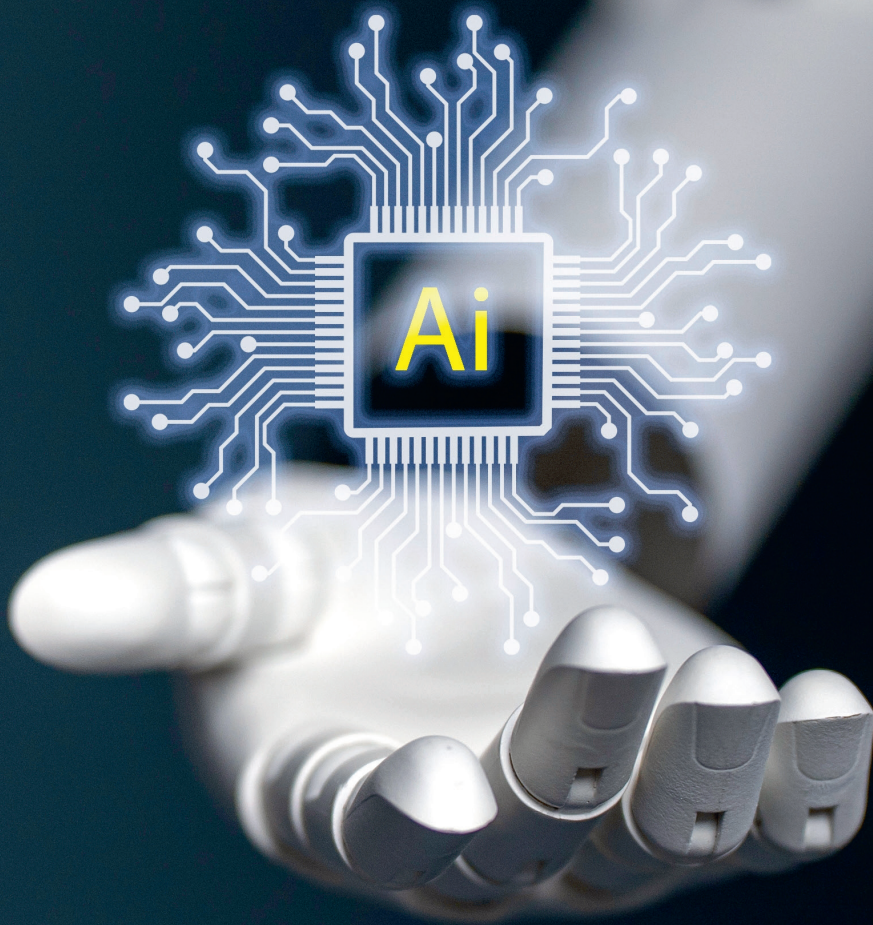


DIGITAL PSYCHOLOGY

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Editors-in-Chief:
Oswald D. Kothgassner & Anna Felinhofer

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Artificial Intelligence

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Personality Organization: Focusing on Shame, Guilt,
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Management**

Editorial

ChatGPT, who?

Oswald D. Kothgassner¹ & Anna Felnhöfer²

¹ Department of Child and Adolescent Psychiatry, Medical University of Vienna, Austria

² Department of Pediatrics and Adolescent Medicine, Division of Pediatric Pulmonology, Allergology and Endocrinology, Medical University of Vienna, Austria

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Artificial intelligence (AI) is a rapidly growing and highly interdisciplinary field that touches all areas of science. However, the impact of generative AI in the scientific publication process is currently still uncertain, although some problem areas and dilemmas are already emerging. Currently, it is ChatGPT (Generative Pre-trained Transformer) from OpenAI, that produces very naturalistic texts, seemingly written by humans, on specific prompts or context. ChatGPT has been trained on a large dataset of texts from the Internet to understand and (re)produce a wide range of topics and language styles.

While AI can be helpful in the academic process to transform large amounts of data into useful and actionable information, which would not be possible for a human researcher. Specifically, ChatGPT can facilitate the text production of scientific papers, assist the editing processes within scientific journals, but it also runs the risk of leading to poorer quality scientific papers, as the linguistic design and also the revision process itself can highlight errors that have crept in, as well as stimulate new ideas and be part of the engagement with a subject matter. In addition, AI only knows the content it has been trained with and it has a lack of ability to generalize from one task to another. All of these are among the topics that will continue to occupy us in this journal in the future.

Digital Psychology does not intend to ban AI-generated texts completely but would like to ask authors to mark passages or graphics of their scientific work that were created with the help of AI and to reference the respective program. It is not desired to cite AI as the author, but it is desired to cite AI as the software used. We would like to point out that AI is also just a tool to produce content and therefore the authors have a corresponding obligation to check and critically use the products of AI. In this issue we also discussed different opinions about AI.

We are also expanding our Editorial Board and would like to welcome Michael Zeiler (Medical University of Vienna) as Associate Editor. Furthermore, we would like to point out the possibility for proposals of Special Issues. We have also included

three articles on different areas of Digital Psychology in the current issue and wish everyone an interesting read.

Oswald Kothgassner & Anna Felnhöfer
Editors-in-Chief

Conflict of Interest

The Editors-in-Chief declare no conflict of interest.

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Expert Views on ...

... Artificial Intelligence

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We asked Prof. Helmut Hlavacs, a well-known Computer Scientist and Prof. Christian Montag, a recognized expert in the field of Cyberpsychology, about the challenges and issues with generative AI and then we asked ChatGPT.

What does AI mean for the development of society?

Helmut Hlavacs: The science of artificial intelligence has made enormous progress in recent years, and here in particular in the field of generative models. Such models can generate digital assets from a small amount of basic information, and impress with a quality never before achieved. Assets include images of people, animals, landscapes and other objects, sounds, speech output in general and mimicking spoken words of specific people, video and short movies, and most importantly written text generated by so-called Large Language Models (LLMs). ChatGPT and similar products from other sources generate correct sentences with seemingly meaningful content that matches the input. These models, which are based on billions of independent parameters, were trained with the help of millions of graphics, texts, videos, etc. freely available on the Internet. It is worth noting here that LLMs generate words only by their probabilities; they are not unlike a parrot that can repeat words but does not understand their meaning. Nevertheless, the quality of the generated texts, images, 3D models, and soon longer videos is so high that the products can already be used in a very useful way. Application areas in economy, administration, entertainment, medicine, therapy and production are numerous and not yet assessable in their totality. Entire professions will fundamentally change their ways of working, from manual tedious work to highly efficient use of software that generates assets quickly and whose output is then made usable. Graphic designers, for example, will soon no longer initially design products themselves, but will instead have AIs make numerous suggestions, work on them, and then possibly copy or refine them in their tried-and-true tools. There are already tools for the interactive generation of images, for example DragGAN. This type of cooperation between humans and AIs will also become visible in other areas. The reason why AIs will not yet completely replace humans, however, is precisely the lack of understanding of the intentions behind the prompts entered.

Christian Montag: “Overall, the impact of ChatGPT on society will depend on how it is developed, deployed, and regulated. It offers immense potential for positive change but also requires careful consideration of ethical, social, and legal implications to harness its benefits responsibly.” I like this answer to your question, and it has been generated by ChatGPT, when I asked this generative AI your question. The quality of the sentences and content produced shows that we already see a powerful AI that can support humans in many tasks. The most critical area where I see problems at the moment is discussions about what jobs will be on the line, because of the spread of generative AI. Another relevant area in which clear problems may arise is the massive distribution of deep fakes, which can be created using software, such as DALL-E 2 or Midjourney. How can we ban deep fakes when they become increasingly difficult to detect? I think we will see a race between groups that come up with the best ways to create deep fakes and those who are able to detect them. Perhaps, we are browsing in the near future with anti-deep fake software, as we do today with antivirus software.

