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How to Boost Group Creative Performance in Times of COVID-19

A field experiment using schema-violation in order to mitigate the effect of
Zoom fatigue thereby fostering Group creative performance in an online
co-creation environment

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'To what extent can the online environment be shaped and reinvented to mitigate the effect of Zoom fatigue thereby fostering Group creative performance in online co-creation contexts?'

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Abstract

The outbreak of the COVID-19 pandemic in 2020 resulted in a significant rise in telecommunication as working remotely was required in order to prevent the transmission of the virus. The use of video conferencing services such as Zoom, WebEx and Microsoft Teams increased enormously in order to pursue daily business operations. However, it soon became clear that telecommunication cannot be equaled to face-to-face communication as people started to feel a certain virtual haze, also referred to as 'Zoom fatigue'. The phenomenon of Zoom fatigue is especially a problem for more interactive meetings such as innovation co-creation processes where the participation of many participants at the same time is desirable. Hence, the study at hand investigated what can be done to mitigate the negative effects of Zoom fatigue thereby spark Group creative performance, specifically divergent thinking, in co-creation sessions. Theoretical research revealed that the use of a schema-violating stimulus could have the potential to mitigate the effect of Zoom fatigue on Group creative performance as it proved to interrupt one's cognitive structures and therefore enhance cognitive thinking, making people more present, active and creative. Therefore, the addition of a schema-violating stimulus to the virtual meeting was expected to mitigate the negative effects of Zoom fatigue on Group Creative Performance. To test the hypothesis, a field experiment was performed. No significant effects of the schema-violation occurred under both the conditions of low and high Zoom fatigue. However, the data showed a positive tendency of the stimulus for participants that experienced relatively high Zoom fatigue. Furthermore, the study at hand revealed that the effect of high Awareness of expression on Group creative performance in the stimulus condition was significantly more positive compared to the effect of high Awareness of expression on Group creative performance in the no-stimulus condition. These findings contribute to the understanding of Zoom fatigue and provide more insights for further research on the topic.

Preface

This master thesis marks the final chapter of the master programme Business Administration with a specialization in 'Marketing'. The research process that took place in the last six months had many ups and many downs.

The study at hand investigates the phenomenon of Zoom fatigue in times of COVID-19 and its negative impact on Group creative performance. This research was conducted using a field experiment which was new to me and therefore quite challenging. Though, the process was very educational and therefore contributed to my research skills and knowledge. I enjoyed conducting a research about a topic which was very real-time. However, COVID-19 also made it quite hard for me to focus and keep myself motivated as I had not been at the Radboud University for the whole year.

Even though I felt quite lonely sometimes, I had people supporting me throughout the process. I would like to thank some people who have been of great value in the realization of this master thesis. First of all, I would like to thank dr. N. Belei for her supervision and confidence in me during the entire research process. Second, I would like to thank dr. V. Blazevic and dr. S. Ritter for the additional feedback on several issues that arose during the research process. Third, I would like to thank all 75 participants that have participated in the experiment. Finally, I would like to thank my boyfriend for always having faith in me and being such a great support to me in times when I was really suffering.

The last six months have been a rollercoaster of emotions due to the strict lockdown of COVID-19 in combination with conducting such a big research as this. However, I am happy that I successfully completed my master thesis and can look forward to better times.

Caroline Hezemans

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1. Introduction

Why is there a real goat participating in my Zoom meeting today? This is what many individuals have wondered in the past months when they joined a Zoom meeting. While it seemed to be just funny or silly, there was actually a good reason behind it: the meeting organizer tried to save participants from “Zoom fatigue” and spark their creativity during online meetings.

Creative performance has proven to be one of the main success factors of firms. The intense global competition and a rapidly changing technology have been forcing firms to devote significant effort in the development of innovative new products to enhance sustainable competitive advantage (Bissola et al., 2014; Callahan & Lasry, 2004; Owens & Cooper, 2001). Hence, firms continuously strive for new sources of innovation and creativity (Prahalad & Ramaswamy, 2004). Unfortunately, many products offered in a market still result in failure, which is largely due to the firms’ lacking ability to produce according to the market’s requirements (Kristensson et al., 2008; Rasool et al., 2017). The ability to understand customer requirements has proven to be critical for product success, which has been more and more recognized in the field since the appearance of the article “Co-opting consumer competence” in 2000 (Ind et al., 2017; Prahalad & Ramaswamy, 2000). As a result, the new product development (NPD) process of many firms has changed from a traditional company-centric, product-and-service focused activity to a more user-centered activity in which consumers are actively involved in the NPD process (Prahalad & Ramaswamy, 2003; von Hippel, 2005). This modern approach mainly resulted in a shifted role of the customer from being isolated to connected, from unaware to aware and from passive to active (Prahalad & Ramaswamy, 2004). Since the last decade, this active involvement of customers in the NPD process has mainly been referred to by the term co-creation which Rasool et al. (2017) define as *“an active, creative and social process which includes some special methods and strategies applied by firms to engage the end-users into the process of the firms’-initiated NPD projects”* (p.3).

Although some scholars have doubts about the ability of customers to express their needs and to generate truly creative and novel ideas, a growing body of studies has proven co-creating with customers to be a successful technique for NPD success (Poetz & Schreier, 2012). Research has indicated that co-creation provides a firm with new business insights, new sources of revenue and profit (Gouillart & Ramaswamy, 2010), a reduced risk of misinterpretation of customer needs and more creative ideas compared to traditional market research techniques (Poetz & Schreier, 2012; Witell et al., 2011; Füller et al., 2011). Therefore, an increasing number of firms organize co-creation sessions in which multiple customers are actively involved in the design and development of future offerings (Rasool et al., 2017). These co-creation sessions typically take place in offline contexts where brainstorming sessions are executed to encourage individuals or groups to generate creative solutions to a certain case (Mcfadzean, 2000).

In the first quarter of 2020, it suddenly became impossible to create offline sessions with groups of people. The COVID-19 pandemic forced people to work remotely due to the governmental restrictions that limited travel movements in order to prevent the transmission of the virus. The world adapted to these restrictions quickly by closing down offices and transferring all their communication to video conferencing services in order to stay connected and pursue daily business operations. At that moment, the work from home concept including telecommunication was not new, since digital transformation had been one of the most discussed topics of the past few years in business. It was said to provide benefits for both employees and employers by saving money on office and travel expenditures and by providing a better work-life balance. However, until the emergence of COVID-19, working from home was only used sporadically by companies and organizations (Savić, 2020). Within days of the outbreak of the virus, working from home became the new normal which resulted in an increasing use of online interaction channels and thereby an extensive increase in use of video conferencing services such as Zoom, Microsoft Teams and Skype. The number of Zoom users jumped 30-fold in the first month after the outbreak of the virus, with 300 million daily participants in virtual meetings at its peak (Reuters, 2020).

This new way of working did have a downside. As time went by, more and more employees experienced a certain mental fatigue as a result of the use of online communication services with all its communicative shortcomings. As the number of employees who started to experience this exhaustion increased, the phenomenon earned its own slang term called “Zoom fatigue” (Sklar, 2020). Zoom fatigue entails problems that people face as a result of excessive use of video conferencing tools such as Zoom, Google Meet, Skype, BlueJeans and Microsoft Teams (Lee, 2020).

According to researchers (Bailenson, 2021; Wiederhold, 2020), Zoom fatigue can be explained by the fact that computer-mediated-communication requires more cognitive load compared to a face-to-face chat, because nonverbal cues cannot be transferred naturally through screens. Consequently, individuals need to invest more cognitive activity to both send and receive nonverbal cues such as gestures or mimics (Bailenson, 2021). While video communication seems to be real time, there is actually a continuous delay between the performance of one participant and the ability for the other participants to observe it. Even though this delay is only a millisecond, the brain will continuously try to overcome this problem and restore synchronicity, which takes more effort and is therefore highly energy draining (Wiederhold, 2020). Furthermore, Zoom makes it impossible to distinguish mutual gaze between people. Especially when there are multiple people joining in a Zoom call, it is hard for one to notice who is making eye contact as people’s gaze are mainly directed to their camera and see multiple people at the same time. However, mutual gaze improves connection and increases likeability and attractiveness (Lee, 2020). Finally, the fact that participants look at their camera and see themselves in the meeting as well makes them highly aware of their own appearance. This continuous view of one’s own appearance is unnatural, distracting and very stressful (Bailenson, 2021).

As computer-mediated-communication is used to replace almost all face-to-face communication in times of the COVID-19 pandemic, these excessive periods of cognitive activity result in mental fatigue. Consequently, people are caught in a certain virtual haze which leads to difficulties in concentrating and focusing their attention to the meeting and the tasks they are required to perform (Boksem et al., 2005; Qi et al., 2019). Hence, today's workforce experiences less collaborate meetings, a reduced performance and a miserable experience for the participants (Fosslien & Duffy, 2020; Qi et al., 2019). Therefore, in the study at hand we define Zoom fatigue as: *The inconveniences people experience related to an unnatural way of communicating through video conference services compared to face-to-face conversations.*

The phenomenon of Zoom fatigue is relatively new as it has arisen only in March 2020. Despite it quickly became a topic of researchers' interest, still little literature is available on the details of the phenomenon. Although a growing number of researchers have investigated the underlying causes of Zoom fatigue, they have not looked at ways to combat it in order to increase engagement and performance during video conference calls.

1.1 Objective and research question

Zoom fatigue might especially be a problem for co-creation sessions which are designed to benefit from mutual cognitive stimulation. Co-creation sessions involve the process of sharing ideas among participants with the intention to generate new novel ideas that would not have come to one's mind without the group process. In these settings customer engagement and cognitive activity are crucial factors in order to achieve creative performance. Considering the importance of co-creation for firms and the fact that the use of online communication will most likely continue to a large extent, it is highly important to combat Zoom fatigue in order to improve the effectiveness of virtual co-creation sessions. Therefore, the study at hand aims to explore how to combat Zoom fatigue in order to facilitate creativity in a virtual co-creation setting.

In order to achieve the objective of this research, the current study aims to answer the following question: *'To what extent can the online environment be shaped and reinvented to mitigate the effect of Zoom fatigue thereby fostering Creative performance in online co-creation contexts?'* To answer this research question, the study at hand aims to increase our understanding of fostering creative performance in a virtual environment.

1.2 Practical and scientific relevance

The current study seeks to make a theoretical contribution to the literature of Zoom fatigue as this research contributes to better understanding the phenomenon of Zoom fatigue in relation to performance. Therefore, this study also contributes to the literature on virtual communication by focusing on improving the performance during video conference calls. Furthermore, this study

contributes to the literature on creativity in virtual contexts as it investigates how to improve creative performance during video conference calls.

