generation, the higher the group idea generation.

The second regression analysis includes the variables individual idea selection and group idea selection, performed with the adjusted variable of group idea selection (N= 70). Before running the analysis, several assumptions had to be met. The assumptions were normality of the error term, linearity of the variate, multicollinearity and homoscedasticity (J. Hair, 2014). Using descriptives, plots, VIF and Tolerance statistics confirms that the assumptions had been met (VIF <10, Tolerance >.1) (see appendix 7). The regression analysis shows that individual idea selection does not explain the model (adjusted R square = -.005). The F-statistic is non-significant (*$F(1, 68)= .637, p= .428 > .05$)*. Thus, the model is not significant. Individual idea selection does not predict group idea selection. No linear relationship exists between individual idea selection and group idea selection. So, a high score on individual idea selection does not predict its score on group idea selection.

The complete regression analyses can be found in appendix 7.

Furthermore, regression analysis has been used to test for other linear relationships in the dataset. However, no linear relationships have been found. The relationships that are tested with regression analyses are:

- Minutes in Zoom / Zoom fatigue
- Zoom fatigue / Group idea generation
- Zoom fatigue / Group idea selection
- Experience experiment / Zoom fatigue
- Experience experiment / Group idea generation
- Experience experiment / Group idea selection
- Zoom fatigue / Group idea generation (also tested with the moderator effect of stimulus)
- Zoom fatigue / Group idea selection (also tested with the moderator effect of stimulus)
- Familiar with group members / Group idea generation
- Familiar with group members / Group idea selection
- Number of people in groups / Group idea generation
- Number of people in groups / Group idea selection

4.2.3. Hypothesis testing

To test the overall model, two ANCOVA analyses have been used. This way, a difference between groups was analysed (no schema violation/schema violation). To test the direct effects of Zoom fatigue on convergent and divergent creative performance, one-way ANOVA analysis and regression analysis have been used. All analyses that included the variable group idea selection is used with a lower power due to the problem of kurtosis (N= 70). The other variables all met the assumptions of normality. Besides, all assumptions have been met for the ANOVA, ANCOVA's and regression analyses. For the complete analyses, see appendix 8.

H1a: The appearance of Zoom fatigue in an online co-creation session leads to less divergent creative performance.

A significant difference has been found testing H1a. There is a significant difference between groups of Zoom fatigue (0: low, 1: medium, 2: high) and group idea generation (*Zoom fatigue (F(2, 72)= 5.390, p= .007 < .05*). The amount of variance explained is 10.6% (adjusted R squared .106). The Tuckey post hoc analysis shows that group 2 (M= 48.67, SD= 12.340) significantly differs from group 1 (M= 29.62, SD= 12.993) (p= .005 < .05). Group 0 and 1 differ from each other; however, this result is not significant. Group 0 and 2 also differ; this result is neither significant. The results of the regression analysis have been used to explore this result further. However, the model is not significant *(F(1, 73)= .711, p= .402 > .05).* No linear relationship exists between Zoom fatigue and divergent group creative performance. Thus, H1a

cannot be supported: group 2 significantly differs from group 1; however, in the opposite direction. Respondents who experienced a high level of Zoom fatigue scored significantly higher on group idea generation than respondents with a medium level of Zoom fatigue.

H1b: The appearance of Zoom fatigue in an online co-creation session leads to less convergent creative performance.

In contrast to H1b, no significant differences have been found between groups of Zoom fatigue (0: low, 1: medium, 2: high) and group idea selection (*Zoom fatigue (F(2, 67)= .165, p= .848 > .05*). Besides, no linear relation has been found between Zoom fatigue and group idea selection since the model is not significant *(F(1, 68)= .309, p= .580 > .05).* Thus, H1b cannot be supported: no significant effects have been found.

H2a: Adding schema-violations to an online co-creation session has a negative effect on the relationship between Zoom fatigue and group divergent creative performance.

In contrast to H2a, no significant differences have been found between groups of Zoom fatigue (0: low, 1: medium, 2: high) and group idea selection under condition of the stimuli (*Zoom fatigue*stimuli (F(2, 69)= .118, p= .888 . > .05*). The main effect of Zoom fatigue on group idea generation is significant, as elaborated on in H1a. Next, no linear relation has been found between Zoom fatigue, group idea selection and moderator schema violation since the model is not significant (F(2, 72)= 1.102, p= .338 > .05). Thus, H2a cannot be supported: no significant effects have been found.

H2b: Adding schema-violations to an online co-creation session has a negative effect on the relationship between Zoom fatigue and group convergent creative performance.

In contrast to H2b, no significant differences have been found between groups of Zoom fatigue (0: low, 1: medium, 2: high) and group idea selection under condition of the stimuli (*Zoom fatigue*stimuli (F(2, 64)= .621, p= .540 . > .05*). Besides, no linear relation has been found between Zoom fatigue, group idea selection and moderator schema violation since the model is not significant (F(2, 67)= .304, p= .739 > .05). Thus, H2b cannot be supported: no significant effects have been found.

H5. Discussion and conclusion

The research objective was to study the effect of Zoom fatigue on group creative performance in an online co-creation setting and the moderator effect of adding a schema violation. Not much research has been done into the topic of Zoom fatigue or its effect on creative performance. Therefore, this research aimed to address the gap in the literature by answering the following research question: *'To what extent can Zoom fatigue be mitigated to positively influence group creative performance within an online co-creation context?'.* To achieve this, a literature study into the topic, conceptualization and operationalisation first identified the problem and gained knowledge regarding co-creation, Zoom fatigue, creative performance and schema violations. Next, a quantitative experiment among students provided insights and answers to the hypotheses. Finally, the research question can be answered, what shortly is: Zoom fatigue cannot be mitigated to positively influence group creative performance by adding a schema violation into an online co-creation setting.

5.1. Theoretical discussion

The concept of Zoom fatigue presents a fascinating array of phenomena, of which many still has to be explored. Due to the novelty and increase in online meetings and working in an online environment, not much research has been done into Zoom fatigue and its influence on the daily working environment. However, research has been done into the effect of fatigue on creative performance, which has similarities since Zoom fatigue and fatigue are closely linked to each other. Research by Davis and Fichtenholtz (2019) studied the relationship between mental fatigue and creativity. The findings of the study at hand extent the findings of Davis and Fichtenholtz (2019) by transferring it into an online setting and the moderating effect of schema violation. Davis and Fichtenholtz (2019) findings implicate a positive effect between mental fatigue and creativity, which was unexcepted. A similar effect is found in the online setting since participants who experienced a high level of Zoom fatigue scored significantly higher on group divergent creativity than respondents with a medium level of Zoom fatigue. This supports Davis and Fichtenholtz (2019) claim that fatigue does not hinder creativity as expected in advance, but it has a positive effect on creative performance.

Reflecting back on the basic definition of Zoom fatigue as described in chapter 2.4., which could result in symptoms like exhaustion, tiredness, stress and burnout-related symptoms, the results of the studies are considered surprising. Expectedly, Zoom fatigue and the consequences of Zoom fatigue would have a negative effect on creative performance as

hypothesized in H1a and H1b, which seemed to be a logical assumption after studying literature concerning fatigue factors, insomnia and CMC. Multiple studies found that in NPD, face-to-face communication is more effective for creative potential than CMC (Scheibe & Gupta, 2017). Besides, De Clercq and Pereira (2020) showed a direct negative effect of people's insomnia on creative behaviour. Thus, the literature is very contradicting about the effects of fatigue and online communication on creative performance. An explanation for this phenomenon could be that both fatigue and creative performance are very broad concepts that are operationalized in different ways in the literature. Due to the lack of research about fatigue on divergent creative performance, no similar study was found that could be tested in the online environment.

Moreover, fatigue is an experience and perception of a person; it cannot be measured directly by the researcher, resulting in differences in measurement approaches and interpretation of the respondents (Nadler, 2020). Besides, the contexts of each study differ. Some have been conducted in an NPD context, others in an educational environment. These factors could all have led to differences between studies since students can have a different result on creative performance than employees. Moreover, students are used to perform creative tasks in groups, employees mostly perform their own daily tasks.

Thus, the study at hand confirms the theory that there is a difference between the level of Zoom fatigue and divergent creative performance. However, this relationship is not linear and consists only between a medium level of Zoom fatigue and a high level of Zoom fatigue. The results confirm studies that show a positive effect between fatigue and creative performance (Davis & Fichtenholtz, 2019). However, no significant results have been found between Zoom fatigue and convergent creative performance. An explanation could be that creative performance as a concept is too broad, and the influence of (Zoom) fatigue could differ per aspect of creativity which corresponds to the differences found in the literature. For example, the study at hand focusses mainly on group creative performance. Other studies only studied idea selection and idea generation on an individual level. As described in the literature, a difference between groups and individuals on creative performance exists, which could have led to differences between studies (Rietzschel et al., 2006).