ChatCPT: ChatGPT, as an advanced language model, has the potential to impact society in several ways:

1. Enhanced communication: ChatGPT can facilitate more effective and accessible communication between people. It can help individuals express their thoughts, find information, and engage in meaningful conversations on a wide range of topics.
2. Information and knowledge sharing: ChatGPT can serve as a valuable tool for sharing information and knowledge. It can provide instant access to vast amounts of information, helping users learn about various subjects, discover new perspectives, and broaden their understanding of the world.
3. Personalized assistance: With its ability to understand and respond to queries, ChatGPT can offer personalized assistance in areas such as customer support, education, and healthcare. It can provide guidance, answer questions, and offer solutions, potentially improving efficiency and accessibility of services.
4. Creative inspiration: ChatGPT can act as a source of inspiration for creative endeavors. It can generate ideas, suggest improvements, and assist in creative writing, thereby supporting artistic expression and innovation.

5. Accessibility and inclusivity: By breaking down language barriers and providing information in a user-friendly manner, ChatGPT has the potential to enhance accessibility and inclusivity. It can empower individuals with limited language proficiency or disabilities, enabling them to participate more fully in society.
6. Ethical considerations: As ChatGPT and similar technologies advance, it is crucial to address ethical concerns. Issues such as bias, privacy, and responsible use need to be carefully considered and mitigated to ensure that the technology benefits society in a fair and responsible manner.

Overall, ChatGPT has the potential to revolutionize the way we communicate, access information, and interact with technology. Its impact on society will depend on how it is developed, deployed, and regulated, with a focus on ensuring inclusivity, ethical considerations, and responsible use.

How can generative AI change research and teaching?

HH: LLMs can now write generic texts in a short time, for example “boiler plate” texts for proposals, introductions to papers, descriptions of technical principles in reports, etc. A short test has also resulted in very useful lists of possible research questions for a certain field of computer science, which could be used for a third party funding application without any changes. It is always important here not to trust the generated texts, but to examine them for errors in content. Close cooperation between humans and AI is therefore also important here, if one does not want to risk nonsense claims. In teaching, one can quite quickly generate graphics for slides, diagrams, lists of important contents of a field to be taught, synthesize new tasks to be solved by the students, and the like.

CM: Currently, many professors and teachers worldwide discuss the impact of generative AI on human learning processes. Simply saying that we forbid this technology in the realm of learning would also lead to not considering the potential of generative AI, such as supporting us in preparing our presentation, running data analysis, or supporting us in data visualization. Currently, it is clear that products such as ChatGPT also hallucinate; hence, they are coming up with false information. This shows that we may also have to change the way we test the students. Instead of asking them to write a piece of research, we might present them with a text that ChatGPT has produced and ask them to find mistakes or ask about overall soundness. This said: In the future, analytical and writing skills will still be important, and if you want to transport your ideas with your individual voice, I advocate the use of your own thinking and writing. In so far, analytical and writing skills still need to be trained. However, I am also aware that ChatGPT may be able to copy our writing style. Needless to say, that we first have to find our own voice.

ChatGPT: Generative AI has the potential to bring about significant changes in teaching and research. Here are a few ways it can impact these areas:

1. Data analysis and pattern recognition: Generative AI models can analyze vast amounts of data and identify patterns that may not be immediately apparent to humans. In research, this capability can aid in data exploration, hypothesis generation, and identifying trends or correlations that lead to new discoveries.
2. Simulation and modeling: Generative AI can be used to simulate complex phenomena and create virtual environments for experimentation. This can be particularly useful in fields such as physics, chemistry, and biology, where conducting real-world experiments may be challenging or expensive. Simulations can provide insights, validate theories, and help researchers refine their understanding of complex systems.
3. Content creation and augmentation: Generative AI models can assist in creating educational materials, such as interactive simulations, virtual lessons, or multimedia content. They can also help in automating certain tasks, freeing up educators’ time to focus on higher-level activities like personalized instruction and mentoring.
4. Language translation and understanding: Language models powered by generative AI can aid in language translation, allowing researchers and educators to collaborate more easily across linguistic barriers. These models can also assist in understanding and summarizing large volumes of text, making research literature more accessible and accelerating the process of literature review.
5. Personalized learning experiences: Generative AI can enable personalized learning experiences tailored to individual students’ needs and learning styles. By analyzing data on students’ performance, preferences, and progress, AI models can recommend personalized content, adaptive learning paths, and targeted interventions to enhance the learning process.
6. Collaborative research and knowledge sharing: Generative AI can support collaborative research by facilitating knowledge sharing, brainstorming, and co-authoring. Models can generate ideas, suggest research directions, and help researchers synthesize and analyze information more efficiently.
7. Ethical considerations: It’s important to address ethical considerations when applying generative AI in teaching and research. These include concerns such as bias, data privacy, transparency, and responsible use of AI-generated content. Ensuring fairness, accountability, and transparency in the development and deployment of generative AI models is crucial.

Generative AI has the potential to augment human capabilities, accelerate research, and transform teaching practices by providing new tools and insights. However, it should be seen as a complement to human expertise rather than a replacement. It is essential to strike a balance between leveraging the power of generative AI and maintaining the critical thinking, creativity,

and ethical decision-making that humans bring to teaching and research.

What problems can AI cause?

HH: LLMs know nothing, they skillfully repeat “sounds” or “characters” in grammatically correct order without understanding their meaning. John Searle created the Chinese Room argument for this in 1980, where a translator sits in a closed room and is given Chinese characters in the form of questions and their answers. The translator now gets better and better at assigning characters as answers to new questions (he “learns”) without actually understanding any of these characters. Clearly, gross errors can happen here as soon as previously unknown characters appear as questions. ChatGPT and other LLMs would simply guess here, insert characters and words even if the meaning is completely wrong. Thus, resumes of nonexistent phantom persons are quickly and convincingly constructed by ChatGPT, and look deceptively real, although fictitious.

As a heuristic we can already say that the more general the topics are, about which ChatGPT writes texts, the higher their reliability seems to be. A possible reason could be that there are more and more comprehensive texts about general topics on the Internet, and the learned quality is therefore also greater than it is the case with texts on very specific topics. For example, if I ask ChatGPT to write 10 pages about a certain topic, but there are not so many texts about this topic in the whole internet, ChatGPT has to start fantasizing at a certain point. The unreflective use of ChatGPT especially in teaching has other dangers, which unfortunately have already been realized. If you ask ChatGPT whether a paper submitted by students was generated by ChatGPT, you will not get a reliable answer - it may be true or not. Recently, in the USA, an naive professor declared such papers (and thus already completed degrees) to be invalid after ChatGPT had declared itself to be their author. Of course, this has no significance, ChatGPT should never have been used in this way.

ChatGPT: While generative AI has numerous benefits, it can also give rise to certain problems and challenges. Here are some of the potential issues associated with generative AI:

1. Bias and fairness: Generative AI models learn from the data they are trained on, and if the training data contains biases, the model can replicate and amplify those biases in its gener-

ated content. This can lead to biased or discriminatory outputs, perpetuating societal inequalities.