The research at hand is of practical relevance as it might provide managers in the field of Business the knowledge on how to reduce fatigue during virtual meetings, thereby improving effectiveness and participant satisfaction. Finally, in the long run (after COVID-19), the study at hand might provide managers with solutions for a sustainable way to have online communications, thus reducing travel expenditures and promoting international cooperation co-creation sessions.

1.3 Thesis outline

This master thesis proceeds with the following structure. Chapter two contains a literature review of relevant theories followed by the hypothesis and the conceptual model. In the third chapter, the methodological design, procedure, measurement and research ethics which were used to answer the research question have been explained in detail. In chapter four the results of the quantitative analysis are presented. Chapter five provides a conclusion and an answer to the research question followed by practical and theoretical implications. The study closes with chapter six including a discussion, the limitations and recommendations for further research on the topic.

2. Literature review

This chapter contains an extensive review of the literature on creative performance. The chapter closes with a hypothesis and a conceptual model which provides a visual representation of the relevant concepts that are investigated within the study at hand.

2.1 Creativity

More and more firms desire to launch creative products or services in order to beat the competition. Hence, firms increasingly strive for creative input from within or outside the company. However, what is creative? Over the past 70 years, many studies have investigated the phenomenon of creativity. Nevertheless, there is still a lack of consensus on the exact definition as researchers in the scientific literature have defined creativity in many different ways. Guilford was one of the first researchers who argued that creativity can be studied scientifically (Runco & Jaeger, 2012). He defined creativity as “the abilities that are most characteristic of creative people” (Guilford, as cited in Runco & Jaeger, 2012, p. 94). According to his publication in 1950, a creative person should have the ability to generate novel and acceptable ideas. Although his work became very popular in the 1950s, it did not provide an unambiguous definition of creativity. According to Runco & Jaeger (2012), the first clear definition was written by Stein (as cited in Runco & Jaeger, 2012, p. 94) who defined creativity as “novel work that is accepted as tenable, useful or satisfying by a group in some point in time.” With these words he was the first to offer a standard definition. To this date, most researchers and theorists agree that creativity involves the development of a product, idea, or problem solution that is both novel (original) and valuable (appropriate and useful) (Hennessey & Amabile, 2010).

Hence, creativity involves two criteria. First of all, ideas, products or problem solutions need to be novel. Novelty implies the degree of originality which is the most valued attribute in products (Kristensson et al., 2004). According to Runco & Jaeger (2012), novelty is vital for a product or solution to be original and therefore creative. However, novelty by itself is not sufficient as highly original ideas can be very useless. Therefore, a second criterium of creativity is usefulness. Usefulness implies the extent to which a product is able to satisfy or solve a problem of specific interest to a person (Kristensson et al., 2004). In addition to these two widely acknowledged criteria, Kristensson et al., (2004) also mentions the criterium of realizability which entails the degree to which an idea can be transformed into a commercial product. Thus, in the study at hand creativity is defined as *“the ability to generate ideas, insights or problem solutions that are novel, valuable and realizable.”*

Many researchers have devoted effort in order to understand how creativity arises. According to Rhodes (1961), creativity consists of four aspects - *person, process, press* and *product* which are highly interrelated. His “4P-framework” has become the most influential framework to study the generation of creative ideas (Tang et al., 2017). According to Rhodes (1961), creativity research from

a *person* perspective focusses on understanding personality traits, characteristics or attributes of an individual that foster creativity. According to research, personality traits such as openness to experience (McCrae, 1987; van Tilburg et al., 2015) and curiosity (Titus, 2018) positively correlate with creativity. Studies focused on the creative *process* examine cognitive activities such as associative thinking and cognitive flexibility that are involved during the development of a product (Tang et al., 2017). Research on the *press* perspective focuses on the external environment and social conditions that will foster creativity (Tang et al., 2017). Hennessey & Amabile (2010) suggest that environments where people feel a certain degree of psychological safety contribute to the creative performance of individuals. When creativity is approached from a *product* perspective the focus lies on the idea, process or physical object that is created. The product is the final outcome that results from the creative process. The product approach is the most objective approach to creativity as it entails a tangible object which can be measured (Tang et al., 2017). Therefore, it is often used as a dependent variable in scientific studies. The other three variables can be derived from the final product: the person, the process and the press factors.

2.2 Creative performance

When thinking of creativity, people tend to imagine innovative pioneers such as Steve Jobs or Elon Musk who introduced products such as the Iphone, the Tesla electric car and the SpaceX Falcon rocket. Kaufman & Beghetto (2009), categorize this form of creativity *Big-C* creativity which consists of creative breakthroughs designed by genius inventors. However, creativity comes in multiple forms. According to the 4-C framework of Kaufman & Beghetto (2009), creative contributions can be categorized into four different levels (from mini-c to Big-C) of creative magnitude. In contrast to Big-C creativity, *little-c* creativity is more focused on the role creativity plays in everyday life such as workplace contexts where nonexperts participate in creative activities. In addition to these two generally accepted categories, Kaufman & Beghetto (2009) added mini-c creativity and pro-c creativity in order to create a more comprehensive model, that contained all kinds of creative activity. *Mini-c* creativity entails the individual interpretations of experiences, actions and insights which result in changes of understanding. Pro-c creativity entails the creative contributions of experts that do not yet make an impact of revolutionary level (Kaufman & Beghetto, 2009) The study at hand investigates creative performance in the category of *little-c* creativity by investigating co-creation sessions held with nonexperts.

Creative performance is the result of either individual or group effort. Individual creativity requires internal cognitive information processing which leads to individual solutions and ideas (Nijstad et al., 2002). Group creativity follows individual creativity as it starts with the process of sharing individual ideas and solutions. The benefit of sharing these individual ideas in the group is that these ideas can serve as new cues and therefore cognitive stimulation. Hence, group creativity is more

sensitive to contextual and group interaction as it is based on the different perspectives of the group members. However, a higher number of different perspectives increases the number of idea categories (Steinberg, 2007). Therefore, group creativity is much more than the sum of the creative output of its individuals (Paulus et al., 2012). Hence, the technique of group brainstorming is widely applied in organizations, as most people believe that group brainstorming is more effective than individual brainstorming (Nijstad & Stroebe, 2006).

However, according to research of Nijstad & Stroebe (2006), people generate more ideas when they work individually compared to when they work together as a group. This productivity loss is mainly caused by the phenomenon of ‘information blocking’ (Diehl & Stroebe, 1987; Nijstad & Stroebe, 2006). That is, group members have to wait until they get the floor to share their ideas with the other members of the group. This information blocking causes interruption of one’s cognitive flow. However, this drawback of group brainstorming only concerns the aspect of productivity. According to Simone M. Ritter & Mostert (2018), the problem of information blocking can be remedied by having participants participating in an individual idea session followed by group idea generation as their study revealed that generating ideas in a group after individual idea generation has a strong beneficial effect on the quality of the ideas generated. When individuals run out of ideas, it is group brainstorming that can boost novelty as reading others’ ideas can be very beneficial. Furthermore, group members are more satisfied with their performance compared to individuals who have brainstormed alone (Nijstad & Stroebe, 2006).

2.3 Creative process

A creative process is the underlying core of creative performance. The creative process is defined as: “a succession of thoughts and actions leading to original and appropriate production” (Botella et al., 2018, p.1). According to Wallas’ model of creativity, the creative process consists of four stages: *preparation*, *incubation*, *illumination*, and *verification* (Paulus et al., 2012). The creative process starts with *preparation*. During preparation, an individual defines the problem and tries to understand the problem. Subsequently, during the preparation stage, an individual starts gathering information in order to solve the problem at stake. The incubation stage allows an individual to take a step back from the problem and therefore allow the mind to wander and stay open to new ideas that come to one’s mind. During the incubation stage, it is best for an individual to perform a non-demanding task to let the mind ‘chew’ on the task. The ‘Aha!’ moment symbolizes the start of the illumination stage. This is the stage where an idea, an image or a solution arises. Finally, the process finishes with the verification stage where ideas are verified and analyzed (Botella et al., 2018).

According to the literature, the creative process requires two cognitive activities: divergent thinking followed by convergent thinking (Runco & Jaeger, 2012; Zhang et al., 2020). Divergent thinking is an unstructured cognitive process which is vital for idea generation (Hennessey & Amabile,

2010). Divergent thinking represents a style of thinking which is characterized by spontaneity, allowing a fluent flow of the mind in order to generate as many as possible novel ideas (Zhang et al., 2020). In order to generate original ideas, it is necessary for an individual to make cognitive connections between principles and elements that have not been connected before. Therefore, divergent thinking demands a certain flexibility of the mind. Although divergent thinking is vitally important as it gives rise to new and novel ideas, it is not sufficient. Novel ideas are not always valuable and realizable. Hence, literature has highlighted the need for an additional cognitive ability which is convergent thinking.

In contrast to divergent thinking, convergent thinking is a much more focused activity in which the generated ideas are analyzed extensively in order to choose the most suitable option (Hennessey & Amabile, 2010). Therefore, convergent thinking requires logic and reasoning. The main goal of convergent thinking after divergent thinking is to narrow down the choices and come to one single idea that is both valuable and realizable (Cropley, 2006). As divergent and convergent thinking seem to be opposites, they complement each other in the process of creativity.

Hence, both divergent thinking (generation of ideas) and convergent thinking (selection of ideas) contribute to a person's creative performance. However, the scope of the study at hand is limited to investigating the creative performance in terms of divergent thinking (idea generation) in online co-creation sessions. The study of Plukaard et al. (2015) proved that mental fatigue negatively affects cognitive flexibility and therefore hinders divergent thinking. Hence, it is especially of interest what can be done to spark cognitive flexibility in order to foster idea generation in online co-creation sessions.

2.4 Cognitive flexibility

An individual must have a certain degree of cognitive flexibility in order to exert divergent thinking. Cognitive flexibility, the ability to break old cognitive patterns and make novel associations between concepts, is regarded as the necessary cognitive core of creativity (Hennessey & Amabile, 2010). Mehta & Dahl (2019, p. 33) define cognitive flexibility as *“the ability to simultaneously consider issues from diverse perspectives and to shift avenues of thought while perceiving and processing incoming information.”* According to literature on cognitive science, this shifting of thought is rather difficult as individuals create paradigms which can limit one's thinking and perception (Turaga, 2018).