In contrast to Zoom fatigue, relatively much research has been done into the effect of schema violations on creative performance. Past research has linked creative performance to unusual and unexpected experiences whereby a curvilinear relationship has been confirmed between schema violations and creativity (Małgorzata Anna Gocłowska et al., 2018; Ritter et

al., 2012; Ritter & Goclowska, 2020). Thus, creative performance improves as a result of adding schema violations. A very similar concept has been tested in the online environment. A result of changing the environment into the online environment is the presence of Zoom fatigue which cannot be excluded and must be considered. Therefore, it contributes to the literature concerning schema violations and creative performance by extending the context and transferring the study into an online environment that brings Zoom fatigue into the relationship.

The results of the analyses show no significant relationship between schema violation and divergent creative performance in an online co-creation setting, which contradicts with literature that studied the relationship in an offline environment (Małgorzata A Gocłowska, Crisp, & Labuschagne, 2013; Małgorzata Anna Gocłowska et al., 2018). Thus, adding schema violations can stimulate creative performance; however, this does not hold in the online environment. In addition, the findings of the study implicate no differences between group means and convergent creative performance. Surprisingly, a difference has been found in group means by one out of three dimensions of convergent creative performance: usefulness. This is the only significant factor out of the three.

No clear explanations can be found in the study or the literature for these contradicting results. However, by reflecting on the experiment design, two possible factors could have led to this result. First, Zoom fatigue influences the study design that the offline relationship between schema violations and creative performance vanishes or changes when transferring it into the online environment. Second, another logical factor that may have influenced the relationship between schema violation and creative performance could be a distraction. Few participants noticed during the sessions that the presence of the schema violation was distracting for them. This has been observed by looking back on the session recordings. Remarks such as: "*The alpaca is so distracting*" and "*I am looking at the alpaca all the time*" indicate that maybe the schema violation was more distracting for the participants than stimulating.

Moreover, no significant results have been found for an effect of schema violations as a moderator variable on Zoom fatigue and group divergent creative performance. Besides, no significant results have been found for schema violations as a moderator variable on Zoom fatigue and group convergent creative performance. This contradicts hypotheses H2a and H2b.

Thus, the study's findings extend existing literature concerning the effect of schema violations and creative performance by transferring it into an online co-creation setting. The contradicting results raise questions about the effect of schema violations in the online setting and its non-existing moderating effect on the relationship between Zoom fatigue and creative performance. It opens a new area of research that still needs to be explored further.

5.2. Theoretical implications

This study is the first to assess creative performance in an online co-creation context with the influence of Zoom fatigue. Few research has been done into Zoom fatigue and its consequences for the online working environment. Moreover, no research has been done on how Zoom fatigue can be mitigated in an online co-creation context to influence divergent and convergent creative performance positively. This research' findings implicate that Zoom fatigue cannot be mitigated in an online co-creation session using schema violations. Besides, no relation exists between Zoom fatigue and divergent and convergent creative performance. The addition of schema violation to this relationship does not result in significant effects. Thus, this study used existing literature regarding divergent and convergent creative performance and schema violations to transfer this into the online co-creation setting; however, the findings indicate that there is no stimulating role of schema violations on creative performance when Zoom is in the online context fatigue is present. Future expectations are that it is possible to mitigate Zoom fatigue and stimulate creative performance in an online co-creation setting. Nonetheless, the stimulus should be changed and used differently.

5.3. Practical implications

Research shows that co-creation is essential for companies, particularly in the manufacturing industry (Prahalad & Ramaswamy, 2004). It can improve brand equity and financial performance. Moreover, it is essential for successful innovations (Chang & Taylor, 2016). Since most co-creations take place online these days, organisations and managers need to stimulate creativity in the online setting. The study's findings do not provide clear answers for managers to mitigate Zoom fatigue in an online co-creation setting and eventually stimulate creative performance since no hypotheses could be supported. However, the results show that Zoom fatigue does not negatively affect creative performance, which implies that no damage is done to creative performance in online co-creation sessions. Critically looking at this implication, it must be noticed that the study at hand designed the experiments so that maybe it was not ideal for Zoom fatigue to strike up (e.g., too active, too short in time). This is elaborated on further in chapter 6. However, this study does not show that Zoom fatigue could harm creative performance in an online co-creation setting. Nonetheless, it neither provides clear implications for practice to stimulate creative performance in an online setting.

5.4. Conclusion

In conclusion, none of the hypotheses could be supported by the research findings. No results could support the overall conceptual model; Zoom fatigue cannot be mitigated to positively influence group creative performance by adding a schema violation in an online co-creation setting. Results found in the literature concerning the relationship between variables in the offline environment vanished or changed in the opposite direction when transferring it into the online setting. Moreover, the findings indicate that Zoom fatigue directly affects divergent creative performance. A high level of Zoom fatigue can result in a high score on divergent creative performance. This does not hold for convergent creative performance. Thus, the online environment substantially affects the relationships between Zoom fatigue, creative performance, and schema violations.

H6. Limitations and future research

The study has a few limitations. First, not much is known about when Zoom fatigue strikes up. Presumably, this differs per person, which can result in differences in the level of Zoom fatigue per person. To make sure every participant experiences some degree of Zoom fatigue, a more extended session is necessary. For example, when working a part of the day or all day via an online video conference call. In this situation, it is more likely for Zoom fatigue to be experienced by all participants to some degree. It is questionable whether the design of the study's experiment was long enough for Zoom fatigue to strike up. Besides, no accurate baseline has been conducted. For future research, this should be taken into account in the research design. Advise for future research is to design the study in a way that it measures a valid baseline concerning Zoom fatigue before the sessions begin. Besides, future research can be conducted with working people, as they better reflect reality. Students are more used to perform creative tasks in groups and employees mostly perform their own daily tasks and meet more often via Zoom. Also, the sessions should last longer (e.g., part of the day or all day), which is more similar to the reality of a co-creation session. Much more research is necessary further to explore the relationship between Zoom fatigue and creative performance. Future research could replicate the conceptual model but first, explore the main effect of Zoom fatigue on group divergent and group convergent creative performance sufficient. To validly measure this effect, a baseline in the offline environment could be used to measure creative performance and fatigue level of the participants.

Another limitation is the lack of control regarding the participants in the study. Since they participated in the study from their own working environment, the researchers had no control of their behaviour. Maybe participants got distracted from noises in their environment, their phones or other environmental factors. The researchers were not able to see or control these factors, which could influence the study. For example, someone who experiences many distractions can be less creative than someone who participated in a calm and quiet environment. Future research could control this more by creating spaces for every participant without distractions. However, this would be challenging and could be expensive. Besides, in reality, people mostly work from their own working environment and not in quite space without distractions. So, to simulate reality, this study had the correct design; however, there was a large limitation of lack of control due to that fact.

As discussed in chapter 5.1., the video of the alpaca was experienced as distracting by some of the participants. This could have harmed the study since a schema violation was not

meant to distract, but to surprise and take people out of the bubble of normality. In future research, it is advised to adjust the schema violation in such a way that it does not distract but only surprises. In an online context this could be done by not showing it the whole session but use it as a short surprise when Zoom fatigue strikes up (e.g., after one or two hours). The schema could be violated by using a small video (e.g., five minutes) of something unexpected. An example could be to use the same alpaca video as used in the study at hand. Then show it after a meeting of an hour when participants start to feel tired. Showing the schema violation for only five minutes can surprise people and could open new conversations which could stimulate creativity.

Moreover, it could help to split the study into three groups for schema violation (e.g., 1: short, not distracting, 2: medium and a little distracting, 3: the entire session, which can be very distracting). This way, the researchers could test whether Zoom fatigue differs per level of schema violation. In addition, researchers could add a new question to the survey to test whether or not participants were distracted.

Reference List

Acar, O. A., Tarakci, M., & van Knippenberg, D. (2019). Creativity and innovation under constraints: A cross-disciplinary integrative review. *Journal of Management, 45*(1), 96-121.

Baer, J., & McKool, S. S. (2009). Assessing creativity using the consensual assessment technique. In *Handbook of research on assessment technologies, methods, and applications in higher education* (pp. 65-77): IGI Global.

Batey, M. (2012). The measurement of creativity: From definitional consensus to the introduction of a new heuristic framework. *Creativity Research Journal, 24*(1), 55-65.