2. Misinformation and manipulation: Generative AI can be used to create highly realistic but fabricated content, such as deepfakes or false information. This raises concerns about the potential for widespread misinformation, manipulation, and the erosion of trust in digital media.
3. Intellectual property and copyright: Generative AI can generate content that may infringe upon intellectual property rights and copyright. Determining the ownership and originality of AI-generated works can become complex, potentially leading to legal and ethical challenges.
4. Privacy and data protection: The use of generative AI often requires access to large amounts of data, which raises concerns about privacy and data protection. There is a risk of sensitive information being inadvertently exposed or misused, requiring robust privacy safeguards.
5. Ethical dilemmas: Generative AI can present ethical dilemmas, particularly when it comes to the creation of AI-generated content that mimics human behavior. Questions arise regarding the transparency of AI systems, consent for using AI-generated content, and potential impacts on individuals' well-being and privacy.
6. Overreliance and human displacement: There is a risk of overreliance on generative AI systems, leading to the potential displacement of human expertise and creativity. While AI can assist in various tasks, it should be used as a tool to augment human capabilities rather than replace them entirely.
7. Lack of accountability: As generative AI systems become more sophisticated, it can become challenging to attribute responsibility for their outputs. This lack of accountability raises concerns about potential misuse, malicious intent, and the ability to identify and address harmful or unethical AI-generated content.

Addressing these problems requires a comprehensive approach that includes ethical development and deployment practices, robust regulatory frameworks, transparent and explainable AI systems, ongoing research on bias mitigation, and responsible use of generative AI technologies.

It is crucial to proactively anticipate and address these challenges to ensure that generative AI is developed and used in a responsible, fair, and beneficial manner, with appropriate checks and balances in place.

Edited Pictures in Social Network and Borderline Personality Organization: Focusing on Shame, Guilt, Body Image and Social Comparison

Gea Elena Spada¹⁻², Roberta Bortolla², Greta Pittelli², Cesare Maffei¹

¹ Università Vita-Salute San Raffaele, Milano, Italy

² IRCSS Ospedale San Raffaele, Milano, Italy

Abstract

The habit to share edited pictures through social networks have been reported in young people and associated with psychological vulnerabilities. Seventy young women rated their perceived identification and attractiveness in original and edited pictures and completed self-report questionnaires. The research addresses the awareness and the effects of the exposure to edited pictures on guilt, shame, body image satisfaction and social comparison tendencies. Furthermore, as borderline organization might affect individual self-perception and behavior in social network, the mediating role of psychopathological traits between guilt and body image satisfaction with the perceived identification and attractiveness in original personal pictures is investigated. Results showed that a high identification in the original picture debars the perceived attractiveness in the edited ones, as well as a high identification in the most edited picture is not associated with attractiveness in the original one. Further, participants reported negative associations between the level of identification and attractiveness in the original picture and dysphoria, guilt and body image satisfaction. However, no results emerged between edited pictures and shame, guilt, body image or social comparison. Finally, the mediating role of dysfunctional personality features partially explaining the effect of guilt and body image on identification and attractiveness is showed.

Keywords: edited pictures, social networks, guilt, body image, borderline personality organization

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1 Introduction

There has been an increasing exposure to personal pictures thanks to the spread of social networks (Rainie, Brenner, & Purcell, 2012). In addition, the habit of editing pictures has become increasingly common. Filters apply physiognomic changes to hide imperfections or approach a beauty ideal (Fox et al., 2016). Exposure to edited images influences this ideal and it increases the desire to fulfill unrealistic standards by users (Sullivan, 2014). Some studies have considered psychological consequences of a massive exposure to edited pictures. Viewing edited pictures has been linked to low self-esteem and body dissatisfaction (Kleemans et al., 2018), as well as doubt and frustration (Hargreaves & Tiggeman, 2004). In line with this, social networks are a potential triggering context in individuals characterized by poor self-esteem (Kelly et al. 2018), shame (Dogan et al., 2016) and depressive symptoms (Bettmann et al., 2021). Social network issues are expected more within psychopathology, especially whether they involve emotional and interpersonal problems as in borderline personality disorder (BPD). Indeed, BPD is char-

acterized by instability of mood associated with feelings of inadequacy (APA, 2013), possibly driven by shame and guilt (Kernberg, 1967; Zanarini et al., 1998), by impaired body acceptance and awareness (Bessenoff et al., 2006; Semiz et al., 2008), a low self-esteem (APA, 2013), and deficient interpersonal functioning (Linehan, 1992; Berenson et al., 2018).

Shame is considered as a failure to meet internalized standards (Lewis, 1971) and it is associated with the tendency to compare with others (Lim & Yang, 2015). Online shaming can lead to a reduction in self-esteem, feelings of inadequacy, fear (Tangney, Miller, Flicker & Barrow, 1996), withdrawal from social life and to suicide (Mayer & Vanderheiden, 2019). Guilt is associated with regret in relation to specific behaviors and to reparative conducts (Tracy and Robins, 2004). Interestingly, the association of guilt and shame is a predictor of social network sites usage (Doğan, Çelik, & Karakaş, 2016) and high levels of shame and guilt are negatively associated with self-esteem (Pila et al. 2015). Moreover, guilt and shame have been linked to body satisfaction (Conradt et al., 2007; Pila et al. 2015). Negative body image reflects an association of social networks with dysphoria

(Kelly et al., 2018) and with the common “appearance exposure” (Meier & Gray, 2014). As a final point, social comparison with peers has been shown positively associated with social network addiction and negatively to self-esteem (Kim et al., 2021). The aim of the research is to understand whether shame, guilt, dysfunctional body awareness and social comparison represent vulnerabilities affecting the processing of social network and edited pictures worsened by high scores to BPD traits.

One previous empirical study has investigated how BPD interpersonal interactions on social media may be dysfunctional (Ooi et al., 2020). Participants with BPD reported greater regret after posting more frequently compared to the control group. Previous studies showed that the presence of BPD traits could influence individuals’ interaction in social networks, leading to addictive behaviors, negligence of interests of real social relationships, and isolation (Wegmann, Stodt, & Brand, 2015). In line with this, BPD patients’ avoidance of close relationship might reflect perceived internal and external inadequacy, that might be associated with sense of guilt, as well as dysfunctional body image perception, self-identification, and attractiveness. The second aim of the research is to analyze whether BPD traits and the fear of close relation mediate the association between guilt and body image with identification and attractiveness in personal pictures, respectively. However, few studies approached the topic and no research investigated about the role of image-sharing behaviors in general population and in specific BPD traits.

Starting from these premises, the presented study investigates these psychological variables through a task with edited and original personal pictures. We predicted that the identification and self-perceived attraction in their own original or edited photographs are associated and correlated with psychological variables of shame, guilt, body awareness and social comparison. Depressive symptoms are investigated as potentially associated with feelings of worthless and negative self-perception. Moreover, BPD features are expected to be associated with the overmentioned psychological variables and they might mediate some of these correlations. Specifically, we hypothesized:

- a) negative associations between identification in the original picture (real self-image) and identification in the filtered picture (ideal self-image); negative associations between identification in the original picture and attractiveness in the original and in edited pictures; lastly, positive associations between identification and attractiveness in edited pictures.
- b) negative associations between identification and attractiveness in the original picture and feelings of shame and guilt, impaired body image and social comparison.
- c) positive association between identification and attractiveness in the filtered pictures and the aforementioned variables.
- d) BPD features and fear of relationships will mediate the association between identification and attractiveness in all pictures with levels of shame and guilt, negative body beliefs and social comparison tendencies, respectively.