A paradigm is a point of view, frame of reference or a belief that is created by an accumulation of knowledge and experiences (Mcfadzean, 1999; Turaga, 2018). Based on these paradigms, individuals can explain what is going on around them. For example, two centuries ago nobody could have imagined that we would be able to communicate with everyone, everywhere, whenever we want to. It is hard to perceive a situation in any other way once a paradigm has been evolved (Mcfadzean, 2000). Hence, it is very hard to perceive communication any other way than verbally both in offline and online settings. However, in the future we might not even use verbal communication anymore or we somehow manage

to break the speed of light and be able to instantly travel to any meeting. Even though it is difficult to break cognitive patterns, researchers have investigated techniques to do so.

According to (Mcfadzean, 1999) the use of different forms of expression such as drawing, visioning and role-playing in combination with the use of forced association and unrelated stimuli are paradigm-breaking techniques which encourage cognitive flexibility. For example, participants can be asked to draw or vision objects such as the successful products of other companies which are then used as unrelated stimuli to encourage the development of new and novel ideas for the company at stake (Mcfadzean, 1999). Titus (2018), also states that the use of stimuli can break cognitive paradigms. However, he suggests that the use of unfamiliar stimuli in particular will provoke spontaneous divergent thought. Unfamiliar or novel stimuli create perceptual confusion that interrupts routine cognitive processing. According to (Titus, 2018), unfamiliar stimuli such as novel people, places, memories or artifacts are more difficult to recognize and thus require additional thought and effort to interpret (e.g., a group of people on a survival weekend become very creative in finding solutions for food and shelter).

Ritter et al. (2012) contributes to the techniques of using stimuli as they argue that highly unusual and unexpected stimuli enhance cognitive flexibility. Research has shown that individuals who have an immigrant status or have lived abroad are more creative compared to individuals who have not experienced these events (Maddux & Galinsky, 2009). According to Ritter et al. (2012), these events, which they define as '*diversifying experiences*', have in common that they are unusual and unexpected. Hence, they investigated whether highly unusual and unexpected experiences, other than the above-mentioned ones, can enhance creative thinking. Several of their studies revealed, that diversifying experiences have the ability to enhance cognitive flexibility (Ritter et al., 2012). Thus, as diversifying experiences are highly unexpected and therefore break one's cognitive pattern, they can push people out of the realm of normality (Ritter & Gocłowska, 2020) which is of specific interest for the research at hand.

2.5 Schema-violations

Individuals have the tendency to form expectations on what is to come in the future based on their cognitive framework (schema) which is in turn based on paradigms and previous experiences (Mendes et al., 2007). However, creativity requires to 'think out of the box' in order to search for new and creative solutions (Gocłowska et al., 2014). Hence, creativity is restrained when individuals generate ideas based on their old schemata. According to Ritter & Gocłowska (2020) one's schemata should be violated in order to bring an individual into a situation which is inconsistent with one's expectations. When diversifying experiences are inconsistent with someone's expectations they are called 'schema-violations' (Ritter & Gocłowska, 2020). When individuals are faced with a schema-violation they witness targets, objects, or actions that are in conflict with their schema. As schema-violations bring individuals in situations which are contradictive with their old schemata, individuals

have to search for new solutions while old solutions no longer apply to the new situation. Hence, schema-violations boost the potential for divergent thinking and, subsequently, creativity (Gocłowska et al., 2014).

According to Ritter & Gocłowska (2020), schema-violations can virtually arise in any situation as there are different techniques to violate one's schema. An example of a smaller and thus relatively weaker violation is the use of contradictory or paradoxical statements. Research has proven that reading or writing down these inconsistent descriptions (e.g., social media is far from being social) fosters creative thought. Another, stronger, type of schema-violation that fosters creative thought are counter-stereotypes. Research (Gocłowska et al., 2013) has shown that listing counter-stereotypes (e.g., granny influencers) or looking at pictures of individuals situated in an unexpected environment (e.g., a priest in front of a mosque) decreases the extent to which individuals recall on easily accessible stereotypic information and therefore improves creative thinking. Finally, the strongest technique is violating one's schema in real-life settings (e.g., prepare a sandwich in an unusual way). Research has proven that actively participating in a schema-violation such as preparing a sandwich in an unusual way increases cognitive flexibility more than vicariously watching a schema-violation (S. Ritter et al., 2012). Even though these techniques are all very different, they do have in common that people experience something which is inconsistent with their expectations.

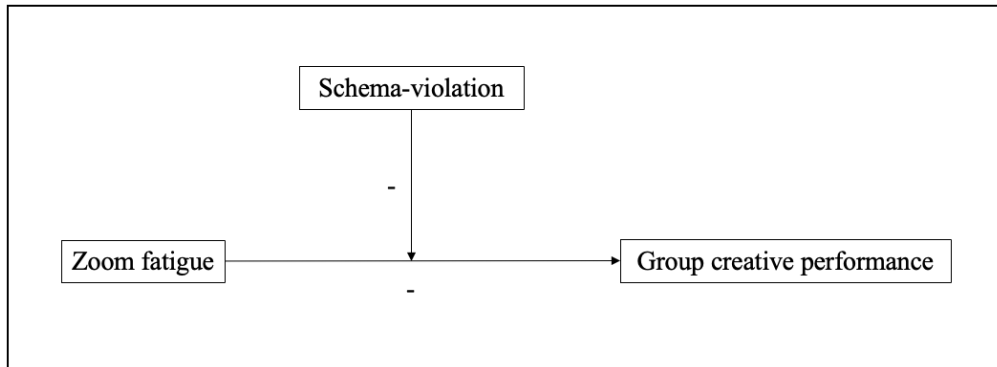
The use of schema-violations is of special interest to the context of this study as it not only fosters creative thought but also has the potential to surprise an individual by interrupting an on-going activity (Gocłowska et al., 2017) and therefore taking an individual out of its usual habitat. This activation of the cognition might also make people more present, active and creative and therefore more collaborative in an online setting. Hence, it is hypothesized that the cognitive interruption caused by a schema-violation decreases the negative effect of Zoom fatigue on Group creative performance in an online co-creation session.

H1: A schema-violating stimulus has a moderating effect of Zoom fatigue on Group creative performance in an online co-creation context.

2.6 Conceptual model

The literature review that has been extensively outlined above results in the following conceptual model. According to this model, it is expected that a schema-violation would reduce the negative effect of Zoom fatigue on Group creative performance. This model is leading in chapter three where the methodological design is outlined.

Figure 1
Conceptual Model



3. Methodology

In the previous chapter the hypothesis and the following conceptual model were presented. To test for this hypothesis an empirical research has been performed. This chapter includes the experimental design, the procedure and the measurement that was used to perform during the research.

3.1 Participants

Seventy-five participants (49 female, $M_{\text{age}} = 23.20$ years, $SD = 2.34$) participated in the study. These participants all met the predefined selection criteria of attending MBO, HBO or WO education at the moment they registered to participate, had a computer/laptop with a working camera and microphone and were available to participate during one of the predefined days. Participants were recruited for voluntary participation via the network of Caroline Hezemans, Amy Voogt and Noortje Nijskens. The message that was used to recruit participants has been included in Appendix F. Participants were able to register by e-mailing their name and their preferred time and day to a specific e-mail address. Subsequently, each participant received a confirmation regarding the date, time and the Zoom link to the session at stake. All participants have given written informed consent to be recorded during the whole Zoom session. Due to a very limited budget, participants were not compensated for their participation. However, they were offered to win one of the three Bol.com gift cards of 20 Euro. For more details concerning participant's characteristics, see Table 1.

Table 1
Group Descriptive statistics: Age, Gender and Level of education

Measure	Control group (N = 38)	Treatment group (N = 37)
Age		
<i>M</i>	22.97	23.43
<i>SD</i>	2.871	1.625
Gender		
<i>Male</i>	13	13
<i>Female</i>	25	24
Level of education		
<i>MBO</i>	0	1
<i>HBO</i>	23	9
<i>WO / University</i>	15	27

3.2 Research Design

Participants were either assigned to the control group ($N = 38$) or the treatment group ($N = 37$). In each group, participants were divided into smaller groups of four to five participants to perform the co-creation session. Consequently, the experiment consisted of sixteen co-creation sessions. Participants were assigned to a certain group according to their availability. Thereafter, eight groups

were randomly assigned to the treatment group. Each participant experienced the experimental procedure only once.

Each co-creation session had a duration of approximately 50-60 minutes and was hosted by either Caroline Hezemans, Noortje Nijskens or Amy Voogt, according to a predefined script, see Appendix D. All sessions took place in the last week of April and the first week of May 2021 using the online platform 'Zoom'. This platform was chosen since most people had become very familiar with this tool as a result of COVID-19. During the session, the participants were asked to perform a creative task in order to measure their divergent thinking skills. As soon as the creative task was finished, participants were asked to complete a predefined survey where the variable 'Zoom fatigue' and the control variables were measured. The total co-creation session consisted of a 5-minute introduction, a 10-minute individual idea generation task followed by a 3-minute individual selection task, a 20-minute group idea generation task followed by a 10-minute group idea selection task and a 10-minute data collection. Zoom fatigue was only measured after the session which means that the data set will not contain a baseline of fatigue. This consideration has been made to avoid people to behave differently as they might assume what the session is about.

The treatment groups have received a manipulation at the start of the group idea generation part of the session until the data collection. As the manipulation was ought to be schema-violating, it was chosen to add another participant (alpaca) to the online Zoom environment. It was assumed that none of the participants would expect an animal to join a Zoom meeting and therefore would have a schema-violating effect. Hence, the treatment group had another participant named 'Tom and friends' joining their co-creation session. The alpaca tuned in approximately 20 minutes after the start of the session because people might start to feel Zoom fatigue and started to zone out at that moment. It was expected that at that moment, the alpaca could really facilitate that boosting effect. The alpaca footage contained multiple alpacas that were recorded at a farm in Vorstenbosch. The footage was edited into a small video with the duration of 8 minutes and was continuously looped. The video contained a variety of (close-up) footage of the alpacas eating, pooping, laying and simply walking in order to increase the schema-violating effect. The Alpaca footage was added to the Zoom meeting as a background video filter. Questions regarding the alpacas were answered after the session. The movie did not include sound as the study at hand only tests for visual stimuli.

Tools that were used during the co-creation session were: the video conference service Zoom, a paper with a pencil for writing down ideas, a mobile phone for sending the ideas to the host and Qualtrics in order to conduct the survey. It has been chosen to use paper and a pencil over an online tool for writing down ideas. The reason behind this decision is the fact that in this way, people won't lose sight of the Zoom meeting interface and therefore increases the chance of Zoom fatigue to kick in.