Benedek, M., Mühlmann, C., Jauk, E., & Neubauer, A. C. (2013). Assessment of divergent thinking by means of the subjective top-scoring method: Effects of the number of top-ideas and time-on-task on reliability and validity. *Psychology of Aesthetics, Creativity, and the Arts, 7*(4), 341.

Chang, W., & Taylor, S. A. (2016). The effectiveness of customer participation in new product development: A meta-analysis. *Journal of Marketing, 80*(1), 47-64.

Chao, S.-H., Jiang, J., Hsu, C.-H., Chiang, Y.-T., Ng, E., & Fang, W.-T. (2020). Technology-enhanced learning for graduate students: Exploring the correlation of media richness and creativity of computer-mediated communication and face-to-face communication. *Applied Sciences, 10*(5), 1602.

Chocomel. (n.d.). Chocomel. Retrieved at March 20th, from https://www.chocomel.nl

Cooper, R. G. (1983). The new product process: an empirically-based classification scheme. *R&d Management, 13*(1), 1-13.

Cranford, S. (2020). Zoom Fatigue, Hyperfocus, and Entropy of Thought. *Matter, 3*(3), 587-589.

Cropley, D. H., Kaufman, J. C., & Cropley, A. J. (2011). Measuring creativity for innovation management. *Journal of technology management & innovation, 6*(3), 13-30.

Davis, T. J., & Fichtenholtz, H. M. (2019). Thinking Outside of Functional Fixedness with the Aide of Mental Fatigue. *Creativity Research Journal, 31*(2), 223-228.

De Clercq, D., & Pereira, R. (2020). Sleepy but creative? How affective commitment, knowledge sharing and organizational forgiveness mitigate the dysfunctional effect of insomnia on creative behaviors. *Personnel Review*.

Dumas, D., Organisciak, P., & Doherty, M. (2020). Measuring divergent thinking originality with human raters and text-mining models: A psychometric comparison of methods. *Psychology of Aesthetics, Creativity, and the Arts*.

Fang, E. (2008). Customer participation and the trade-off between new product innovativeness and speed to market. *Journal of Marketing, 72*(4), 90-104.

Fauville, G., Luo, M., Muller Queiroz, A. C., Bailenson, J. N., & Hancock, J. (2021). Zoom Exhaustion & Fatigue Scale. *Available at SSRN 3786329*.

Fosslien, L., & Duffy, M. W. (2020). How to combat zoom fatigue. *Harvard Business Review, 29*.

Gilson, L. L., & Madjar, N. (2011). Radical and Incremental Creativity: Antecedents and Processes. *Psychology of Aesthetics, Creativity, and the Arts, 5*(1), 21-28. doi:10.1037/a0017863

Girotra, K., Terwiesch, C., & Ulrich, K. T. (2010). Idea generation and the quality of the best idea. *Management science, 56*(4), 591-605.

Gocłowska, M. A., Crisp, R. J., & Labuschagne, K. (2013). Can counter-stereotypes boost flexible thinking? *Group Processes & Intergroup Relations, 16*(2), 217-231.

Gocłowska, M. A., Damian, R. I., & Mor, S. (2018). The Diversifying Experience Model: Taking a broader conceptual view of the multiculturalism–creativity link. *Journal of Cross-Cultural Psychology, 49*(2), 303-322.

Goldschmidt, G. (2016). Linkographic evidence for concurrent divergent and convergent thinking in creative design. *Creativity Research Journal, 28*(2), 115-122.

Gu, X. (2021). *Empowering Creativity through Training*. Retrieved from

Haner, U. E. (2005). Spaces for creativity and innovation in two established organizations. *Creativity and innovation management, 14*(3), 288-298.

Hillebrand, B. (2020). [Lecture Marketing and Innovation].

J. Hair, W. B., B. Babin & R. Anderson. (2014). *Multivariate Data Analysis*: Harlow: Pearson Education Limited

Kylliäinen, J. (2019). What is Idea Generation? - Definition, Techniques and Success Factors. Retrieved from https://www.viima.com/blog/idea-generation#what-is-idea-generation

Lee, J. (2020). A neuropsychological exploration of zoom fatigue. *Psychiatric Times. https://www. psychiatrictimes. com/view/psychological-exploration-zoom-fatigue*.

Lee, J., Park, B.-J., Tsunetsugu, Y., Kagawa, T., & Miyazaki, Y. (2009). Restorative effects of viewing real forest landscapes, based on a comparison with urban landscapes. *Scandinavian Journal of Forest Research, 24*(3), 227-234.

Lichtenfeld, S., Elliot, A. J., Maier, M. A., & Pekrun, R. (2012). Fertile green: Green facilitates creative performance. *Personality and Social Psychology Bulletin, 38*(6), 784-797.

Markman, A. (2020). How to Brainstorm - remotely. Retrieved from https://hbr.org/2020/07/how-to-brainstorm-remotely

Martens, Y. (2008). Unlocking creativity with the physical workplace. *Center for People and Buildings, Delft, The Netherlands*.

Massimiliano, P. (2015). The effects of age on divergent thinking and creative objects production: a cross-sectional study. *High Ability Studies, 26*(1), 93-104.

Moldovan, S., Goldenberg, J., & Chattopadhyay, A. (2011). The different roles of product originality and usefulness in generating word-of-mouth. *International Journal of Research in Marketing, 28*(2), 109-119.

Morris, B. (2020). Why does zoom exhaust you? Science has an answer. *Wall Street Journal, March, 27*.

Nadler, R. (2020). Understanding "Zoom fatigue": Theorizing spatial dynamics as third skins in computer-mediated communication. *Computers and Composition, 58*, 102613.

Paulus, P. B., Coursey, L. E., & Kenworthy, J. B. (2019). Divergent and convergent collaborative creativity. In *The Palgrave Handbook of Social Creativity Research* (pp. 245-262): Springer.

Pepsico. (2012). Lay's Maak de Smaak - The Battle. Retrieved from https://www.pepsico.nl/nl-NL/live/pressrelease/lays-maak-de-smaak--the-battle

Phutela, D. (2015). The importance of non-verbal communication. *IUP Journal of Soft Skills, 9*(4), 43.

Prahalad, C. K., & Ramaswamy, V. (2000). Co-opting customer competence. *Harvard Business Review, 78*(1), 79-90.

Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of interactive marketing, 18*(3), 5-14.

Qualtrics. (n.d.). Qualtrics. Retrieved at March 20th, from https://www.qualtrics.com

RadboudUniversity. (2021). Data privacy. Retrieved from https://www.ru.nl/rdm/collecting-data/data-privacy/

Reiter-Palmon, R. (2017). *Team creativity and innovation*: Oxford University Press.

Reiter-Palmon, R., Herman, A. E., & Yammarino, F. J. (2008). Creativity and cognitive processes: Multi-level linkages between individual and team cognition. In *Multi-level issues in creativity and innovation*: Emerald Group Publishing Limited.

Rietzschel, E. F., De Dreu, C. K., & Nijstad, B. A. (2007). Personal need for structure and creative performance: The moderating influence of fear of invalidity. *Personality and Social Psychology Bulletin, 33*(6), 855-866.

Rietzschel, E. F., Nijstad, B. A., & Stroebe, W. (2006). Productivity is not enough: A comparison of interactive and nominal brainstorming groups on idea generation and selection. *Journal of experimental social psychology, 42*(2), 244-251.

Ritter, S. M., Damian, R. I., Simonton, D. K., van Baaren, R. B., Strick, M., Derks, J., & Dijksterhuis, A. (2012). Diversifying experiences enhance cognitive flexibility. *Journal of experimental social psychology, 48*(4), 961-964.

Ritter, S. M., & Ferguson, S. (2017). Happy creativity: Listening to happy music facilitates divergent thinking. *PloS one, 12*(9), e0182210.

Ritter, S. M., & Goclowska, M. A. (2020). 'Diversifying experiences'. In *Encyclopedia of Creativity* (3rd edition by Elsevier ed.).

Ritter, S. M., Kühn, S., Müller, B. C., Van Baaren, R. B., Brass, M., & Dijksterhuis, A. (2014). The creative brain: Corepresenting schema violations enhances TPJ activity and boosts cognitive flexibility. *Creativity Research Journal, 26*(2), 144-150.

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal, 24*(1), 92-96.

Said-Metwaly, S., Van den Noortgate, W., & Kyndt, E. (2017). Approaches to measuring creativity: A systematic literature review. *Creativity. Theories–Research-Applications, 4*(2), 238-275.

Scheibe, K. P., & Gupta, M. (2017). The effect of socializing via computer-mediated communication on the relationship between organizational culture and organizational creativity. *Communications of the Association for Information Systems, 40*(1), 13.