2 Methods

Participants

Seventy voluntary female adolescent and young adults (M age = 22.74, SD = 2.84) are included in the study. Data were collected between December 2020 and March 2022. Participants were selected according to the following criteria: female gender; aged between 18-30 years old; absence of intellectual disability, alcohol and/or substance use, psychopharmacological treatments and psychiatric disorders. Socio-demographic variables are assessed. All participants gave their written consent to participate in the study after it had been explained to them. They agreed to complete questionnaires and to provide a personal picture. None of the participants were paid either directly or indirectly to participate in the study. This study is conducted adhering to the American Psychology Association code of conduct.

Instruments

State Shame and Guilt Scale (SSGS-8, Cavallera et al., 2017). Four items are selected for each of the two subscales: shame and guilt, rated on a 5-point Likert scale. Shame subscale showed Cronbach’s α = .82 and guilt subscale Cronbach’s α = .87.

Netherlands Comparison Orientation Measure (INCOM) is a scale of social comparison (Gibbons & Buunk, 1999) consisting of 11 items, measured with a 5-point Likert scale. There are two subscales: the first one reflects an interest in ability-related social comparisons, and the second opinion-based social comparisons. As a single scale, the INCOM has excellent internal reliability (Cronbach’s α = .90).

Body Image States Scale (BISS, Cash, et al., 2002) is a 6-item questionnaire, correlated with trait measures of body image. It is sensitive to reactions in positive (versus negative) situational contexts. The scale showed good internal consistency (Cronbach’s α = 0.83).

Borderline Personality Inventory (BPI, Leichsenring, 1999) is a 53-item questionnaire, based on Kernberg’s (1984) concept of borderline personality organization, used as a screening instrument; it is divided in four subscales (Identity Diffusion, Primitive Defense Mechanisms, Reality Testing and Fear of Close Relation). The reported Cronbach’s α for each subscale is between 0.68-0.91.

The Beck Depression Inventory-II (BDI-II, Beck et al., 1996) is a 21-item self-report inventory measuring the state depression severity. The Cronbach’s alpha for the BDI-II total score was 0.89.

Procedure

Participation occurred in two stages. In the first stage, a link with BDI and BPI questionnaires was administered. Subjects send a personal picture (colloquially called “selfie”) to the research team via their smartphone. Participants were asked to take a picture in 16:9 format, framing the face, without filter or any modification. The experimenter used a smartphone app named *Face-app* to modify participants’ pictures, creating three versions of

the selfie. In the Slightly Edited condition (Picture 1), the selfie was edited by ½ unit thin face, 1 unit narrowing of the nose, and ½ unit beauty filter. In the Fairly Modified condition (Picture 2), the selfie was edited by ½ unit thin face, 1 unit narrowing of the nose, ½ unit beauty filter, 1 unit mouth enlargement, and 1 unit smooth skin. Finally, in the Heavily Edited version (Picture 3), the selfie was edited by 1 unit slim face, 1 unit narrowing of the nose, 1 unit eye enlargement, 1 unit mouth enlargement, 1 unit beauty filter, and 1 unit smooth skin. In addition, eventual imperfections (e.g., skin impurities, acne, scars) are removed in all the edited images. See Figure 1 for an example of heavily edited picture.

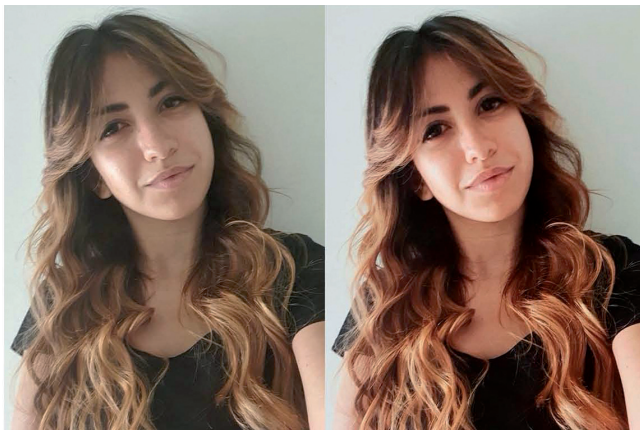


Figure 1. Examples of a participant’s original picture (left) compared with picture 3 (right).

All original and edited pictures were uploaded on a digital platform generating an experiment link. The four pictures were presented in randomized order and participants were asked to rate the degree to identification with and the attractiveness of each image on an 8-point Likert scale (from 1= “not at all” to 8 = “extremely”).

After rating all images, questionnaires assessing shame and guilt (SSGS-8), social comparison (INCOM) and body image (BISS) were given. Finally, qualitative questions about social networks habits were asked to explore this issue and to exclude participants who did not use social network. In particular, variables as the type of social networks used, the average time and moment of the day spent using social networks, which functions are they used for and if participants edited their pictures, were asked.

Statistical analysis

Non-parametric procedures are proposed to analyze data. Spearman’s correlations evaluated associations between identity and attractiveness scores, self-report questionnaires and task responses. For each correlation computed, we used a simple bootstrap to estimate confidence limits (Chernick, 1999). Due to possible confounding effects of age and education level on selected variables, correlations with shame, guilt, body image, social comparison, and BPD trait were conducted. Finally, two mediation models through SPSS PROCESS toolbox (Hayes, 2018) were im-

plemented. Specifically, the mediation Model 4 was chosen to assess direct, indirect, and total effects. Guilt and body image were entered as independent variables. Identification and attractiveness in the original picture were entered as dependent variables. BPD traits were classified as possible mediators. Bonferroni’s correction was applied to post-hoc multiple comparisons.

3 Results

Original and edited pictures: Associations between identification and attractiveness scores.

Considering original and edited pictures (Picture 1, 2, 3) and their relation to identification and attractiveness, descriptive analysis (Table 1) and Spearman correlations (Table 2) are reported. Overall, identification and attractiveness in the original pictures resulted positively associated to edited ones (Picture 1, 2, 3) although the associations were not always significant.

Table 1. Descriptive statistics related to identification and attractiveness in original pictures and edited pictures (picture 1, picture 2 and picture 3).

	N=70	
	Identification	Attractiveness
Original Picture	7.343 (1.587)	4.786 (1.718)
Edited Picture 1	7.014 (1.805)	4.714 (1.827)
Edited Picture 2	6.457 (2.205)	4.857 (1.994)
Edited Picture 3	5.000 (2.340)	4.329 (2.124)

Table 2. Spearman correlation between Identification and Attractiveness.

	N=70			
	Identi- fication Original Picture	Identi- fication Edited Picture 1	Identi- fication Edited Picture 2	Identi- fication Edited Picture 3
Attractiveness Original Picture	.395*	.335	.330	.258
Attractiveness Edited Picture 1	.422*	.533*	.425*	.332
Attractiveness Edited Picture 2	.368	.481*	.587*	.458*
Attractiveness Edited Picture 3	.271	.437*	.470*	.655*

Note: all provided statistical values refer to rho (r)

* p<.001 Significant after Bonferroni correction

Identification and attractiveness: Relationships with shame, guilt, social comparison, and body image.