3.3 Procedure

Participants were directed to an online waiting room. Once all participants had arrived, they were accessed to the Zoom meeting where the study took place. In the Zoom meeting, the host introduced herself briefly and informed the participants of how the study would be conducted. After the introduction of the participants, the host instructed the participants regarding the required Zoom settings. Once all participants had successfully adjusted the settings, the host explained the task. After each instruction, the host asked the participants if they had any questions. The task description was also sent into the group session chat in order for the participants to have a look at the requirements again.

Following, the participants started the individual idea generation of 10 minutes where they were instructed to write down as many novel ideas in accordance with the task criteria as possible on the piece of paper in front of them. Thereafter, they were asked to individually select and rank their three best ideas. Next, the host instructed the participants on the following 20-minute session which consisted of group brainstorming; sharing individual generated ideas in order to generate new ideas together. The host asked the group to assign one team leader to write down all ideas that were mentioned in these 20 minutes.

After the group brainstorm, participants were asked to make another selection of their top three together. When the group selection task had finished, participants were asked to send a photo of their ideas to a specific e-mail address. Subsequently, they were asked to fill out a quick Qualtrics survey (see Appendix E) whereafter they were able to leave the Zoom session or to ask any remaining questions.

3.4 Measurement

The study at hand measures ‘Group creative performance’ and ‘Zoom fatigue’. This section provides a detailed explanation of the measurement scale which was used in this research.

3.4.1 Creativity measures

The current study aims to measure the dependent variable ‘Group creative performance’ focusing on divergent thinking. According to the literature (Hennessey & Amabile, 2010; Runco & Acar, 2012), divergent thinking can be measured by three dimensions – *fluency*, *flexibility* and *originality*. These three dimensions appear in nearly every published research on creativity and are commonly used in divergent thinking measures such as the Alternative Uses Task and the Torrance Test of Creative Thinking. *Fluency* is defined as generating as many ideas, options, or solutions as possible with the argument that the more ideas, the greater the chance that the best idea will be unveiled (Steinberg, 2007). *Flexibility* is the capacity to consider a variety of approaches to a problem simultaneously which can be measured by the number of distinct semantic categories that a group can

access (Rietzschel et al., 2007). *Originality* is one of the defining characteristics of creative behavior which represents the generation of rare ideas (Rietzschel et al., 2007).

The study at hand measured divergent thinking on the basis of the co-creation task using the three widely accepted dimensions of *fluency*, *flexibility* and *originality*. Divergent thinking scores were measured both during the individual brainstorm session as well as during the group brainstorm session. The creativity scores that were measured during the individual brainstorm session were used as a baseline measurement of creativity. The group creative performance scores are based on all the ideas that were mentioned by the participants in the 20 minutes of group brainstorm. To check whether the group leader wrote down all the ideas that were mentioned, each and every list has been verified using the recordings. *Fluency* scores were obtained by counting the absolute number of generated ideas by the group that met the requirements. Ideas that did not meet the requirements and identical duplicates were removed. *Flexibility* scores were obtained by assigning the ideas into predefined categories (Appendix B), followed by counting the number of distinct semantic categories that a group had accessed. *Originality* scores were obtained in the following way: if an idea was not mentioned by another group the idea scored 2 points. If an idea was mentioned by only one other group, the idea scored 1 point. If the idea was mentioned by two or more groups, the idea scored a 0. For the individual creativity, originality scores were obtained in the following way: ideas that were mentioned by no other individual scored 2 points, ideas that were mentioned by less than 5% of the other individuals scored 1 point, all the other ideas scored 0 points. The final scores on fluency, flexibility and originality of all the groups were ranked and divided into quantiles of 25% forming a low group (1), medium-low group (2), medium-high group (3) and a high group (4). The sum of these scores on flexibility, fluency and creativity was used as the final score of Group creative performance.

3.4.2 Zoom fatigue measures

As Zoom fatigue is a new phenomenon, it has not been measured frequently in previous studies. The study at hand defines Zoom fatigue as: *The inconveniences people experience related to an unnatural way of communicating through video conference services compared to face-to-face conversations*. According to the literature Zoom fatigue entails inconveniences regarding verbal communication, the lack of mutual gaze, the strong awareness of one's own appearance and the feeling of not being able to contribute much. A recently published study of Fauville et al. (2021), suggests that Zoom fatigue consists of five dimensions of fatigue: *general*, *social*, *emotional*, *visual* and *motivational*. However, this scale does not optimally represent the construct as it is defined in the study at hand. Hence, a new scale has been operationalized to measure the construct of Zoom fatigue using the reviewed literature, see Appendix A. The Drained feeling dimensions and the Motivational fatigue items were taken from the Zoom fatigue scale of Fauville et al. (2012). The other dimensions are derived

from the literature discussed in Chapter 2. The fatigue items were measured on a 7-point Likert scale ranging from: Strongly disagree – Strongly agree.

After data collection, the construct validity of the measurement scale was tested using an Exploratory Factor Analysis (EFA) and the reliability was tested through Cronbach's alpha. The EFA returned a Kaiser-Meyer-Olkin (KMO) value of .717 and a Bartlett's test of sphericity ($\chi^2 = 511.127$, $Df = 105$; $p \leq .001$) which demonstrated that the data were adequate for the factor analysis. The Varimax rotation method was employed for a factor through commonality analysis which reduced the original 6 factors into 5 factors (Communicational effort, Productivity, Drained feeling, Reduced motivation and Awareness of expression). Out of the 17 initial items, 2 items were removed due to their cross-factor loading. All items presented commonalities higher than 0.5. In order to assess construct validity, Pearson's correlation was employed (see Table 2 for the bivariate correlations).

Table 2
Bivariate Correlation between factors of Zoom fatigue

	1.	2.	3.	4.	5.
1. Communicational effort					
2. Productivity	.047				
3. Drained feeling	.325**	.133			
4. Reduced motivation	.551**	.688	.377**		
5. Facial expression	.284*	-.102	.362**	.233*	

Note. ** $p < .001$ (two-tailed), * $p < .05$ (two-tailed)

The Pearson correlation indicates that factor 2 does not correlate with the other factors. Hence, factor 2 is not a valid representation of Zoom fatigue and therefore was excluded from the analysis. Finally, The Cronbach's alphas were calculated for each of the four remaining constructs of fatigue. The reliability for each construct was above .7 which indicated acceptable reliability, see Table 3. The average scores on all constructs were summed and then divided by four to come to a final Zoom fatigue group score per participant. These individual scores were ranked and divided into quantiles of 33% forming a low, medium and a high fatigue group. These quantiles are somewhat variable to optimize the spread of participants in each category trying to stay as close to that 33% as possible.

3.4.3 Control variables

The study at hand controls for the Number of participants, the Time of day the session took place, Gender, Group dynamic, Direction of education and the Number of minutes one has participated in a meeting before. The sessions took place in the morning, the afternoon and the evening which were respectively coded. The variable 'Group dynamic' is calculated using the amount of people who know each other within a group, on a scale of 1 to 4. Number of minutes a participant had participated in a

meeting before was included to provide an approximation of the baseline of Zoom fatigue as much as possible.

To make a subsequent comparison on the group creative performance, the study at hand controlled for preexisting individual differences in creativity using the Individual creative performance as a baseline comparison. An Independent-Samples T-test revealed that the treatment group ($M = 8.54$, $SD = 3.88$) compared to the control group ($M = 8.03$, $SD = 3.77$) scored not significantly different on Individual creativity, $t(73) = .126$, $p = 0.562$. See appendix C for more details regarding the T-test. Hence, a subsequent comparison of the group creativity between the control group and the treatment group is reliable.

Table 3
Factor Loadings and Cronbach Reliability of the Zoom fatigue scale

Construct	Items	Loading	α
Communicational effort	It took me more effort to respond to others compared to a face-to-face conversation.	.541	.800
	It was difficult for me to make eye contact with others in the Zoom session	.673	
	Trying to make eye contact with the other participants was tiresome.	.637	
	Trying to make eye contact to the other participants resulted in me being less focused.	.734	
	Seeing my own camera window resulted in me being less focused.	.507	
Drained feeling	Compared to before this Zoom session, I currently feel more emotionally tired.	.717	.896
	Compared to before this Zoom session, I currently feel more exhausted.	.781	
	Compared to before this Zoom session, I currently feel more mentally tired.	.946	
Awareness of own expression	I was aware of my own facial expressions during the Zoom session.	.789	.746
	I often looked at my own camera window during the session.	.758	
Reduced Motivation	I dread having to do other things after this Zoom session.	.732	.754
	I feel like doing nothing after this Zoom session.	.760	
	I feel too tired to do other things after this Zoom session.	.529	

3.5 Statistical model

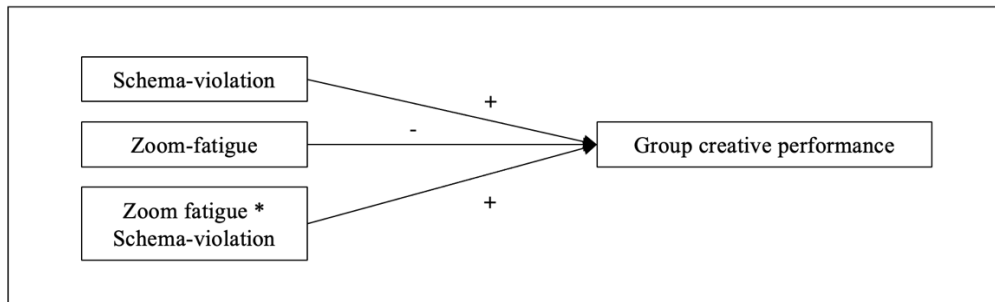
Originating from the reviewed literature in chapter 2, it is assumed that there is a negative main effect of Zoom fatigue on creative performance. Furthermore, according to previous research on schema-violation it is assumed that there is a positive effect of a schema-violation and one's creative

performance. The study at hand specifically tests whether there is an interaction effect resulting from the schema-violating stimulus and one's fatigue level. Expected is that, for groups that received the schema-violating stimulus the Zoom fatigue has a less negative impact on the Group creative performance compared to groups that did not receive the schema-violating stimulus, controlling for Gender, Direction of education, Group dynamic, Time of day, Number of participants and Previous minutes in a zoom meeting. This results in the following statistical model with the corresponding hypothesis:

H0: The interaction effect of a schema-violation on Zoom fatigue has no significant influence on Group creative performance ($\beta = 0$).

H1: The interaction effect of a schema-violation on Zoom fatigue has a significant positive effect on Group creative performance ($\beta > 0$).