Sethi, R., & Iqbal, Z. (2008). Stage-gate controls, learning failure, and adverse effect on novel new products. *Journal of Marketing, 72*(1), 118-134.

Sklar, J. (2020). 'Zoom fatigue' is taxing the brain. Here's why that happens. Retrieved from https://www.nationalgeographic.com/science/2020/04/coronavirus-zoom-fatigue-is-taxing-the-brain-here-is-why-that-happens/.

Smith, D. (2019). What everyone gets wrong about this famous Steve Jobs quote, according to Lyft's design boss. Retrieved from https://www.businessinsider.nl/steve-jobs-quote-misunderstood-katie-dill-2019-4?international=true&r=US

Song, M., & Thieme, J. (2009). The role of suppliers in market intelligence gathering for radical and incremental innovation. *Journal of Product Innovation Management, 26*(1), 43-57.

Stein, M. I. (1953). Creativity and culture. *The journal of psychology, 36*(2), 311-322.

Stone, K. (2020). The state of video conferencing in 2020 [50 statistic]. Retrieved from https://getvoip.com/blog/2020/07/07/video-conferencing-stats/

Tang, X. (2019). The effects of task modality on L2 Chinese learners' pragmatic development: Computer-mediated written chat vs. face-to-face oral chat. *System, 80*, 48-59.

Tichavsky, L. P., Hunt, A. N., Driscoll, A., & Jicha, K. (2015). " It's Just Nice Having a Real Teacher": Student Perceptions of Online versus Face-to-Face Instruction. *International Journal for the Scholarship of Teaching and Learning, 9*(2), n2.

Vercoulen, J., Alberts, M., & Bleijenberg, G. (1999). De checklist individuele spankracht (CIS). *Gedragstherapie, 32*(131), 6.

Wang, X., Schneider, C., & Valacich, J. S. (2015). Enhancing creativity in group collaboration: How performance targets and feedback shape perceptions and idea generation performance. *Computers in Human Behavior, 42*, 187-195.

West, M. A. (2002). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied psychology, 51*(3), 355-387.

WordoMeter. (2021). COVID-19 Coronavirus pandemic. Retrieved from https://www.worldometers.info/coronavirus/?

Wu, C. H., Cheng, Y., Ip, H. M., & McBride-Chang, C. (2005). Age differences in creativity: Task structure and knowledge base. *Creativity Research Journal, 17*(4), 321-326.

Wu, Y., Chang, K., & Sha, X. (2016). Creative performance in the workplace: The roles of Simmelian ties and communication media. *Computers in Human Behavior, 63*, 575-583.

Zhang, W., Sjoerds, Z., & Hommel, B. (2020). Metacontrol of human creativity: The neurocognitive mechanisms of convergent and divergent thinking. *NeuroImage, 210*, 116572.

Zhou, J., & Oldham, G. R. (2001). Enhancing creative performance: Effects of expected developmental assessment strategies and creative personality. *The Journal of Creative Behavior, 35*(3), 151-167.

Zhu, Y., Ritter, S. M., Müller, B. C., & Dijksterhuis, A. (2017). Creativity: Intuitive processing outperforms deliberative processing in creative idea selection. *Journal of experimental social psychology, 73*, 180-188.

Appendices

Appendix 1: Invitation

Figure 4: Invitation

Appendix 2: Script

- *Welcome everyone! First, I would like to thank you for joining this session. With this, you help us enormously in our research!*

  We are 3 students from the Marketing Master program at Radboud University and are currently working on our Master's Thesis. My name is xxxxxx and I will be today's session leader. I do this study together with xxxx and xxxxx.
- *We would like to note that the entire session will be recorded. Does everyone agree with this? The data will be handled with the utmost care and will be destroyed once the research has been completed. The data will only be used for this particular research and will only be accessible for the researchers and the supervisor.*
- *It is possible that some of you know each other and others don't. We kindly ask you to seriously participate in this session. After completing the survey, at the end of the session, there is time to ask questions and have a short chat. The duration of the session is maximum 1 hour and starts with an assignment. At the end, we will ask you to fill in a short survey.*
- *Before we start, I would like to ask everyone to unmute yourself and briefly tell us your name and what city you are currently in. That way, everyone knows each other's name. Let's begin with xxxxx*
- *Before we start, I provide the following instructions, please follow these:*
  - *It is important that all participants are visible. You can do this by turning on the Gallery view which can be found at the right top by clicking on "View" and then on "Gallery". You will now see all participants on your screen. Did this work for everyone? *waiting for response*.*

    Keep your webcam switched on during the whole session.
  - *Now, I would like to ask you to make sure that Zoom covers your entire screen and that you have nothing else visible on your screen besides the Zoom screen. This should stay that way throughout the session.*
  - *Next, I would like to ask you to stay muted during the first part of the session. *Make sure all participants are muted*. If you want to ask something, you can turn on the microphone at that time. During the second part of the session, you will brainstorm together and then everyone's microphone has to stay on continuously. At that moment, I will tell you when to unmute yourself.*

- *If all goes well, everyone has a pen and at least three pieces of paper in front of them. If not, then please find yourself a pen and paper. Write your name on each piece of paper you use.*
- *Please, put your phone on 'do not disturb' and switch off the sound. However, keep it close to you, you will need it to send an email at the end of the session.*

- *I will now first explain what we are going to do today and then you can get to work! After the explanation I will send all the important points in the chat of this Zoom session. You can open the chat by clicking on "chat" at the bottom of your screen.*
- *Today's assignment is as follows:*

  On the 17th of November this year, it is the day of the International student. In honour of this day, Radboud University in Nijmegen is planning to offer a gift to all students. Today, it is your task to think about ideas for this gift. It can be anything, but there are a number of conditions that must be met:

  ** The budget for this gift is €25 per student. You do not need to take the shipping costs into account.*

  ** The gift needs to be able to send by post, so the products must not leak, damage, spoil or break.*

  ** The packaging of the total gift may not be larger than the size of a shoe box which is approximately 30cm long, 20cm wide and 12cm high.*

  ** The idea must fit the target group: students of Radboud University.*

  ** The gift must be packaged in a fun way, like a real gift!*
- *I will now send the explanation and requirements of the assignment in the chat so that you can always look back at it.*
- *Does anyone have any questions so far? *waiting for response**
- *Okay, so let's start in a bit. The first 10 minutes you will come up with ideas individually. You write as many ideas as possible on the paper that is in front of you. Please, leave your microphone off and your webcam on. Do not click away from the zoom screen.*
- *Please, write down your first and last name, and 'individual ideas' at the top of the paper. And write down your ideas in bullet points.*
- *The 10 minutes start *now*. When the time is running out, I will let you know.*
- **Set timer for 10 minutes**
- **After 9 minutes* You have 1 minute left.*
- **After 10 minutes* The 10 minutes have passed. Please, put down your pens.*

- *I would now like to ask you to select your top 3 best ideas. Note, this means that you are not allowed to write down new ideas, but only select 3 of the existing ideas on your paper. You do this by writing a 1, 2 or a 3 in front of the selected ideas.*
- *In addition, take a look back at the requirements of the assignments!*
- *You will have 3 minutes for the selection of the ideas.*
- *Does anyone have any questions so far? *waiting for response**
- *Okay, then the 3 minutes will start now. When the time is running out, I will let you know. Good luck!*
- **Time 3 minutes**
- **After 2 minutes* You still have 1 minute left.*
- **After 3 minutes* Time is up, please put down your pens.*

- **Add alpaca movie to the stimuli groups**

- *You should all have written down and selected your ideas. Place this piece of paper next to you for a moment.*
- *Do you want to be the team leader for the next assignment xxxx? The team leader xxxxx may take a new piece of paper and write down his/her name at the top. In addition, write down the title "group ideas" at the top of the paper. Did this succeed? *waiting for response*.*
- *For the next 20 minutes you will brainstorm together and generate as many as possible ideas together. Keep the assignment criteria in mind! Please look back at this for a moment. Note, it is the same assignment as you just did individually.*
- *Do you *xxxxxx (teamleader)* want to write down all your ideas on the paper in front of you. Again, with bullet points?*
- *Are there any questions? *waiting for response**
- *Please all unmute yourself.*
- *Then the 20 minutes will start now. I will remind you when the time is running out.*
- **Timing 20 minutes**
- **After 15 minutes* You still have 5 minutes to generate as many as possible ideas*
- **After 20 minutes* Time is over! Please finalize the ideas.*