The identification in original pictures was negatively associated with the level of self-reported guilt ($r = -.329, p = .006$). Identification with the original and all edited pictures was not significantly associated either with shame, social comparison, or body

image scores. A significant association between attractiveness ratings of the original picture and body image total score was found ($r = .347, p = .003$). The perceived attractiveness of edited pictures was not associated with shame, guilt, or social comparison. All correlations are reported in Table 3.

Table 3. Spearman correlation between Identification and Attractiveness in Original Picture, Picture 1, Picture 2, Picture 3 with BPI, SSGS-8, INCOM, BISS.

N=70					
	SSGS-8 Shame	SSGS-8 Guilt	Social Comparison (INCOM Total Score)	Body Image (BISS Total Score)	BPI Total Score
Identification Original Picture	-.217	-.329*	-.165	.048	-.256*
Identification Edited Picture 1	-.137	-.178	-.043	.100	-.232
Identification Edited Picture 2	-.055	-.182	-.109	.055	-.229
Identification Edited Picture 3	-.119	-.116	-.019	.185	-.319*
Attractiveness Original Picture	-.099	-.236	-.015	.347*	-.300*
Attractiveness Edited Pic 1	-.085	-.180	-.203	.045	-.229
Attractiveness Edited Pic 2	-.075	-.197	-.110	.035	-.222
Attractiveness Edited Pic 3	-.065	-.176	-.213	.034	-.217

Note: all provided statistical values refer to rho (r)

* $p < .01$, ** $p < .001$ Significant after Bonferroni correction

Identification and Attractiveness: their relation to personality traits and dysphoria.

Identification in the original picture showed significant association to BPI total score ($r = -.256, p = .004$). Furthermore, the identification in Picture 3 showed negative association with BPI total score ($r = -.319, p = .008$). BPI total score correlations with identification and attractiveness in original and edited pictures are reported in Table 3. Attractiveness in the original selfie was associated with the Fear of Closeness subscale ($r = -.359, p = .002$). Attractiveness in the original picture showed a significant negative association with BDI total score ($r = -.300, p = .02$). All other data (identification in edited pictures and attractiveness in edited pictures) did not show significant associations.

Borderline Personality Traits: relations to Shame, Guilt, Social Comparison and Body Image.

BPI total scores as well as identity diffusion, primitive defence mechanisms, and fear of close relation subscales were positively associated with shame and guilt. Identity diffusion and primitive defence mechanisms and BPI total score were positively associated with social comparison and negatively associated with body image. Also, fear of close relation subscale results related to body image (Table 4).

Table 4. Spearman correlation between BPI, SSGS-8, INCOM, BISS.

	N=70			
	SSGS-8 Shame	SSGS-8 Guilt	Social Comparison (INCOM Total Score)	Body Image (BISS Total Score)
BPI Total Score	.607**	.438**	.432**	-.385**
Identity Diffusion (BPI)	.633**	.345*	.404**	-.333*
Primitive Defence Mechanisms (BPI)	.505**	.315*	.441**	-.459**
Reality Testing (BPI)	.206	.064	.144	-.239
Fear of Closeness (BPI)	.493**	.369*	.256	-.369*

Note: all provided statistical values refer to rho (r)

* p<.01, ** p<.001 Significant after Bonferroni correction

Borderline Personality Traits as mediators.

Two mediation models are presented to explore whether a psychopathological organization mediates the relation between guilt and identification, and between dysfunctional body image and attractiveness.

a) The first mediation model tested the mediation effect of BPI total score on the relationship between guilt and identification with the original picture. Guilt significantly predicted BPI total score, unstandardized path coefficient = 7.278, p <.001. In turn, BPI total score significantly predicted identification in the origi-

nal picture, unstandardized path coefficient = -.029, p <.05. The total unstandardized effect of guilt on identification was -.453, p <.01. BPI total score significantly mediated the relationship between guilt scores and identification in the original picture scores, a x b = -.208, 95% CI: -.46 – -.02. After accounting for the indirect effect, the direct effect of guilt became non-significant, unstandardized path coefficient = -.245, p =.199. The BPI score effect size measure for this total mediation effect is .07, i.e., 7% of the association between guilt and identification in the original picture scores can be attributed to BPD traits (Figure 2a.).

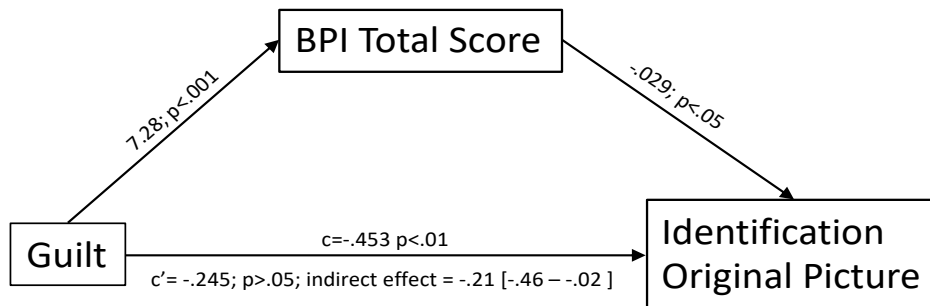


Figure 2a. The mediating role of borderline personality organization on the perceived identification in the original pictures (N =70). BPI= Borderline Personality Inventory.

b) The second mediation model investigated the mediation effect of BPI Fear of Closeness subscale on the relationship between body image scores (i.e., BISS total score) and attractiveness ratings of the original picture. Body image significantly predicted Fear of Closeness, unstandardized path coefficient = -.664, p <.01. In turn, Fear of Closeness scores significantly predicted attractiveness ratings of the original picture, unstandardized path coefficient = -.148, p <.05. The total unstandardized effect of the body image on attractiveness in the original picture

is .362, p <.01. BPI Fear of Closeness significantly mediated the relationship between body image and attractiveness in the original picture scores, a x b = .098, 95% CI: .004–.117 and the direct effect of body image remained significant, unstandardized path coefficient = .264, p <.05. The BPI subscale effect size measure for this total mediation effect is .08, i.e., 8% of the association between body image and attractiveness in the original picture scores can be attributed to BPD traits (See Figure 2b.).

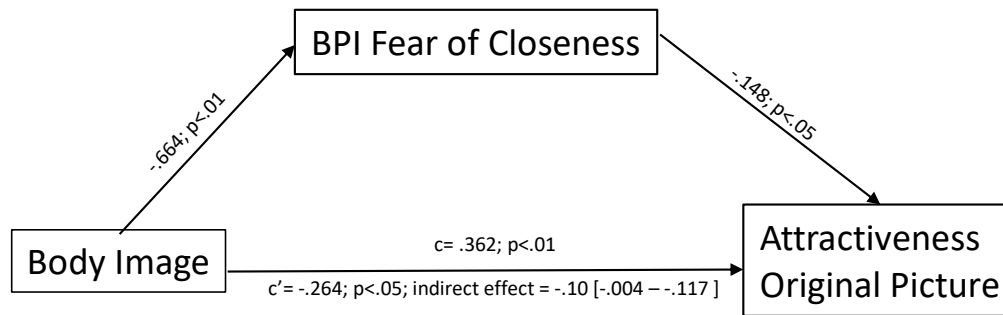


Figure 2b. The mediating role of borderline personality organization subscale “fear of closeness” on the perceived attractiveness in the original pictures (N =70). BPI= Borderline Personality Inventory.

Age and education level.