Figure 2
Statistical model



Two statistical methods were performed in order to test the hypothesis. In the first place, an ANCOVA (GLM) was performed in order to compare the mean scores on Group creative performance between the treatment group and the control group including the interaction effect. An ANCOVA is a suitable technique to test for statistically significant differences of a model which includes an interaction effect. Second, a Bivariate Linear Regression was performed to test the robustness of the ANCOVA results.

3.6 Research ethics

During all stages of this master thesis research, the ethical principles of the University's code of academic integrity were followed (Appendix G). All respondents participated on a voluntary basis and were never forced to participate. As this research included participants from outside the research project, it was important to protect and respect the participants' privacy. Hence, all participants were informed about the fact that they would be recorded during the entire session and that the survey was not anonymous. The participants were also told that their data were handled with the utmost care and would be destroyed once the research had been completed.

4. Results

This chapter provides an extensive analysis of the collected data. The chapter includes descriptive statistics and multiple statistical analyses among which an ANCOVA and a Bivariate Linear Regression.

4.1 Data

An analysis of the data revealed that overall participants experienced the co-creation sessions as pleasant, interesting, challenging and somewhat educational as can be seen in Table 4. A significant difference between the control group and the treatment group was found in the extent to which participants experienced the session as challenging and educational. This indicates that participants who received the stimulus ($\mu = 4.73$, $SD = 1.305$) compared to the participants who did not receive the stimulus ($\mu = 5.42$, $SD = 1.407$) experienced the session significantly less challenging $t(73) = 2.2$, $p = .031$. Furthermore, this indicates that participants who received the stimulus ($\mu = 3.84$, $SD = 1.519$) compared to the participants that did not receive the stimulus ($\mu = 4.58$, $SD = 1.130$) experienced the session significantly less educational $t(73) = 2.4$, $p = .019$.

Table 4

Descriptive statistics experience session

Stimulus		Educational	Interesting	Challenging	Pleasant
No (N=38)	Mean	4.58	5.45	5.42	6.03
	Std. Deviation	1.130	1.179	1.407	.753
Yes (N=37)	Mean	3.84	5.46	4.73	6.14
	Std. Deviation	1.519	1.169	1.305	.713

Note. Likert Scale 1-7

Overall, participants in the treatment group indicated to be highly amazed by the participation of the animals and frequently gazed at the animals during the session. However, the majority of the treatment group somewhat disagreed to the statement that the stimulus made the session more interesting or made it easier to think ‘out of the box’. Finally, the participants were neutral about the stimulus making the session more interesting.

Table 5

Descriptive statistics experience stimulus

	Amazed	Often watched	Interesting	Shocking	Out of the box
Mean	5.72	4.97	3.92	3.22	3.46
Median	6	5	3	3	3
Mode	7	6	3	2	4
Std. Deviation	1.427	1.691	1.656	1.601	1.406

Note. N = 37, Likert Scale 1-7

4.1.1 Group creative performance

The mean scores per dimension of Group creative performance are displayed in Table 6. For each group these scores were divided into four quantiles and then summed to form the Group creative performance (GCP) score which was used in further analyses. The treatment group scored slightly different on the three dimensions of creativity compared to the control group. However, these differences are very minimal.

Table 6
Descriptive statistics of Group Creative Performance

Stimulus		Fluency	Flexibility	Originality	Creative performance
No (N=37)	Mean	19.68	13.58	13.45	7.21
	Minimum	12	9	2	3
	Maximum	35	19	28	12
	Std. Deviation	6.897	2.974	7.157	3.015
Yes (N=38)	Mean	20.68	12.89	12.73	7.29
	Minimum	13	10	3	3
	Maximum	31	19	22	12
	Std. Deviation	6.377	3.098	6.072	3.398

4.1.2 Zoom fatigue

Table 7 displays the results on both the factors of Zoom fatigue as well as the overall experienced Zoom fatigue. The factors consist of multiple items and were therefore averaged to obtain these descriptive statistics. The awareness of one's own expression ($\mu = 5.12$) and the effort it took to communicate ($\mu = 4.02$) were scored relatively high compared to the extent that one felt a reduced motivation ($\mu = 2.87$) and a drained feeling ($\mu = 2.87$). The overall score on Zoom fatigue was relatively low ($\mu = 3.71$) on a Likert scale of 1 to 7.

Table 7
Descriptive statistics Zoom fatigue

	Communicational Effort	Reduced motivation	Drained feeling	Awareness expression	Zoom fatigue
Mean	4.02	2.87	2.87	5.12	3.71
Median	4.3	2.67	2.67	5.5	3.78
Mode	4.8	2	2	6	2.46
Std. Deviation	1.260	1.322	1.290	1.191	.909

Note. $N = 75$, Likert scale 1-7

4.2 ANCOVA

To formally test whether there is an interaction effect between Zoom fatigue and the stimulus on GCP, an ANCOVA analysis was performed. First, the main analysis was performed including the

variable ‘Zoom fatigue’ consisting of four factors as the independent variable. Thereafter, further analyses were performed using the relatively high scored factors: ‘Awareness of one’s own expression’ and ‘Communicational effort’ as independent variables. Before running the analyses, standard checks were performed to check whether the assumptions of normality, independence of errors, independent scores and homogeneity of variance were adhered to. No violations were found regarding the normality of distributions, Levene’s test of each ANCOVA indicated equal variances and the errors were independent. For more details concerning these assumptions, see Appendix C.

4.2.1 Main analysis

First, the main analysis was performed using the overall Zoom fatigue variable (four factors) as an independent variable. The descriptive statistics that followed from the main analysis are displayed in Table 8. These statistics indicate that the GCP in the stimulus condition increased as participants experienced relatively high Zoom fatigue (delta 1.35). In contrast, the GCP in the no-stimulus condition decreased when participants experienced relatively high Zoom fatigue (delta -1.12). Furthermore, participants who experienced relatively low Zoom fatigue have a higher creative performance when they are not exposed to the stimulus compared to when they experienced relatively low Zoom fatigue and were exposed to the stimulus. Standard deviations are relatively high compared to the differences in means. Further analysis of the data investigated whether these differences in means were significant.

Table 8
Descriptive statistics

Fatigue		Stimulus	No stimulus	ΔD	Total
Low	Mean	6.80	7.87		7.44
	Std. Deviation	4.050	2.503		3.176
	N	10	15		25
High	Mean	8.15	6.75		7.48
	Std. Deviation	3.105	3.166		3.151
	N	13	12		25
Delta		1.35	-1.12	2.47	.04

Note. Dependent variable = Group creativity

An ANCOVA analysis was performed, taking the control variables into account. The ANCOVA revealed no significant interaction effect ($p = .342$) as well as no significant main effects of the stimulus ($p = .938$) and the Zoom fatigue ($p = .842$) at the 5% statistical level. Estimates of the effects are represented in Table 9. Hence, it cannot be stated that the effect of Zoom fatigue on GCP was significantly different in the stimulus condition compared to the no-stimulus condition.

Table 9
ANCOVA Main Analysis of Group Creativity Scores

	Factor	df	Mean square	F	Partial eta squared
1	<i>Between-subjects effects</i>				
	Stimulus	1	.044	.006	.000
	Zoom fatigue	1	.292	.040	.001
	Stimulus x Zoom fatigue	1	6.728	.930	.028

Note. $N = 50$. * $p < .05$

4.2.2 Further analyses

Subsequent analyses were performed to gain more insight into the two relatively high scoring factors of Zoom fatigue. Hence, a new variable (Zoom fatigue 2) was computed which included the average scores of the factors ‘Communicational effort’ and ‘Awareness of own expression’.

Table 10
Descriptive Statistics

			Stimulus	No Stimulus	ΔD	Total
Zoom fatigue 2	Low	Mean	7.10	8.33		7.84
		Std. Deviation	3.604	2.582		3.023
		N	10	15		25
	High	Mean	8.75	5.54		7.08
		Std. Deviation	3.279	3.205		3.570
		N	12	13		25
Delta			1.65	-2.79	4.44	-0.76
Communicational Effort	Low	Mean	7.17	8.30		7.68
		Std. Deviation	3.786	2.751		3.33
		N	12	10		22
	High	Mean	9.08	7.73		8.33
		Std. Deviation	3.45	2.939		3.19
		N	12	15		27
Delta			1.91	-.57	2.48	.65
Awareness expression	Low	Mean	5.75	8.08		7.19
		Std. Deviation	3.240	2.139		2.786
		N	8	13		21
	High	Mean	7.68	6.22		7.21
		Std. Deviation	3.215	4.024		3.489
		N	19	9		28
Delta			1.93	-1.86	3.79	.02

Note. Dependent variable = Group creative performance

The descriptive statistics as displayed in Table 10 indicate similar tendencies compared to the main analysis. GCP increases (delta = 1.65) for participants who experienced relatively high Zoom fatigue 2 compared to participants who experienced relatively low Zoom fatigue 2 in the stimulus condition. GCP decreases (delta = -2.79) for participants who experienced relatively high Zoom fatigue 2 compared to

participants who experienced relatively low Zoom fatigue 2 in the no-stimulus condition. GCP remains the lowest for participants in the stimulus condition who experienced relatively low Zoom fatigue 2. However, the differences between low and high Zoom fatigue 2 in both conditions increased compared to the main analysis and the delta of the deltas relatively increased for Zoom fatigue 2 ($\Delta D = 4.44$) compared to Zoom fatigue ($\Delta D = 2.47$). Further analysis of the data investigated whether this difference resulted in significant effects, taking the control variables into account. The ANCOVA revealed a drastic improvement for the interaction effect, though not significant at the 5% statistical level ($p = .073$). Furthermore, the direct effects of Zoom fatigue 2 ($p = .154$) and the stimulus ($p = .262$) were nonsignificant at the 5% statistical. Estimates of the effects are represented in Table 11. This indicates that the effect of Zoom fatigue 2 on GCP was not significantly different in the stimulus condition compared to the non-stimulus condition.

Table 11
ANCOVA Further Analyses of Group Creativity Scores

	Factor	<i>df</i>	Mean square	<i>F</i>	Partial eta squared
<i>Between-subjects effects</i>					
2	Stimulus	1	12.526	1.302	.038
	Zoom fatigue 2	1	20.532	2.134	.061
	Stimulus x Zoom fatigue 2	1	32.961	3.425	.094
3	Stimulus	1	.779	.082	.002
	Communicational effort	1	4.164	.441	.013
	Stimulus x Communicational effort	1	5.574	.590	.018
4	Stimulus	1	5.124	.674	.021
	Awareness of expression	1	2.342	.308	.010
	Stimulus x Awareness of expression	1	31.880	4.195*	.119

Note. $N=50$, * $p < .05$

As diving deeper into the factors that construct the Zoom fatigue factor proves its value, it is also interesting to look at the two factors that construct the 'Zoom fatigue 2' variable separately. Hence, two separate ANCOVA analyses were performed with the factors 'Communicational effort' and 'Awareness of expression'. The descriptive statistics revealed similar tendencies as previous analyses and a relatively high ΔD (3.79) for Awareness of own expression.