- *Ok, everything is going great! As you have generated ideas, you will now get 10 minutes to choose the group's three best ideas. No new ideas can be generated, only select the three best ideas from the previously generated ideas. You also have to rank the ideas from 1 to 3. Do you, *person X*, want to place the ranking 1, 2 and 3 in front of the 3 best ideas? After these 10 minutes, you can briefly share your ideas with me.*
- *Does anyone have any questions? *waiting for response**
- *Okay, so let's start. The 10 minutes start now. When the time is almost over, I will let you know.*
- **Timing 10 minutes**
- **After 7 minutes* You have only 3 minutes left to select your top 3 best ideas.*
- **After 10 minutes* Time is up, please put down your pen.*
- *What are your three best ideas? *Waits for response of group leader**
- *Thank you!*

- *I would now like to ask you to pick up your phone and take clear pictures of your notes with all ideas. *Person x*, please would you also make a picture of the group's ideas and the three best ideas of the group? Make sure that each piece of paper has your name and the correct title at the top.*
- *If you have taken these pictures, please send them by email. I will now send the email address in the chat of this session. thesisexperiment2021@gmail.com*
- *Did everyone send it? *Wait**

Link to survey: https://qfreeaccountssjc1.az1.qualtrics.com/jfe/form/SV_80JmB3xKSN00vhc

- *Finally, I will send a link to a short survey in this session's chat. It takes about 8 minutes. Please, make sure you fill this in now. *Wait* Is everyone done?*
- *If anyone has any questions, feel free to ask them now or send an email to the email address in the chat. Group 21*
- **Time for questions and a small chat**
- *I would like to thank you very much for your time and participation. You have helped us a lot!*
- *When you have completed the survey and sent the email with clear photos, you may leave the zoom session.*

Appendix 3: Measurements

Table 9: Measurements

Concept	**Dimensions**	**Items**	**Scale**
Divergent creativity – Individual	Fluency	Total number of ideas	Absolute numbers
	Creativity / originality	Novelty and rarity of responses (individuals compared to all other individuals and groups compared to all other groups)	Mentioned ≤1% = 15 Mentioned ≤5% = 5 Mentioned >5% = 1
	Flexibility	Number of categories or domains	Absolute numbers of semantic categories
Convergent creativity - Group	Creativity	Creativity is the combination of originality and usefulness.	All ideas scored by the researcher for creativity, originality and usefulness (using a 7-point scale: 1 = "*not at all creative/original/useful*", 7 = "*very much creative/original/useful*")
	Originality	Originality is defined as how often an idea is named by other respondents.	
	Usefulness	An idea is useful when it meets the requirements of the task, especially the target group and if it falls in the budget.	Ratings are combined by the CAT method.
Divergent creativity – Group	Fluency	Total number of ideas	Absolute numbers
	Creativity / originality	Novelty and rarity of responses (individuals compared to all other individuals and groups compared to all other groups)	Mentioned ≤1% = 15 Mentioned ≤5% = 5 Mentioned >5% = 1
	Flexibility	Number of categories or domains	Absolute numbers of semantic categories
Convergent creativity – Group	Creativity	Creativity is the combination of originality and usefulness.	All ideas scored by the researcher for creativity, originality and usefulness

	Originality Usefulness	Originality is defined as how often an idea is named by other respondents. An idea is useful when it meets the requirements of the task, especially the target group and if it falls in the budget.	(using a 7-point scale: 1 = "*not at all creative/original/useful*", 7 = "*very much creative/original/useful*") Ratings are combined by the CAT method.
Zoom Fatigue (ZEF-scale, CIF scale & research specific adjustments)	Delay verbal responses Lack of mutual gaze Awareness of own facial expressions	During the Zoom session I felt that: - My verbal responses to others were slower compared to a face-to-face conversation. - It took me more effort to respond to others compared to a face-to-face conversation. - It was difficult for me to make eye contact with others in the Zoom session. - Trying to make eye contact with the other participants was tiresome. - Trying to make eye contact to the other participants resulted in me being less focused. - I was aware of my own facial expressions during the Zoom session - I often looked at my own camera window during the session - Seeing my own camera window was tiresome - Seeing my own camera window resulted in me being less focused.	7-point Likert scale ranging from not at all to extremely. Based on research by Vercoulen et al. (1999) and Fauville et al. (2021).

	Productivity	- I dread having to do other things after this Zoom session - I feel like doing nothing after this Zoom session - I feel too tired to do other things after this Zoom session - I think I have contributed a lot to this Zoom session - I think I have been productive during this Zoom session	
	Drained feeling	Compared to before this Zoom session, I currently feel more: - Emotionally tired - Exhausted - Mentally tired - Very focused (Reversed Item)	

Appendix 4: Survey

Dear participant,

The last part of today is completing this survey. This survey contains questions on a variety of topics and will take approximately 8 minutes to complete. At the end of the survey, you will be asked to enter your name and your email address (which is voluntary). Participation in this experiment is not anonymous, but the data will be handled with utmost care and will be destroyed as soon as our research has been completed.

This survey is part of a study by students at Radboud University in Nijmegen.

Use the following statements to indicate how you experienced the Zoom session

7-point Likert scale. 1: Strongly agree - 7: Strongly disagree

- Educational
- Interesting
- Challenging
- Pleasant
- Other (please indicate)

Did you notice anything remarkable during the session?

- Yes
- No → straight to question 4

What did you notice during the session?

Open question

<u>Only for groups with schema violation:</u>

Did you consciously notice the animals that participated in the Zoom session?

- Yes
- No → straight to question 9

What kind of animals were this?

- Horses
- Goats
- Cows
- Alpacas
- Dogs
- Cats
- Sheeps

- I don't know
- Other, namely: …

What colour were the animals?

- Brown
- White
- Black
- Grey
- I don't know

What were the animals called?

- Dave & friends
- Polly & friends
- Tom & friends
- Fiona & friends
- I don't know
- Other, namely: …

The following questions are about your personal experiences regarding the session. Indicate to what extent you agree with the following statements.

Fatigue marker 1 – Delay verbal responses

7-point Likert scale. 1: Strongly agree - 7: Strongly disagree

During the Zoom session I felt that …

- My verbal responses to others were slower compared to a face-to-face conversation.
- It took me more effort to respond to others compared to a face-to-face conversation.

Fatigue marker 2 – Lack of mutual gaze

7-point Likert scale. 1: Strongly agree - 7: Strongly disagree

Indicate to what extent you agree with the following statements

- It was difficult for me to make eye contact with others in the Zoom session.
- Trying to make eye contact with the other participants was tiresome.

- Trying to make eye contact to the other participants resulted in me being less focused.

Fatigue marker 3 – Awareness of own facial expression

7-point Likert scale. 1: Strongly agree - 7: Strongly disagree

Indicate to what extent you agree with the following statements

- I was aware of my own facial expressions during the Zoom session
- I often looked at my own camera window during the session
- Seeing my own camera window was tiresome
- Seeing my own camera window resulted in me being less focused.

Fatigue marker 4 - Productivity

7-point Likert scale. 1: Strongly agree - 7: Strongly disagree

Indicate to what extent you agree with the following statements

- I dread having to do other things after this Zoom session
- I feel like doing nothing after this Zoom session
- I feel too tired to do other things after this Zoom session
- I think I have contributed a lot to this Zoom session
- I think I have been productive during this Zoom session

Fatigue marker 5 – Drained feeling

7-point Likert scale. 1: Strongly agree - 7: Strongly disagree

Compared to before this Zoom session, I currently feel more:

- Emotionally tired
- Exhausted
- Mentally tired
- Very focused (Reversed Item)

Only for groups with schema violation:

During the session, animals took part in the Zoom session. The following questions are about your personal experiences regarding their presence. Indicate to what extent you agree with the following statements.

I have experienced during the session that….

7-point Likert scale. 1: Strongly agree - 7: Strongly disagree

- I was amazed by the presence of the animal
- I was shocked when the animal was added
- I often watched the animal during the session

- Adding the animal to the Zoom session made the session more interesting for me
- Adding the animal to the Zoom session broadened my mindset
- Adding the animal to the Zoom session made it easier for me to think 'out of the box'

How many minutes have you participated in online meetings today before participating in this session?

- 0-30
- 30-60
- 60-90
- 90-120
- More than 2 hours

What is your age?

Open question

What is your gender?

- Male
- Female
- Other

What is your highest level of education?

- MBO
- HBO
- WO / University

What is your direction of education?

- Earth and environment
- Economy, business and management
- Natural sciences
- Behavioral sciences
- Health care
- Arts
- Education
- Law

- Language and communications
- Technology
- Other, namely: …….

What is your first and last name?

Open question

What is the number of your session group?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21

Have you taken a picture of your brainstorming paper that clearly shows all of your individual brainstorming ideas?

- Yes
- No, I'm going to do this now

Have you sent the photo(s) by email to thesisexperiment2021@gmail.com ?