No significant differences in the associations between identification nor attractiveness (in original and edited pictures) emerged with shame, guilt, body image or social comparison questionnaires considering age and education level as covariates.

4 Discussion

This study investigated whether identification and attractiveness in filtered images and original ones are: related to each other (a), and associated to shame, guilt, body image, social comparison (b and c) in a pool of young women. We expect that identification and attractiveness in the original picture will be negatively related to the aforementioned variables (b), while high identification and attractiveness in the filtered picture will be positively associated with them (c). Finally, we explored if BPD dysfunctional traits as social isolation and fear of relationships mediated the association between identification and attractiveness in original pictures with levels of shame, guilt, negative body beliefs and social comparison tendencies reported by participants (d).

Correlations between identification and attractiveness show that in all the four pictures the two variables are positively, but not always significantly, associated. A high identification in the original picture debar the perceived attractiveness in the edited ones, as well as a high identification in the most edited picture is not associated with attractiveness in the original one. So, there are influences in the reciprocal association between the two variables depending on how much the subject recognizes herself in original or edited pictures. This data may say that once a young woman identifies in edited pictures her ideal beauty is markedly different from her real appearance. Literature claims that there is a risk for vulnerable individuals with high social comparison tendencies to fall victims of media unrealistic standards (Kleemans et al., 2018). Moreover, the use of social networks brought generation Z to a decline in face-to-face communication (Turner, 2015). For these reasons, the large use of them among young women (Seetharaman, 2015) stresses the importance of studying the effects of exposure to this virtual environment. Interestingly

a meta-analysis demonstrates that higher impact on body image satisfaction is mostly related to the view of contents posted by common users and peers (Huang et al., 2020), accordingly these might contribute to body satisfaction and social comparison. In the presented study, social comparison was not associated either with identification or with attractiveness of pictures. This result might be explained because the experimental stimuli consisted of judging personal pictures without the interactive behaviours with others. However, data partially confirms the research predictions that identification in the original picture resulted is negatively related to guilt. As guilt score is inversely related to identification in the original picture, it might be that high identification in personal pictures leads to low level of guilt. This result might say that an awareness of personal real self-image is associated with absence of guilt feelings. Attractiveness in the original picture resulted positively related to body satisfaction. It might be that body satisfaction is a protective trait against unrealistic beauty. Both identification and attractiveness in the original picture were negatively associated with depression. People with depression may feel like they are worthless, and they may not see positive qualities in themselves. Interestingly, obtained results suggest that identifying with the real image and finding this image attractive is a protective factor against depressive symptoms (Garvin et al., 2008). Finally, identification and attractiveness in the edited pictures did not show associations with any of the selected variables.

Regarding borderline organization, Kernberg’s model of BPD is considered with BPI questionnaire (Leichsenring, 1999). The research hypothesis considers dysfunctional psychological traits (higher BPD features) to be related to a higher identification and attractiveness in edited pictures compared to the original one. Moreover, higher BPD scores should be associated with higher levels of shame, guilt, social comparison and body image. Contrary to the advanced predictions, both identification in the original picture and in the most edited one resulted negatively related to BPI scores. Although we did not find discrepancies between the presence of BPD features and identification in edited or original pictures, this is consistent with the assumption that BPD may be associated with a pervasive dysfunctional iden-

tity and poor body awareness (Govern & Marsch, 2001). On the other part, as expected, BPD features resulted related to shame, guilt, dysfunctional social comparison and body dissatisfaction. These results are in line with the expectations, as BPD manifest a lack of body awareness and satisfaction (Bessenoff et al., 2016; Semiz et al., 2008), interpersonal difficulties (Salzer, et al., 2013), and it is potentially related to social comparison and rejection sensitivity (Foxhall et al., 2019). Interestingly, according to the examined scientific background, there is no accordance on guilt. Some authors claim that these patients are not used to experience guilt (Kernberg, 1967) but recent evidence supports dysfunctional behaviour in dealing with it (Gottlich et al., 2020), in line with the obtained results of the presented study.

Considering obtained results with specific features of Borderline organization, BPI fear of closeness assesses behaviors of avoidance in close relationship and it is negatively related to attractiveness in the original picture and to body satisfaction. These results may show that high presence of BPD is reflected in impaired self-esteem (attractiveness) and in personal recognition (identification).

Examining aspects of guilt and body image, significant mediation of BPI features on identification and attractiveness emerged. The influence of guilt on identification in the original picture is reduced, as obtained data show a total mediation of BPD features. In particular, high levels of guilt are associated with high scores in BPD features that predict a poor image identification. These data support the hypothesis that BPD organization have a paramount role in the degree of self-recognition in the original picture. A second mediation model showed that the fear of close relation mediates the association between body satisfaction and perceived attractiveness. Taken together, the results are in line with literature showing that BPD symptomatology is associated with body dissatisfaction (Sansone et al., 2010), to body dissociative symptoms (Bekrater-Bodmann et al., 2016) up to the worsen cases of comorbidities with dysmorphic disorders (Semiz et al., 2008). It is interesting that the first model shows a mediation of the totality of BPD features in the deficient identification of the subject and in the linked experience of guilt. The second model points out that is specifically the fear of closeness that explain the relation between perceived attractiveness and body satisfaction. This is in line with the need of self-esteem to look for relationship and avoid social isolation.

An important aspect to consider is the role of the participants' developmental phase on the presented results. Given the associations between BPI scales and age variable, concerns on results interpretation may include the transience of maladaptive borderline traits in youth given that personality is not fully developed. According to this view, current results should be interpreted as transient and not maintained into adulthood. However, partial correlations were conducted with age as controlled variable. Results showed that BPI is associated with guilt, body image and social comparison independently from age effects. This is in line with the common agreement within clinicians that a predictive diagnosis of psychopathological functioning

and organization is also possible in youth and adolescence and not only in adult individuals (Winsper et al., 2016).

Limitations of the current study are that the sample was composed exclusively by woman, due to the differences in editing pictures between male and female subjects. Further, the different quality of pictures is due to the variety of cameras. The time interval between the first and the second phase of the experiment is not the same for all participants (ranging from 3 to 14 days). Furthermore, body image comparison has not been properly assessed: the selected instruments assessing body image and social comparison (BISS and INCOM) should had provided more specific information regarding the processes and motivators of personal image comparisons with others. Of importance, all the reported results should be interpreted correlationally only and not causally.

To conclude, it could be that BPD influences the level of identification and attractiveness in personal pictures. High levels of fear of relations might mediate body satisfaction and perceived attractiveness, possibly enhancing avoidance of others. As a whole, results demonstrate associations between identification and attractiveness in edited and original pictures. Dysfunctional traits as guilt, body image and dysphoria are significantly associated with identification and attractiveness in pictures. These results are more significant when considering condition with altered interpersonal functioning and body awareness. Finally, BPD features mediate either the relation between guilt and identification and the association between body image and attractiveness in original pictures. These aspects need further examination in relation to interpersonal interactions within social networks.