For the factor 'Communicational effort', the ANCOVA analysis revealed no significant interaction effect ($p = .448$) as well as no significant direct effect of the stimulus ($p = .776$) and Communicational effort ($p = .511$) at the 5% statistical level. Hence, no significant different effects of Communicational effort on Group creative performance were found for the stimulus condition compared to the no stimulus condition. However, for the factor 'Awareness of expression' the ANCOVA analysis revealed a significant interaction effect at the 5% statistical level ($p = .049$). This indicates that the effect of high Awareness of expression on GCP in the stimulus condition was

significantly different compared to the effect of high Awareness of expression on GCP in the no-stimulus condition. The Post hoc test reveals a significant more positive effect of high Awareness of expression on GCP in the stimulus condition compared to the effect of high Awareness of expression on GCP in the no-stimulus condition. According to Table 12, the confidence interval of participants with high Awareness of expression in the stimulus condition overlaps the confidence interval of the participants with high Awareness of expression in the no-stimulus condition. It can therefore not be stated that the GCP of participants in the stimulus condition who have relatively high Awareness of their own expression during the session is significantly higher than that of participants who have a relatively high Awareness of expression in the no-stimulus condition. The interaction explains 11.9 percent of the variance in the dependent variable which is not quite high but reasonable.

Table 12

*Estimated Marginal Means of the Awareness of Expression * Stimulus*

Stimulus	Awareness of Expression	Mean	Std. Error	95% Confidence interval	
				Lower Bound	Upper Bound
No	Low	7.80	.840	6.089	9.514
	High	5.13	1.157	2.772	7.493
Yes	Low	6.53	1.135	4.219	8.848
	High	8.06	.731	6.567	9.551

Note. Dependent variable = Group creative performance, Control variables included.

4.3 Bivariate Linear Regression

To check the robustness of the results of the ANCOVA, a Bivariate Linear Regression was performed. The data adhered to the assumptions of linearity, constant variance of residuals, independency of residuals and normality of residuals, see appendix C. The data showed no multicollinearity ($VIF > 1$).

4.3.1 Main Analysis

In line with the ANCOVA, the Bivariate Linear Regression reveals a positive estimate of the interaction effect, indicating that the effect of Zoom fatigue on GCP was more positive in the stimulus condition compared to the no-stimulus condition. However, the Linear Regression revealed that this parameter was nonsignificant on the 5% statistical level ($p = .342$), which does not allow the rejection of the null hypothesis, see Table 13.

The effect of both the stimulus and Zoom fatigue are negative, this indicates that adding a stimulus in the form of an alpaca leads to a lower predicted GCP. Furthermore, participants with a relative high score of Zoom fatigue have a lower predicted GCP compared to participants with a relative low score of Zoom fatigue. The direct effect of both the stimulus ($p = .494$) and Zoom fatigue ($p =$

.557) are, however, nonsignificant at the 5% statistical level. The control variables capture distortion in the data, which significantly improves the model.

Table 13
Linear Regression Main Analysis of Group creative performance

Model		B	Std. error	VIF
1.	Constant	7.363*	.736	
	Stimulus	.193	.031	1.015
	Zoom fatigue	.017	.003	1.015
2.	Constant	7.867*	.818	
	Stimulus	-1.067	1.293	2.070
	Zoom fatigue	-1.117	1.226	1.875
	Moderator	2.471	1.811	3.145
3.	Constant	9.608	5.547	
	Stimulus	-.970	1.402	2.644
	Zoom fatigue	-.725	1.221	1.938
	Moderator	1.794	1.860	3.547
	Control variables			Yes

Note. $N = 50$. * $p < 0.5$

Table 14 indicates that the overall fit of the model increases as the model expands with the interaction effect and control variables. The highest value (0.263) of the adjusted determination coefficient is seen in model 3 with a significant F change ($p = .027$). Hence, 26.3 percent of the variance of the GCP is described by the variables included in model 3.

Table 14
Statistics of Model fit: Adjusted R square and F change

Model	Adjusted R square	Sign. F change
1	-.042	.977
2	-.023	.179
3	.263	.027*

Note. $N = 50$. * $p < 0.5$

4.3.2 Further analyses

The Linear Regression reveals an almost significant positive estimate of the interaction effect ($p = .073$) for Zoom fatigue 2, indicating that the effect of Zoom fatigue 2 on GCP was almost significantly more positive in the stimulus condition compared to the non-stimulus condition. These findings are in line with the ANCOVA analysis. Meanwhile, a significant negative direct effect of Zoom fatigue 2 was found ($p = .023$), indicating that participants who experienced relatively high Zoom fatigue 2 scored significantly lower on GCP compared to groups who experienced relatively low Zoom fatigue 2. The direct negative effect of the stimulus remained nonsignificant at the 5% statistical level ($p = .664$).

In line with the ANCOVA, no significant interaction effect ($p = .414$) as well as no significant direct effect of the stimulus ($p = .470$) and the factor ‘Communicational effort’ ($p = .810$) were found at the 5% statistical level. However, the tendencies of the factor ‘Communication effort’ are similar to the previous models. On the contrary, a significant positive interaction effect ($p = .048$) was found for the factor ‘Awareness of expression’ at the 5% statistical level. This indicates that the effect of high Awareness of expression on GCP in the stimulus condition was significantly more positive compared to the effect of high Awareness of expression on GCP in the no-stimulus condition. These findings are in line with the ANCOVA analysis.

The negative main effects of the stimulus ($p = .339$) and the factor ‘Awareness of expression’ ($p = .079$) were nonsignificant at the 5% statistical level. See Table 15 for the estimates of the effects.

Table 15

Linear Regression Further Analysis of Group creative performance

Zoom fatigue 2		B	Std. error	VIF	Adjusted R square
N = 50	Constant	11.817	6.816		.404
	Stimulus	-.718	1.542	3.043	
	Zoom fatigue 2	-3.660*	1.536	3.065	
	Moderator	3.919	2.117	4.249	
	Control variables			Yes	
Communicational effort					
N = 49	Constant	9.335	6.641		.382
	Stimulus	-1.246	1.704	3.594	
	Communicational effort	-.370	1.526	2.862	
	Moderator	1.827	2.206	4.517	
	Control variables			Yes	
Awareness of expression					
N = 49	Constant	3.361	5.216		.241
	Stimulus	-1.473	1.516	3.476	
	Awareness of expression	-2.841	1.564	3.653	
	Moderator	4.420*	2.149	6.787	
	Control variables			Yes	

Note. * $p < 0.05$

5. Conclusion

The aim of the study at hand was to investigate what can be done to improve video conference calls in order to mitigate the new phenomenon of Zoom fatigue, thereby fostering creative performance. Hence, the following research question was formulated: *'To what extent can the online environment be shaped and reinvented to mitigate the effect of Zoom fatigue, thereby fostering creative performance in online co-creation contexts?'*. In order to answer this research question, a detailed literature study on the phenomenon of creativity was performed. Based upon the literature study, it was hypothesized that a schema-violating stimulus could have a moderating effect on the relationship of Zoom fatigue on Group creative performance, specifically Group divergent thinking, in an online co-creation context. The schema-violation theory has its foundation in the field of psychology where several scientists proved that schema-violations have the ability to disturb one's cognitive structures and therefore improves one's cognitive flexibility.

The hypothesis was tested by performing a field experiment that consisted of sixteen online co-creation sessions of which eight included a schema-violating stimulus, an Alpaca joining the session. In total, 75 students participated in the study of which 37 participants were assigned to the treatment group. The treatment group was faced with the alpaca which joined the meeting as an extra participant after 20 minutes from the start of the session. During the experiments, Group creative performance was measured by a mutual brainstorm task after which a survey was used to measure ones experienced Zoom fatigue during the session.

Extensive quantitative data analysis which consisted of both an ANCOVA as well as a Bivariate Linear Regression revealed a positive interaction effect of the schema-violation and the Zoom fatigue on Group creative performance, indicating that the effect of Zoom fatigue on GCP was significantly different in the stimulus condition compared to the no-stimulus condition. This follows the rationale that participants in the need of a schema-violation due to their relative high Zoom fatigue, respond better to one. Though, the interaction effect was nonsignificant at the 5% statistical level which means that we cannot reject the null hypothesis that there is no interaction effect.

A more empirically profound analysis into the relatively high scoring Zoom fatigue factors 'Communicational effort' and 'Awareness of expression' revealed a positive significant interaction effect of the factor 'Awareness of expression' at the 5% statistical level. This indicates that the effect of the factor 'Awareness of expression' on Group creative performance was significantly more positive in the stimulus condition compared to the no-stimulus condition. This is an interesting finding which might implicate that the stimulus ensures that someone's attention is less focused on themselves and more focused on the environment.

Based on the study at hand it can be concluded that the online environment can be shaped by the addition of a schema-violating stimulus in order to mitigate the effect of certain aspects of Zoom fatigue thereby fostering Group creative performance in online co-creation contexts.

5.1 Practical and scientific implications

The findings of the study at hand implicate that the negative effects of Zoom fatigue on Group creative performance may be remedied by the addition of a schema-violating stimulus to the online environment. Especially in the case where participants in a meeting suffer from high awareness of their own expression, a stimulus might improve their Creative performance. This implicates that Zoom fatigue indeed has a negative effect on Group creative performance, but that there might be a way to improve virtual communication. The tendencies that were found reveal that firms can still benefit from the use of video conference services such as Zoom, WebEx and Microsoft Teams in order to pursue their daily business. However, they might benefit from adding a schema-violating stimulus in meetings where active involvement is desired and participants suffer from a relative high level of Zoom fatigue. This study offers an optimistic counter note to the negative productivity effects surrounding virtual communication which could help firms to keep the door open for successful use of virtual communication even after the COVID-19 pandemic.

6. Discussion

Although the results of the study at hand showed some interesting tendencies, The main analysis revealed no significant effects. So, why is there a real goat participating in my Zoom meeting today? Does it boost creativity or is it just a fun but distracting factor? The field experiments revealed that a stimulus as such definitely distracts participants as they indicated that their eyes were glued to the unexpected participant.