- Yes

- No, I'm going to do this now

Do you have an idea what the purpose of this experiment is?

- Yes
- No→ directly to debriefing

What do you think the purpose of this experiment was?

Open question

Debriefing

This session contributes to an experiment where it is expected that a schema-violating stimulus, which in this case was the alpaca, could surprise participants in such a way that they would experience a lower degree of Zoom fatigue and therefore be more creative.

Zoom fatigue is the exhaustion someone experiences after the frequent use of video platforms such as Zoom. Expected is that this has a negative influence on someone's creativity. By implementing stimuli, such as the alpaca, it can be tested whether this mitigates the negative effects of Zoom fatigue on creativity.

Thank you for participating in our experiment! If you would like to compete to win one of the three €20 Bol.com gift cards, enter your email address here: ……

Please note: you will only be eligible to win one of the three Bol.com gift cards if you have sent the photo of your brainstorming ideas to the abovementioned email address and have completed the survey. (Your email address will only be used to announce the winner, and we will not use it for marketing purposes).

Don't forget to click through to send the survey!

Appendix 5: Factor Analysis

Items that are included in the factor analysis:

- 1_1
- 1_2
- 2_1
- 2_2
- 2_3
- 3_1
- 3_2
- 3_3
- 3_4
- 4_1
- 4_2
- 4_3
- 4_4
- 4_5
- 5_1
- 5_2
- 5_3
- 4_1

Table 10: KMO and Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.694
Bartlett's Test of Sphericity	Approx. Chi-Square	665.142
	df	153
	Sig.	.000

KMO> .05

Bartlett's Test is significant < .001

Thus, the assumptions for the factor analysis have been met.

Table 11: Factor correlation matrix

Factor Correlation Matrix					
Factor	1	2	3	4	5
1	1.000	.188	.209	-.426	.210
2	.188	1.000	.175	-.184	-.105
3	.209	.175	1.000	-.219	.247
4	-.426	-.184	-.219	1.000	-.220
5	.210	-.105	-.247	-.220	1.000

The factor correlation matrix shows that there is a correlation value >.32 (item 4 – item 1).

Thus, the factor analysis has to stick with oblimin rotation.

Table 12: Total variance explained model

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.656	33.270	33.270	5.262	30.954	30.954	3.767
2	2.100	12.352	45.623	1.726	10.152	41.106	1.945
3	1.788	10.518	56.141	1.394	8.199	49.305	2.440
4	1.507	8.863	65.004	1.169	6.875	56.179	3.723
5	1.058	6.225	71.228	.671	3.945	60.125	2.243
6	.906	5.328	76.556				
7	.803	4.721	81.277				
8	.655	3.850	85.127				
9	.476	2.801	87.928				
10	.393	2.309	90.238				
11	.346	2.038	92.275				
12	.314	1.850	94.125				
13	.273	1.603	95.728				
14	.243	1.427	97.155				
15	.216	1.273	98.428				
16	.145	.853	99.281				
17	.122	.719	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

The total variance explained table shows that five factors have an Eigenvalue of >1. Therefore, the factor analysis conducts five factors.

Start with excluding item 3_3 because the difference between the factor loadings is the smallest. After excluding item 3_3, the pattern matrix only has three cross loaders left.
Item 1_1 has the smallest difference between the factor loadings, so this variable is excluded in the next factor analysis.

Table 13: Pattern matrix C

Pattern Matrix[a]

	Factor				
	1	2	3	4	5
V2_3_Focus_Eyecontact	.729				
V2_1_Difficult_Eyecontact	.699				
V2_2_Exhausting_Eyecontact	.638				
V1_2_Difficult_Responding	.542				
V3_4_Focus_Face_Expressions	.504				
V4_4_Little_Contributed		.945			
V4_5_Not_Productive		.676			
V4_2_Do_Nothing			.750		
V4_1_Not_Looking_forward			.745		
V4_3_Too_Exhausted			.529	-.381	
V5_3_Mentally_Exhausted				-.940	
V5_2_Exhausted				-.791	
V5_1_Emotionally_Exhausting				-.702	
V3_1_Conscious_Face_Expressions					.804
V3_2_Watching_Face_Expressions					.745

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 8 iterations.

The pattern matrix when item 3_3 and item 1_1 are excluded only shows one cross loader; however, the item loads only significantly on factor 3. Therefore, the pattern matrix is accepted and shows the final result of the factor analysis.

Because the items load different than expected, new, more suitable names have been assigned to the factors:

- Factor 1: Communicational effort
- Factor 2: Productivity
- Factor 3: Drained Feeling
- Factor 4: Exhaustion
- Factor 5: Awareness Facial Expressions

Reliability analysis

Factor 1:

Table 14: Reliability statistics 1A

Reliability Statistics

Cronbach's Alpha	N of Items
.803	5

Table 15: Reliability statistics 1B

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
V2_3_Focus_Eyecontact	16.88	27.648	.646	.753
V2_1_Difficult_Eyecontact	15.41	26.381	.628	.753
V2_2_Exhausting_Eyecontact	16.32	26.869	.582	.767
V1_2_Difficult_Responding	15.67	25.604	.526	.790
V3_4_Focus_Face_Expressions	15.99	25.824	.586	.766

Factor 2:

Table 16: Reliability statistics 2A

Reliability Statistics

Cronbach's Alpha	N of Items
.759	2

Table 17: Reliability statistics 2B

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
V4_4_Little_Contributed	2.80	1.324	.614	.
V4_5_Not_Productive	3.05	1.538	.614	.

Factor 3:

Table 18: Reliability statistics 3A

Reliability Statistics

Cronbach's Alpha	N of Items
.754	3

Table 19: Reliability statistics 2B

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
V4_1_Not_Looking_forward	6.04	8.606	.573	.685
V4_2_Do_Nothing	4.84	5.677	.661	.602
V4_3_Too_Exhausted	6.32	9.275	.570	.700

Factor 4:

Table 20: Reliability statistics 3A

Reliability Statistics

Cronbach's Alpha	N of Items
.894	3

Table 21: Reliability statistics 3B

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
V5_3_Mentally_Exhausted	5.60	6.378	.832	.814
V5_2_Exhausted	5.81	7.316	.785	.856
V5_1_Emotionally_Exhausting	5.76	7.293	.763	.873

Factor 5:

Table 22: Reliability statistics 4A

Reliability Statistics

Cronbach's Alpha	N of Items
.746	2

Table 23: Reliability statistics 4B

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
V3_1_Conscious_Face_Expressions	5.19	1.613	.597	.
V3_2_Watching_Face_Expressions	5.05	1.943	.597	.

Correlation

Table 24: Correlation analysis

Correlations

		Factor_1	Factor_2	Factor_3	Factor_4	Factor_5
Factor_1	Pearson Correlation	1	.049	.325**	.548**	.280*
	Sig. (2-tailed)		.677	.004	.000	.015
	N	75	75	75	75	75
Factor_2	Pearson Correlation	.049	1	.155	.064	-.107
	Sig. (2-tailed)	.677		.185	.584	.363
	N	75	75	75	75	75
Factor_3	Pearson Correlation	.325**	.155	1	.369**	.362**
	Sig. (2-tailed)	.004	.185		.001	.001
	N	75	75	75	75	75
Factor_4	Pearson Correlation	.548**	.064	.369**	1	.231*
	Sig. (2-tailed)	.000	.584	.001		.046
	N	75	75	75	75	75
Factor_5	Pearson Correlation	.280*	-.107	.362**	.231*	1
	Sig. (2-tailed)	.015	.363	.001	.046	
	N	75	75	75	75	75

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Appendix 6: ANCOVA

Zoom fatigue – Group idea generation under control of schema violation

The assumptions are met:

- IV are mutually exclusive
- No correlations between IV's
- Normality is met (skweness -2 and +2, kurtosis -4 and +4):

Table 25: Descriptives ANCOVA A

Statistics

		Zoom_fatigue_1_3	GG_Total	V_Schema_Violation
N	Valid	75	75	75
	Missing	0	0	0
Mean		.85	32.07	.49
Median		1.00	31.00	.00
Mode		1	19a	0
Skewness		-.121	.886	.027
Std. Error of Skewness		.277	.277	.277
Kurtosis		.280	-.164	-2.055
Std. Error of Kurtosis		.548	.548	.548

a. Multiple modes exist. The smallest value is shown

- Levene's test is non-significant:

Table 26: Levene's test ANCOVA A

Levene's Test of Equality of Error Variances[a,b]

		Levene Statistic	df1	df2	Sig.
GG_Total	Based on Mean	1.080	5	69	.379
	Based on Median	.513	5	69	.765
	Based on Median and with adjusted df	.513	5	55.196	.765
	Based on trimmed mean	.976	5	69	.438