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*Corresponding author

Gea Elena Spada
 Università Vita-Salute San Raffaele
 Via Olgettina, 60 Segrate
 Mobile: +39 3920935668
 spada.gea@hsr.it

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Post-Traumatic Stress Symptoms After Corona Virus Disease 19 (COVID-19): The Role of Gender and Distressing Social Media Exposure As Risk Factors

Adelais Reichmann¹, Ines Bauda¹, Bettina Pfeffer¹, Andreas Goreis^{2,3}, Mercedes Bock⁴, Paul L. Plener^{1,5} & Oswald D. Kothgassner^{1*}

¹ Department of Child and Adolescent Psychiatry, Medical University of Vienna, Vienna, Austria

² Department of Clinical and Health Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria

³ Outpatient Unit for Research, Teaching and Practice, Faculty of Psychology, University of Vienna, Vienna, Austria

⁴ Social Psychiatric Services, City of Vienna, Vienna, Austria

⁵ Department of Child and Adolescent Psychiatry and Psychotherapy, University of Ulm, Ulm, Germany

Abstract

Direct (e.g. being in contact with the virus) and indirect traumatic experiences (e.g. Distressing Social Media Exposure: DSME) of the COVID-19 pandemic led to a variety of psychological and psychosocial consequences. They represent COVID-19-related Posttraumatic Stress Symptoms (PTSS) risk factors, whereby their interactions and their relations to gender have not yet been explored in detail.

1368 participants filled out an online survey between January and March 2021. Risk ratios and 95% CIs were calculated to estimate the magnitude of risk related to a self-reported COVID-19 infection, self-reported COVID-19 symptom severity, gender and DSME on COVID-19-related PTSS. A 2x2x2 ANOVA was used to determine main and interaction effects of a self-reported COVID-19 infection, gender and DSME on COVID-19-related PTSS.

174 (13%) participants reported COVID-19-related PTSS, which was more prominent in female ($n=127$; 15%), than in male participants ($n=49$; 9%). Individuals, who reported to have or have had a COVID-19 infection showed a significantly higher risk ($RR=2.50$, $LCI=1.87$, $UCI=3.32$) for COVID-19-related PTSS, especially when severe COVID-19 symptoms were reported ($RR=4.01$, $LCI=2.66$, $UCI=6.03$). Whereas non-infected females were at higher risk than males ($p<.001$, $LCI=16.96$, $UCI=23.81$), a non-significant mean difference of 6.54 ($p=.159$, $LCI=-14.62$, $UCI=1.54$) between males and females was found at self-reported COVID-19 infections. DSME increased the Risk Ratios by 2.81 ($LCI=2.08$, $UCI=3.79$) and was more prominent in males.

The results from this study indicate that self-reported severe COVID-19 symptoms, DSME and female gender are risk factors for COVID-19 related PTSS. This underlines the need for effective public health measures for prevention.

Keywords: COVID-19, traumatic stress, crisis, pandemic, social media

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1 Introduction

In December 2019, the World Health Organisation (WHO) published concerns on a new Coronavirus (SARS-CoV2) that began to spread in November 2019 in Wuhan, China. The novel Coronavirus disease (COVID-19) caused by SARS-CoV2 showed high transmission and fatality rates. In beginning of March 2020, the number of COVID-19 cases increased by a 13-fold and the number of affected countries tripled within two weeks. Due to the concerns over its geographic spread, the WHO declared the outbreak of SARS-CoV2 a worldwide pandemic (WHO, 2020). Accordingly, governments worldwide adopted different

approaches to contain SARS-Cov2, such as lockdown strategies, strict quarantine measures, curfews, social distancing measures as well as closing of public places and events. In addition, there was also a change in recommendations concerning hygiene measures, e.g. wearing a mask in public areas or supermarkets, frequent hand washing or using disinfecting agents (Regmi & Lwin, 2021). Nevertheless, within 18 months of the COVID-19-pandemic more than 200 million people all over the world were infected and nearly 4.5 million people died from COVID-19 (WHO Coronavirus (COVID-19) Dashboard, 2021).

The effects of the pandemic were varying. Besides affecting the health of those who were infected, general population sam-

ples showed an impact on mental health as well. This has various reasons like losing a loved one, changing of the work like having to work from home or unemployment (Cénat et al., 2021). This is underlined by the results of Nochaiwong et al. (2021), showing that during the pandemic the global estimate for depression was 28%, 26.9% for anxiety and 24% for PTSS and are now higher than before the COVID-19 pandemic (Steel et al., 2014; Zhou et al., 2021). In their meta analysis, including studies from 1980 to 2013, Steel et al. (2014) reported a lifetime prevalence of 29.1% for mental illness, 9.6% for mood disorders and 12.9% for anxiety disorders in adults. PTSS showed a prevalence of 14% in the Canadian population in Reynolds et al. (2008)s study. This corresponds to results from previous outbreaks of infectious diseases (e.g. Ebola, SARS, MERS-Cov, Zika, Influenza), showing high prevalence of post-traumatic stress symptoms in the respective aftermath, with a pooled prevalence of 17% (Zhou et al., 2021). For the COVID-19-pandemic it is still unclear how many people will suffer from post-traumatic stress. Multiple studies were reporting rates from 4% to 96% (Bo et al., 2021; Cai et al., 2020; Chen et al., 2021; Einvik et al., 2021; Horn et al., 2020; Ismael et al., 2021; Janiri et al., 2021; Khademi et al., 2021; Mazza et al., 2020; C. Wang et al., 2020). Additionally, evidence is scarce regarding the role of direct exposure to COVID-19 (e.g., being infected with COVID-19) such as by assessing the role of severity of COVID-19 infection (Chamberlain et al., 2021), indirect exposure (e.g., knowing someone who is COVID-19 infected), Distressing Social Media Exposure (DSME) and individual factors, such as gender (Janiri et al., 2021; Zhang et al., 2021), in the development of PTSS (Wang et al., 2021).

Post-traumatic stress symptoms (PTSS) result from experiencing a traumatic event, such as natural disasters, violent assaults, or other negatively experienced events that are outside the realm of common human experience (Deja et al., 2006). COVID-19 related PTSS refers to the consequences of the COVID-19 pandemic on the population, which is often interpreted as a collective traumatic event due to its global spread with possible long-term harmful consequences (e.g. Long COVID-19) (Houben-Wilke et al., 2022; Sanchez-Gomez et al., 2021). Symptoms of PTSS occur early after the event and are in their nature consistent with those of a post-traumatic stress disorder (Sparks, 2018). Studies have previously shown that viral outbreaks may have the potential to be experienced as disturbing and traumatic (Deja et al., 2006) and can lead to trauma-related symptoms such as intrusion, avoidance and hyperarousal (Deja et al., 2006). Trauma may result in a clinically significant post-traumatic stress disorder (Sparks, 2018), but with a prevalence rate of 8%, it is more often the exception than the rule (Tsao et al., 2006), especially when considering the high lifetime exposure rate to trauma, ranging from 51% to 60% in the American population (Kessler, 1995). Following this, PTSS research appears especially relevant as it addresses a part of the population which is experiencing troubling symptoms due to a traumatic event, despite not meeting the diagnostic criteria for PTSD (Erickson et al., 2013).

One characteristic of the current pandemic is that COVID-19 is the first worldwide pandemic in the age of social media platforms, such as Facebook, Instagram, YouTube, Twitter or TikTok. Several studies show a relationship between social media use, smartphone use and rates of depression, anxiety and post-traumatic stress (Bendau et al., 2021; Neill et al., 2021; Pieh et al., 2021; Wang et al., 2020; Yang et al., 2021) whilst research on PTSS is lacking. Social media use, as one of several types of smartphone use, has been found to be particularly relevant to mental health (Twenge & Farley, 2021). Research indicates that the time spent on social media (>2 hours per day) or checking social media (five times a day) were significantly associated with anxiety, higher likelihood of experiencing PTSD and a decrease in overall mental health (Bendau et al., 2021; Neill et al., 2021). This effect was seen across all age-groups (Yang et al., 2021).