However, in contrast to previous research on Schema-violation theory of (S. Ritter et al., 2012; Simone M. Ritter et al., 2014; S.M. Ritter & Gocłowska, 2020), the study at hand revealed no significant direct increase in Group creative performance due to the Schema-violating stimulus. The negative estimate of the Schema-violating stimulus is not in line with existing literature on Schema-violation theory, as it indicates that groups with the Schema-violation stimulus have a lower predicted Group creative performance compared to groups without the Schema-violation. The difference in results of the study at hand compared to previous research on Schema-violation theory could be due to a different research setup.

In contrast to previous studies, the stimulus in this experiment was present during the entire group brainstorm task instead of before which therefore could have a more disturbing character. As described in chapter 2 an individual goes through four phases in the creative process (Botella et al., 2018). The stimulus might be more suitable for the preparation and incubation stages when the mind is wandering around and looking for new ideas. The stimulus might then really cause this extra trigger of cognitive flexibility. However, it is discussable whether the stimulus is effective during the somewhat more focused stages as illumination and verification when the ideas that came to one's mind are shared and evaluated or whether the stimulus has a more disrupting character in the negative sense. In these stages, the stimulus could have a more disturbing character. Hence, a more nuanced perspective needs to be taken to add a schema-violating stimulus at the right time in order to achieve the maximum result of the stimulus for all participants.

Another explanation for the difference in results of the stimulus compared to the literature on schema-violations, could be the fact that research at hand applied a schema-violation in a group context instead of an individual setting. Problems that arise in group contexts such as information blocking might even be more present when there is an additional surprising participant that elicits a response which results in other participants having to wait until they get the floor to share their ideas and therefore inhibits performance (Diehl & Stroebe, 1987; Nijstad & Stroebe, 2006).

Finally, the study at hand used a schema-violation in an online meeting context which might influence the effectiveness as there is much more to look at than just the schema-violation. There are also multiple participants who move, make sounds etc. to look at. The addition of just another extra

stimulus might therefore not be effective enough and therefore flatten the effect of the violation. Besides, the results revealed that the stimulus was not experienced as shocking.

Even though the direct effect of the schema-violating stimulus tends to decrease Group creative performance, the stimulus tends to increase Group creative performance in the case where participants feel relatively high Zoom fatigue. However, this effect was not significant. A positive significant interaction effect was found for 'Awareness of expression' with the stimulus. The level of significance was just under .05 with a p-value of .048. Hence, it seems that the stimulus has some effect for people who experience Zoom fatigue which gives reason to improve the experimental design which may reveal more robust significant results.

6.1 Limitations of research

In this research, tradeoffs have been made regarding the methodological design to prevent biased data. The most technical choice in the analysis was to determine the Zoom fatigue of participants after the session in the form of a questionnaire. Asking people their Zoom fatigue before the session has started would compromise their experience during the session. Performing the questionnaire afterwards results in biased answers as people are not reliable in remembering how they felt at the start of the session. This results in a lack of a Zoom fatigue 'baseline'. As we are interested in the difference in effect the schema-violation has for the low and high Zoom fatigue group on their Group creative performance, a baseline Zoom fatigue score is required. For this research, the Zoom fatigue experienced during the session is what separates the two Zoom fatigue groups now instead of the Zoom fatigue experienced at the start of the Group session, which is not measured. The questions regarding Zoom fatigue are formulated in such a way that it provides as much insight as possible into the Zoom fatigue experienced during the session. The variable 'Minutes that the participant has been in a video meeting that day before our experiment started' is used as a control variable in our analysis. These factors combined form the approximation of the baseline Zoom fatigue required for our analysis. This leaves a gap as it is not fully visible to what extent the experiment contributed to the effect of Zoom fatigue of the participant. Another study could overcome this baseline problem, by having participants under close supervision, e.g., using technology to measure eye-movement or even brain activity.

Secondly, because of limited time and resources, only students in the age of 18 through 29 years old participated in the experiment. Therefore, it is not possible to make statements on other age groups on the basis of this research. It is chosen to include students as it increased the feasibility to recruit participants. Overall, students have more time compared to fulltime workers to participate in an experiment. However, students might not feel very zoom fatigued as they do not participate in online video calls as much as fulltime workers do. In addition, the co-creation session only had a duration of 50-60 minutes. Even though participants were restricted to look at the Zoom interface for the duration of the whole session in order to have the Zoom effect kick in as much as possible, the results indicated

that the Zoom fatigue did not kick in as much as was hoped for. Hence, the analysis is based on a high Zoom fatigue level with a relatively low mean which might affect the tendencies. Resulting from these limitations, performing larger scale experiments with fulltime workers would be interesting as it is expected that they attend significantly more virtual meetings on a daily basis and therefore suffer more from Zoom fatigue. With more time and resources, it would be possible to run these experiments not only in short, interactive sessions but longer, more draining sessions letting the Zoom fatigue better kick in. This could increase the spread of Zoom fatigue scores which increases the probability of significance as the relative high Zoom fatigue group is further away from the relative low Zoom fatigue group.

Finally, significant effort has been made to control the setting as much as possible by providing clear predefined instructions to the participants. However, the session is not fully under the control of the host as there is a physical distance between the host and the participants. It is not visible for the host whether participants in reality look at the Zoom interface for the duration of the whole session or might click it away. This problem could be solved by monitoring the screens in another experiment. However, in real life, meeting hosts are also not monitoring participants' screens. Therefore, it is discussable whether this has to be controlled for as clicking away screens is also part of the phenomenon of Zoom fatigue.

6.2 Future research

The study at hand helps build the foundation to mitigate the effects of Zoom fatigue on creative performance. The topic is in need of further investigation to better understand the phenomenon of Zoom fatigue, as existing literature is very limited. The COVID-19 pandemic has given the field of study a kick-start, as it has proven the importance of online communication. In future research, it would be interesting to re-design the online environment in other ways so that existing schemata are violated and therefore the participants experience the hypothesized effects. This would in its turn improve the robustness of the effect of schema-violations in experiments where participants suffer from Zoom fatigue. Research of S. Ritter et al., (2012) revealed that actively participating in a schema-violation is more effective compared to vicariously watching a schema-violation. The stimulus that was used in the study at hand was not active. An example of possible future research could be to redesign the online environment in such a way that every 10 minutes the meeting is interrupted by a screen wide message that tells the participant to stand up and perform a task such as a certain movement for the duration of 30 seconds. After these 30 seconds participants will see each other again and the meeting will be resumed. This way of active involvement might contribute to reducing Zoom fatigue as participants are suddenly disrupted and taken away from the online environment for a short period in a fun and also healthy way where the mind can really just let go and the body can move. In addition, this redesign should contribute to one's creative performance as the tasks are active and very unexpected.

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Appendix A – Operationalization Measurement

Operationalization Table

Variable	Dimension	Indicator
Zoom fatigue	Delay of verbal response	Slower to respond
		Effort to respond
	Lack of mutual gaze	Takes away focus
		Difficult to make eye contact
		Exhausting to make eye contact
	Awareness of facial expression	High awareness
		Often look at yourself
		Tiresome to look at yourself
		Distracted by looking at yourself
	Performance	Not contributed to the session
		Not productive
	Motivation	Dread having to do things
		Feel like doing nothing
		Tired
	Drained feeling	Emotionally tired
		Exhausted
		Mentally tired
		Less focused

Items Survey

Delay of verbal response

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

Lack of mutual gaze

It was difficult for me to make eye contact with others in the Zoom meeting

Trying to make eye contact with the other participants was tiresome

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

Awareness of facial expression

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

Performance

I think I have contributed a lot to this Zoom session

I think I have been productive during this Zoom session

Motivation

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

Drained feeling

Compared to before this Zoom session, I currently feel more emotionally tired

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

Compared to before this Zoom session I currently feel more mentally tired

Compared to before this Zoom session I currently feel less focused

Appendix B – Coding scheme

Coding flexibility measures

Category	Code	Category	Code
Sports (attribute and/or (online) lesson)	A	Relaxing / care	M
Home accessories	B	Not specified merchandise	N
Food / Beverages	C	Hobby and creative	O
Books / Magazines / Albums	E	Flowers and plants	P
Electronics	G	Workshops	Q
Games	H	Coupon for (online) stores (products and clothing)	D
Clothing / Shoes / Clothing accessories	I	(Recreational) activities	AA
Office / School supplies	J	Coupon streaming services	BB
Household products	K	Coupon for services	DD
Dining / On the go	L	Combibox	EE

Coding variables

Variable		Meaning	Score
Group dynamic	0 %	Nobody knows each other	1
	< 50 %	Less than half the group	2
	≥ 50 %	Half or more than half the group	3
	100 %	Everyone knows each other	4
Zoom fatigue (quantiles)	33%	Low	1
	33%	Medium	2
	33%	High	3
Minutes Zoom	0 – 30	Very low	1
	30 – 60	Low	2
	60 – 90	Moderate	3
	90 - 120	High	4
	> 120	Very High	5
Gender		Male	0
		Female	1
Time of day		Morning	1
		Afternoon	2
		Evening	3

Appendix C – Analysis output

Individual creativity

Descriptives individual creativity

	Alpaca	Individual creativity
No	Mean	5,491
	Std. Deviation	2,581
	Kurtosis	-.536
		(.750)
	Skewness	.491
		(.383)
Yes	Mean	6,469
	Std. Deviation	3.739
	Kurtosis	1.083
		(.759)
	Skewness	1.384
		(.388)

Note. Standard error in brackets

Independent Samples Test; Individual Creativity

Levene's Test		t-test for Equality of Means				
<i>F</i>	Sig	<i>t</i>	<i>Df</i>	Sig. (2-tailed)	Mean Difference	Std. Error Difference
.126	.723	-.582	73	.562	-.51422	.88348

Note. N = 75

ANCOVA assumptions

Main analysis

Normality of independent variables and error term

Descriptive statistics: Mean, Median, Mode, Kurtosis and Skewness

	Zoom Fatigue	Group Dynamic	Group Creativity	Error term ANCOVA
Mean	3.71	2.75	7.25	.000
Median	.910	.93095	3.188	.808
Mode	.826	.867	10.16	.653
Skewness	-.328	-.567	.107	-.733
	(.277)	(.564)	(.277)	(.337)
Kurtosis	-.318	-.119	-1.12	.208
	(.548)	(1.091)	(.548)	(.662)

Note. N=75, Standard error in brackets

Independent scores

Bivariate correlation independent variables

	1.	2.	3.	4.	5.	6.
1. Number of participants						
2. Group dynamic	.540**					
3. Time of day	.480**	.232*				
4. Gender	.208	.014	.194			
5. Alpaca	-.126	-.154	.137	-.010		
6. Zoom fatigue	.001	.149	-.027	-.082	.149	
7. Minutes in a Zoom before	.134	-.128	.294*	.092	.163	-.085

Note. N=75, * $p < .05$, ** $p < .01$

There is a correlation between the number of participants and the extent to which people in the group know each other and the time of day the session took place. However, participants were randomly assigned to groups. Furthermore, there is a correlation between minutes in a zoom meeting and the time of day. However, this correlation is quite weak. Hence, it can be assumed that the variable scores are independent.