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Dependent variable: GG_Total

b Design: Intercept + Zoom_fatigue_1_3 + V_Schema_Violation + Zoom_fatigue_1_3 * V_Schema_Violation

Table 27: ANCOVA Output A

Tests of Between-Subjects Effects

Dependent Variable: GG_Total

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2285.181a	5	457.036	2.396	.046	.148
Intercept	46.894.606	1	46.894.606	245.848	.000	.781
Zoom_fatigue_1_3	1.933.438	2	966.719	5.068	.009	.128
V_Schema_Violation	29.516	1	29.516	.155	.695	.002
Zoom_fatigue_1_3 * V_Schema_Violation	45.178	2	22.589	.118	.888	.003
Error	13.161.486	69	190.746			
Total	92.567.000	75				
Corrected Total	15.446.667	74				

a R Squared = .148 (Adjusted R Squared = .086)

Zoom fatigue – Group idea selection under control of schema violation

The assumptions are met:

- IV are mutually exclusive
- No correlations between IV's
- Normality is met (skweness -2 and +2, kurtosis -4 and +4):

Table 28: Descriptives ANCOVA B

Statistics

		Zoom_fatigue_1_3	GS_Total	V_Schema_Violation
N	Valid	70	70	70
	Missing	0	0	0
Mean		.84	41.80	.46
Median		1.00	40.00	.00
Mode		1	37	0
Skewness		-.061	.508	.176
Std. Error of Skewness		.287	.287	.287
Kurtosis		.086	-1.181	-2.028
Std. Error of Kurtosis		.566	.566	.566

a. Multiple modes exist. The smallest value is shown

- Levene's test is non-significant:

Table 29: Levene's test ANCOVA B

Levene's Test of Equality of Error Variances[a,b]

		Levene Statistic	df1	df2	Sig.
GS_Total	Based on Mean	1.565	5	64	.183
	Based on Median	.631	5	64	.677
	Based on Median and with adjusted df	.631	5	50.687	.677
	Based on trimmed mean	1.496	5	64	.204

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Dependent variable: GS_Total

b Design: Intercept + Zoom_fatigue_1_3 + V_Schema_Violation + Zoom_fatigue_1_3 * V_Schema_Violation

Table 30: ANCOVA Output B

Tests of Between-Subjects Effects

Dependent Variable: GS_Total

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	51.007a	5	10.201	.371	.867	.028
Intercept	57.781.165	1	57.781.165	2.100.902	.000	.970
Zoom_fatigue_1_3	1.766	2	.883	.032	.968	.001
V_Schema_Violation	36.075	1	36.075	1.312	.256	.020
Zoom_fatigue_1_3 * V_Schema_Violation	34.176	2	17.088	.621	.540	.019
Error	1.760.193	64	27.503			
Total	124.118.000	70				
Corrected Total	1.811.200	69				

a R Squared = .028 (Adjusted R Squared = -.048)

Appendix 7: Regression analyses

Individual idea generation – Group idea generation

Before running the analysis, several assumptions have to be met. The assumptions are normality of the error term, linearity of the variate, multicollinearity and homoscedasticity.

Table 31: Scatterplot A

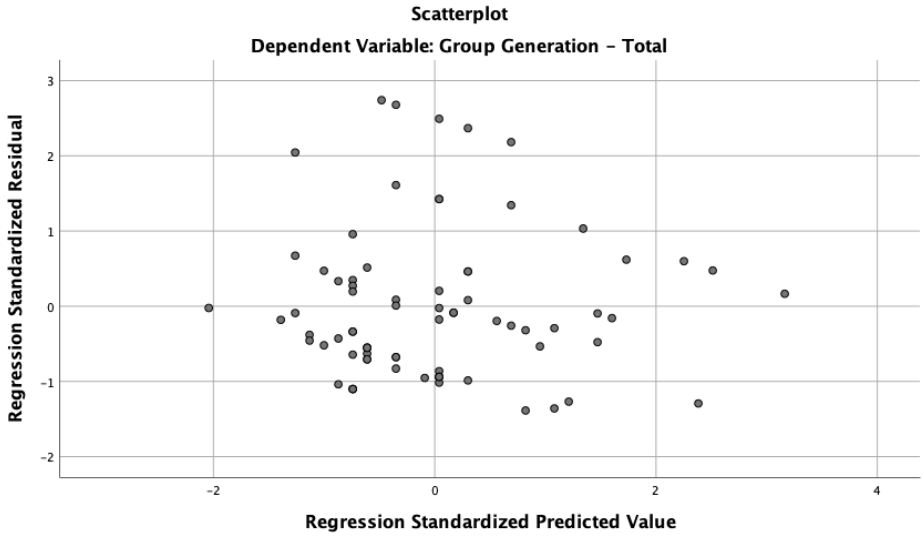

Table 32: P-Plot A

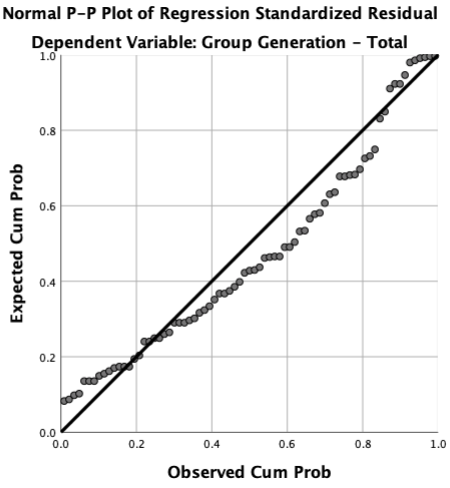

Table 33: Coefficients table A

Coefficients[a]

Model	Unstandardized Coefficients	Standardized Coefficients	Collinearity Statistics

		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	13.613	4.750		2.866	.005		
	IG_total	.813	.198	.433	4.099	.000	1.000	1.000

a Dependent Variable: GG_Total

All assumptions have been met (normality of error term, linearity of the variate, multicollinearity and homoscedasticity).

Table 34: Model Summary A

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.125a	.016	.002	14.433	.016	1.155	1	73	.286

a Predictors: (Constant), Zoom_fatigue_1_3

b Dependent Variable: GG_Total

Table 35: ANOVA output A

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	240.602	1	240.602	1.155	.286b
	Residual	15.206.065	73	208.302		
	Total	15.446.667	74			

a Dependent Variable: GG_Total

b Predictors: (Constant), Zoom_fatigue_1_3

Individual idea selection – Group idea selection

Before running the analysis, several assumptions had to be met. The assumptions were normality of the error term, linearity of the variate, multicollinearity and homoscedasticity.

Table 36: Scatterplot B

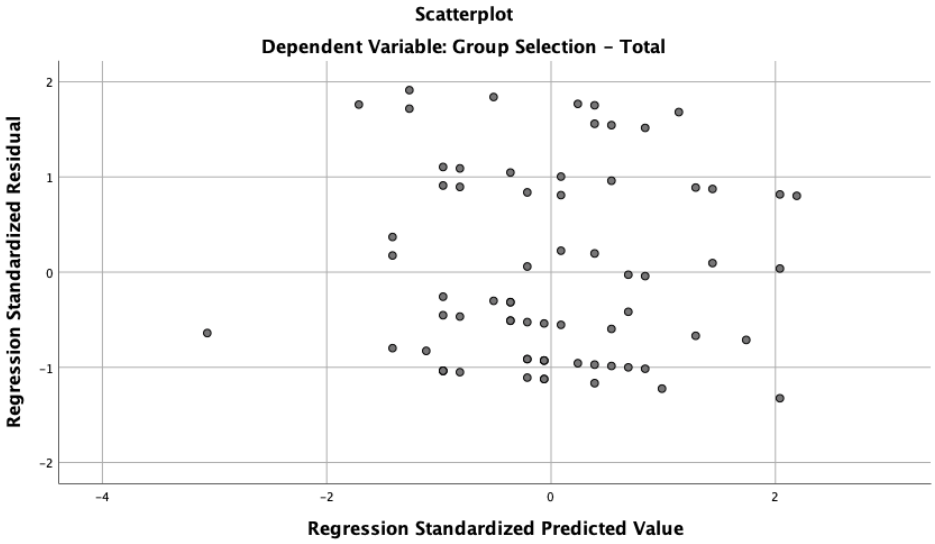

Table 37: P-Plot B

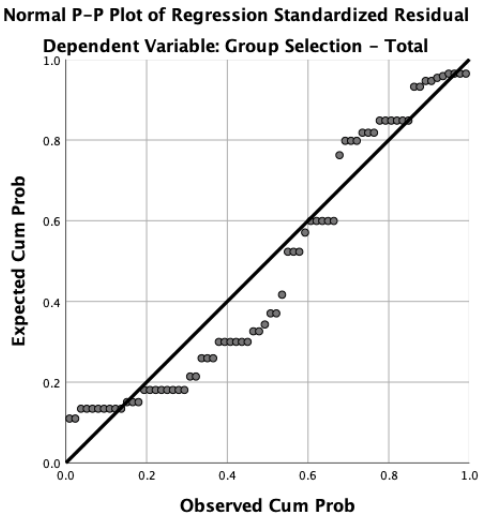

Table 38: Coefficients B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	38.954	3.619		10.763	.000		
	IS_Total	.074	.093	.096	.798	.428	1.000	1.000