Homogeneity of variance

Levene's Test of Equality of Error Variances

F	Df1	Df2	Sig.
1.232	2.75	7.25	.309

Note. Dependent variable: Group creative performance

Further analysis

Normality of independent variables and error term

Descriptive statistics: Mean, Median, Mode, Kurtosis and Skewness

	Zoom Fatigue 2	Error term ANCOVA2	Error term ANCOVA3	Error term ANCOVA4
N	75	50	49	
Mean	4.47	.00	.00	
Median	4.70	-.03	.18	
Mode	4.90	-1.03	.88	
Skewness	-.544 (.277)	-.100 (.337)	-.472 (.340)	
Kurtosis	.251 (.548)	-.336 (.662)	.015 (.668)	

Note. Standard error in brackets

Independent scores

Variables included in the further analysis were the same as in the main analysis except for the variable 'Zoom fatigue'. Therefore, no different correlations were found compared to the displayed statistics above.

Homogeneity of variance

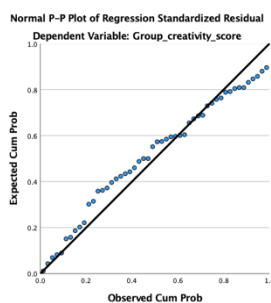
Levene's Test of Equality of Error Variances

Model	F	Df1	Df2	Sig.
Zoom fatigue 2	.484	3	46	.695
Communicational effort	1.720	3	45	.176
Awareness of expression	.247	3	45	.867

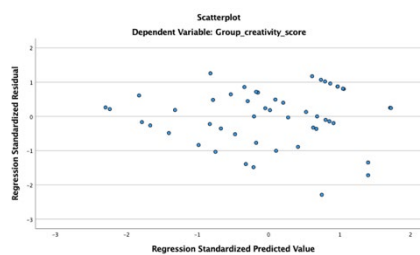
Bivariate Linear Regression assumptions

Main analysis

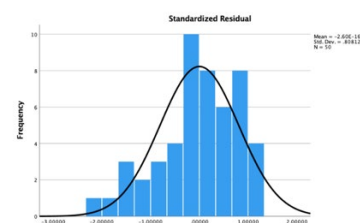
Constant variance of Residuals



Independent scores of residuals



Normal distribution residuals



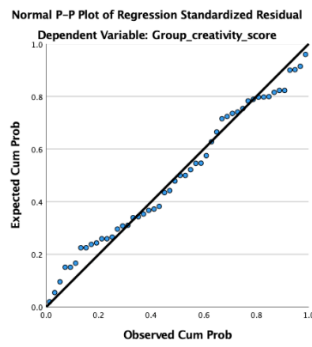
Normal distribution of Residuals

Descriptive statistics residuals

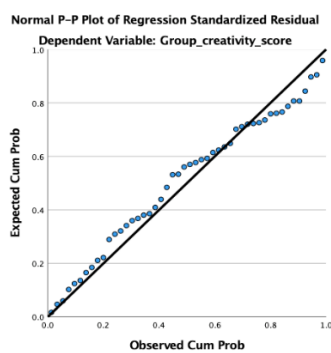
Standardized residuals	
Mean	0
Median	.102
Mode	.737
Skewness	-.795 (.337)
Kurtosis	.362 (.662)

Note. Standard error in brackets

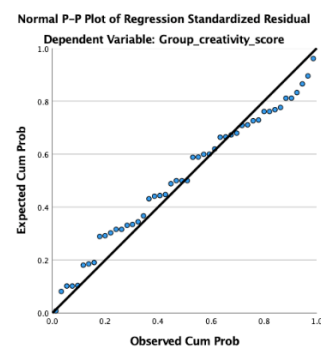
Constant variance of residuals



Note. Zoom fatigue 2

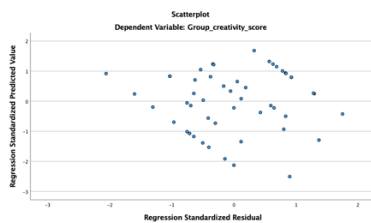


Note. Communicational effort

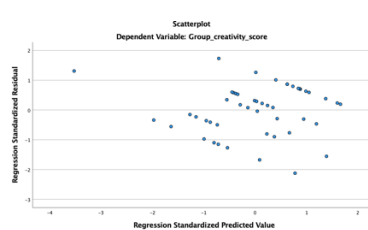


Note. Awareness expression

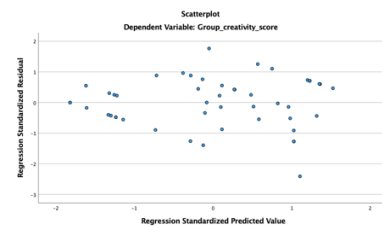
Independent scores of residuals



Note. Zoom fatigue 2



Note. Communicational effort



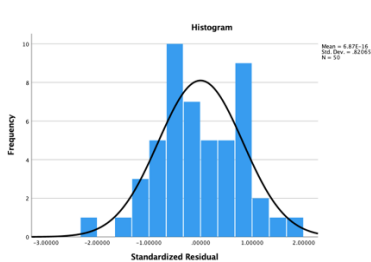
Note. Awareness expression

Normal distribution of residuals

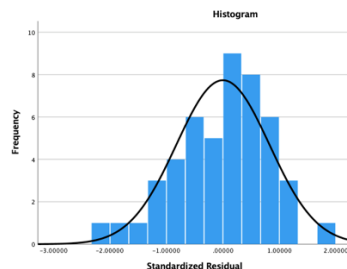
Descriptive statistics standardized residuals

	Zoom fatigue 2	Communicational effort	Awareness of expression
Mean	.00	.00	.00
Median	-.03	.16	.00
Mode	-1.03	.87	-1.27
Skewness	-.100 (.337)	-.449 (.343)	-.527 (.343)
Kurtosis	-.336 (.662)	-.018 (.574)	.661 (.674)

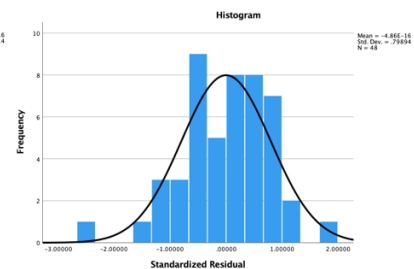
Note. Standard error in brackets



Note. Zoom fatigue 2



Note. Communicational effort



Note. Awareness of expression

Appendix D – Script

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

We would like to note that the entire session will be recorded. The data will be handled with the utmost care and will be destroyed once the research has completed. The data will only be used for this particular research and will only be accessible for the researchers and the supervisor.

- 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 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 honor 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. So, both bachelor, pre-master and master students, both Dutch and Internationals.
 - The gift must be packaged in an efficient and fun way; you should think about this too!
 - The gift must be environmentally friendly
- 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.
- 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.
- You should all have written down your ideas. For the next 20 minutes you will brainstorm together and generate as many as possible ideas together. Keep the product criteria in mind! Please all unmute yourself.
- Do you, *person X* want to write down all ideas that you have generated together? Please write your name and “group ideas” at the top of the paper.
- Does anyone have questions about this next session? *Waiting for a response*
- 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.
- 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 write down your 3 best ideas clearly on the paper in front of you at the end? Write “3 best ideas” on top of the paper 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 write down your three best ideas as concretely as possible. Also check whether your ideas meet the conditions of the assignment. You can find these in the chat.
- *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 take 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.
- Did everyone send it? *Wait*
- 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.
- 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 E – 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)

Treatment group

Did you notice anything remarkable during the session?

- Yes
- No → straight to question 4

What did you notice during the session?

Open question

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 think I have contributed a lot to this Zoom session
- I think I have been productive during this Zoom session

Fatigue marker 5 – Reduced motivation

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

Fatigue marker 6 – 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

Treatment group

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 made me have a **less broad** 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 | • Education |
| • Economy, business and management | • Law |
| • Natural sciences | • Language and communications |
| • Behavioral sciences | • Technology |
| • Health care | • Other, namely: |
| • Arts | |

What is your first and last name?

What is the number of your session group?

(1-20)

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 F – Invitation experiment



Participants needed!

Are you a student and do you have 1 hour to participate in a fun and challenging marketing study?

Coronaproof via videoconferencing platform Zoom

Required is that you:

- Have a Zoom account
- Have a working webcam
- Have a working microphone
- Have a good working internetconnection
- Agree that the session is being recorded (the recording will be destroyed at the end of the thesis project)

Are you available on the 28th, 29th, 30th of april or the 1th of may (10:30, 12:00, 14:30, 18:30 or 20:00 o'clock)?

Send an email with your availability (if possible, multiple data) to thesisexperiment2021@gmail.com and we will contact you!

Participating in this fun study gives a chance at one of the three Bol.com gift cards worth €20,-!



Appendix G – Research Integrity Form

Name: Caroline Hezemans	Student number: 1047699
RU e-mail address: caroline.hezemans@student.ru.nl	Master specialisation: Marketing

Thesis title: The effect of a schema-violating stimulus on Zoom fatigue in a co-creation context
Brief description of the study: An experiment testing the effect of a schema-violating stimulus on the negative relationship of Zoom fatigue on Group creative performance.

It is my responsibility to follow the university's code of academic integrity and any relevant academic or professional guidelines in the conduct of my study. This includes:

- providing original work or proper use of references;
- providing appropriate information to all involved in my study;
- requesting informed consent from participants;
- transparency in the way data is processed and represented;
- ensuring confidentiality in the storage and use of data;

If there is any significant change in the question, design or conduct over the course of the research, I will complete another Research Integrity Form.

Breaches of the code of conduct with respect to academic integrity (as described / referred to in the thesis handbook) should and will be forwarded to the examination board. Acting contrary to the code of conduct can result in declaring the thesis invalid

Student's Signature:  **Date:** March 25th 2021

To be signed by supervisor

I have instructed the student about ethical issues related to their specific study. I hereby declare that I will challenge him / her on ethical aspects through their investigation and to act on any violations that I may encounter.

Supervisor's Signature: _____ **Date:** _____