a Dependent Variable: GS_Total

Table 39: Model Summary B

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.096a	.009	-.005	5.137	.009	.637	1	68	.428

a Predictors: (Constant), IS_Total

b Dependent Variable: GS_Total

Table 40: ANOVA Output B

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.804	1	16.804	.637	.428b
	Residual	1.794.396	68	26.388		
	Total	1.811.200	69			

a Dependent Variable: GS_Total

b Predictors: (Constant), IS_Total

Using descriptives, plots, VIF and Tolerance statistics confirms that the assumptions had been met (VIF <10, Tolerance >.1)

Appendix 8: Hypothesis testing

H1a: The appearance of Zoom fatigue in an online co-creation session leads to less divergent creative performance.

The assumptions are met:

- IV are mutually exclusive
- No correlations between IV's
- Normality is met (skweness -2 and +2, kurtosis -4 and +4):
- Levene's test non-significant

Table 41: Descriptives H1a

Descriptives

GG_Total

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound	Minimum	Maximum
0	17	33.71	15.936	3.865	25.51	41.90	13	65
1	52	29.62	12.993	1.802	26.00	33.23	13	65
2	6	48.67	12.340	5.038	35.72	61.62	33	65
Total	75	32.07	14.448	1.668	28.74	35.39	13	65

Table 42: Levene's test H1a

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
GG_Total	Based on Mean	.550	2	72	.579
	Based on Median	.398	2	72	.673
	Based on Median and with adjusted df	.398	2	70.069	.673
	Based on trimmed mean	.493	2	72	.613

Table 43: ANOVA Output H1a

ANOVA

GG_Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.011.496	2	1.005.748	5.390	.007

Within Groups	13.435.170	72	186.600		
Total	15.446.667	74			

Table 44: Multiple Comparisons H1a

Multiple Comparisons

Dependent Variable: GG_Total

Tukey HSD

(I) Zoom_fatigue_1_3	(J) Zoom_fatigue_1_3	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
0	1	4.090	3.816	.535	-5.04	13.22
	2	-14.961	6.487	.061	-30.48	.56
1	0	-4.090	3.816	.535	-13.22	5.04
	2	-19.051*	5.890	.005	-33.15	-4.96
2	0	14.961	6.487	.061	-.56	30.48
	1	19.051*	5.890	.005	4.96	33.15

* The mean difference is significant at the 0.05 level.

All the assumptions for the regression analysis are met. The assumptions are normality of the error term, linearity of the variate, multicollinearity and homoscedasticity.

Table 45: Regression Output H1a

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	57.453	1	57.453	.711	.402b
	Residual	5.897.933	73	80.794		
	Total	5.955.387	74			

a Dependent Variable: GS_Total

b Predictors: (Constant), Zoom_fatigue_1_3

H1b: The appearance of Zoom fatigue in an online co-creation session leads to less convergent creative performance.

The assumptions are met:

- IV are mutually exclusive

- No correlations between IV's
- Normality is met (skweness -2 and +2, kurtosis -4 and +4):
- Levene's test non-significant

Table 46: Levene's test H1b

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
GS_Total	Based on Mean	.947	2	67	.393
	Based on Median	.445	2	67	.643
	Based on Median and with adjusted df	.445	2	65.282	.643
	Based on trimmed mean	.992	2	67	.376

Table 47: ANOVA output H1b

ANOVA

GS_Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.882	2	4.441	.165	.848
Within Groups	1.802.318	67	26.900		
Total	1.811.200	69			

In contrast to H1b, no significant differences have been found between groups of Zoom fatigue (0: low, 1: medium, 2: high) and group idea selection (*Zoom fatigue (F(2, 67) = .165, p = .848 > .05*).

All the assumptions for the regression analysis are met. The assumptions are normality of the error term, linearity of the variate, multicollinearity and homoscedasticity.

Table 48: Regression output H1b

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.191	1	8.191	.309	.580b
	Residual	1.803.009	68	26.515		
	Total	1.811.200	69			

a Dependent Variable: GS_Total

b Predictors: (Constant), Zoom_fatigue_1_3

H2a: Adding schema-violations to an online co-creation session has a negative effect on the relationship between Zoom fatigue and group divergent creative performance.

The assumptions are met:

- IV are mutually exclusive
- No correlations between IV's
- Normality is met (skweness -2 and +2, kurtosis -4 and +4):
- Levene's test non-significant

Table 49: Levene's test H2a

Levene's Test of Equality of Error Variancesa,b

		Levene Statistic	df1	df2	Sig.	
GG_Total	Based on Mean	1.080	5	69	.379	
	Based on Median	.513	5	69	.765	
	Based on Median and with adjusted df	.513	5	55.196	.765	
	Based on trimmed mean	.976	5	69	.438	

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Dependent variable: GG_Total
b Design: Intercept + Zoom_fatigue_1_3 + V_Schema Violation + Zoom_fatigue_1_3 * V_Schema Violation

Table 50: ANCOVA Output H2a

Tests of Between-Subjects Effects

Dependent Variable: GG_Total

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2285.181a	5	457.036	2.396	.046	.148
Intercept	46.894.606	1	46.894.606	245.848	.000	.781
Zoom_fatigue_1_3	1.933.438	2	966.719	5.068	.009	.128
V_Schema Violation	29.516	1	29.516	.155	.695	.002
Zoom_fatigue_1_3 * V_Schema Violation	45.178	2	22.589	.118	.888	.003
Error	13.161.486	69	190.746			
Total	92.567.000	75				
Corrected Total	15.446.667	74				

a R Squared = .148 (Adjusted R Squared = .086)

All the assumptions for the regression analysis are met. The assumptions are normality of the error term, linearity of the variate, multicollinearity and homoscedasticity.

Table 51: Regression output H2a

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	458.983	2	229.492	1.102	.338b
	Residual	14.987.683	72	208.162		
	Total	15.446.667	74			

a Dependent Variable: GG_Total

b Predictors: (Constant), V_Schema Violation, Zoom_fatigue_1_3

H2b: Adding schema-violations to an online co-creation session has a negative effect on the relationship between Zoom fatigue and group convergent creative performance.

The assumptions are met:

- IV are mutually exclusive
- No correlations between IV's
- Normality is met (skweness -2 and +2, kurtosis -4 and +4):
- Levene's test non-significant

Table 52: Levene's test H2b

Levene's Test of Equality of Error Variances[a,b]

		Levene Statistic	df1	df2	Sig.
GS_Total	Based on Mean	1.565	5	64	.183
	Based on Median	.631	5	64	.677
	Based on Median and with adjusted df	.631	5	50.687	.677
	Based on trimmed mean	1.496	5	64	.204

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Dependent variable: GS_Total

b Design: Intercept + Zoom_fatigue_1_3 + V_Schema Violation + Zoom_fatigue_1_3 * V_Schema Violation

Table 53: ANCOVA output H2b

Tests of Between-Subjects Effects

Dependent Variable: GS_Total

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	51.007a	5	10.201	.371	.867	.028
Intercept	57.781.165	1	57.781.165	2.100.902	.000	.970
Zoom_fatigue_1_3	1.766	2	.883	.032	.968	.001
V_Schema Violation	36.075	1	36.075	1.312	.256	.020
Zoom_fatigue_1_3 * V_Schema Violation	34.176	2	17.088	.621	.540	.019
Error	1.760.193	64	27.503			
Total	124.118.000	70				
Corrected Total	1.811.200	69				

a R Squared = .028 (Adjusted R Squared = -.048)

All the assumptions for the regression analysis are met. The assumptions are normality of the error term, linearity of the variate, multicollinearity and homoscedasticity.

Table 54: Regression output H2b

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.301	2	8.150	.304	.739b
	Residual	1.794.899	67	26.790		
	Total	1.811.200	69			

a Dependent Variable: GS_Total

b Predictors: (Constant), V_Schema Violation, Zoom_fatigue_1_3