The aim of the current study was to investigate the effect of potential risk factors (symptom severity, gender, social media exposure) for developing COVID-19-related PTSS during the COVID-19 pandemic in a German speaking sample. Furthermore, we hypothesize that there are specific interaction effects of risk factors for COVID-19-related PTSS. Consequently, we set our focus on the following research questions:

Previous studies showed a strong association between a reported COVID-19 disease and COVID-19-related PTSS (Bridgland et al., 2021; Ren et al., 2020; Wang et al., 2020) and has linked the severity of a COVID-19 infection with a greater psychological impact (Horn et al., 2020). The purpose of this study is to provide detailed information on whether a diagnosis with COVID-19 alone is sufficient for increased PTSS, when symptom severity is considered in detail, and whether there are differences in PTSS gradients between levels of symptom severity. Therefore, our first research question addresses the following:

- (1a) Does a self-reported COVID-19 infection influence COVID-19 related PTSS?
- (1b) Is COVID-19 related PTSS intercorrelated with self-reported COVID-19 symptom severity?

An important risk factor for developing PTSD after traumatic exposure is female gender (Irish et al., 2011a). However, the exact impact of the pandemic on PTSS is unclear. While Brivio et al. (2021) defined gender as an essential discriminatory variable in this scenario, with women as the more affected part, Cénat et al. (2021) cites women and men as equally burdened. Linking the evidence from both studies while including self-reported COVID-19 infection would lead to the hypothesis, that among *uninfected* individuals, females are thought to be at increased risk (Brivio et al., 2021), while *infected* individuals are equally at risk (Cénat et al., 2021).

- (2) How do women and men differ regarding COVID-19 related PTSS, and what roles does the self-reported infection status play regarding the PTSS outcome?

Moreover, as the pandemic is portrayed on various social media sites (Goreis & Kothgassner, 2020), a study by Wang et al. (2021) showed that frequency of media exposure is

related to COVID-19 related PTSS. In this study, the frequency using social media is surveyed and additionally elicited whether the perceived COVID-19-related social media *content* is reported as predominantly distressing. The impact of distressing social media exposure will be determined with the following research question:

- (3) What impact does DSME show on reported COVID-19 related PTSS severity?

Therefore, we propose that the defined risk factors do not act as individual phenomena but interact with each other and mutually foster each other. Therefore, we state the following research question:

- (4) What main and interaction effects do all three factors show on COVID-19 related PTSS?

This study is – to our knowledge – the first study combining one of the most important direct traumatizing factors (being infected with the virus) with individual factors, such as gender and indirect effects, such as knowing someone who is COVID-19 infected or experiencing DSME (Wang et al., 2020) and looking into the interplay between these factors. Traumatic experiences may lead to a variety of psychological and psychosocial consequences, but since PTSS has been shown to be the predominant one, it will be considered in depth for possible prevention measures (Norris et al., 2002).

2 Method

2.1 Procedure and Participants

For this observational, cross-sectional study, participants were recruited from the end of January to the end of March 2021 via various Facebook groups, Instagram channels and Reddit forums. Prior to this, the study protocol (no. 2171/2020) was reviewed and approved by the ethics committee of the Medical University of Vienna.

To take part, participants had to be at least 14 years of age and had to approve to the General Data Protection Regulation (GDPR)-compliant data storage and utilization of their given data. After providing informed consent, the survey was started. Out of 1384 participants, 16 had to be excluded from the analysis due to a large number of missing values. Missing values that accounted for less than 10% of the total scale were compensated by imputing the median per participant per scale, to form a valid sum score. For individuals who identified themselves as diverse ($n = 9$) or did not specify their gender ($n = 7$), it was not possible to achieve a satisfactory group size to make representative statements regarding inter- and intra-individual group differences. For this reason, these individuals had to be excluded from the analysis.

Outliers were examined but did not lead to further exclusion. This resulted in a final sample size of $N=1368$ German-speaking participants, out of which 524 (38%) were male and 844 (62%)

were female. 361 (26.4%) participants were 20-29 years and 303 (22.1%) 30-39 years old. The minority of people were 14 – 19 years old ($n=84$; 6.1%) as well as 60 years and older ($n=132$, 9.6%). 195 (14%) of the analyzed sample reported to have or have had a self-reported COVID-19 infection.

2.2 Materials

Sociodemographic variables. Concerning demographic data, age, gender, highest level of education, occupational status, monthly income and country of residence were recorded, as well as data regarding the relationship status.

Frequency and duration of digital social media use as well as receipt of news and current information were collected. To measure the frequency of social media use, subjects reported the number of minutes spent on social media daily or weekly, depending on their pattern of use.

Impact of Event Scale with modifications for COVID-19 (IES-COVID-19). This self-report questionnaire was used to estimate COVID-19 related PTSS in terms of short- and long-term impact on participants. Three subscales with 7 items each were used to measure intrusion (e.g. “Other things kept reminding me of the COVID-19 outbreak.”), avoidance (e.g. “I keep trying not to think about this pandemic.”) and hyperarousal (e.g. “I’ve been easily irritable and jumpy since the pandemic started.”). All items are rated on a four-point Likert scale (0 = *not at all*, 1 = *rarely*, 3 = *sometimes*, 5 = *often*). The subscales are formed by summing values, whereas the total score is calculated by using a regression equation. This is due to the intercorrelation of the symptoms over time (Horowitz et al. 1986). According to Maercker and Schützwohl (1998), the diagnostic test score formula is derived from the following regression equation: Diagnostic score = $-0.02 * \text{intrusion} + 0.07 * \text{avoidance} + 0.15 * \text{hyperarousal} - 4.36$. A value > 0 is to be interpreted as a clinical meaningful cut-off of PTSS and a high scores indicate a stronger psychological influence of the COVID-19 outbreak (Vanaken et al., 2020). The psychometric properties of this scale showed excellent internal consistency of the IES-COVID-19 total sumscore ($\alpha=.92$), as well as for the subscales Intrusion ($\alpha=.86$), Avoidance ($\alpha=.86$) and Hyperarousal ($\alpha=.87$).

Distressing Social Media Exposure. Subjects were asked about the frequency of social media exposure (“How often do you use social media per day or per week?”) and their total consumption time (“How many minutes in total do you use social media per day or per week?”). If used daily, participants indicated frequency and duration per day; if used less than daily, frequency and duration was indicated per week. If weekly use was indicated, it was adjusted to correspond the daily intake. To get an outline of the use of the various platforms, the use/non-use of the following social platforms was queried: Facebook, Twitter, Instagram, WhatsApp, Telegram, Snapchat, Reddit, TikTok, Tumblr, Pinterest, LinkedIn, Youtube. The extent of perceived distress due to general media exposure with regards to COVID-19 was assessed

with the use of a single bivariate item, asking if participants have seen content on social media related to COVID-19 and the pandemic, that they can't let go of or found predominantly distressing.

Self-reported COVID-19 health status. The self-reported COVID-19 infection status of the respondents was assessed using up to two items: The respondents were asked if they had experienced a COVID-19 infection themselves. If symptoms were reported, participants were asked to self-assess the severity according to the list of symptoms displayed. Categories ranged from no symptoms, mild to moderate symptoms (cough and sore throat, up to breathing problems and fever), severe symptoms (cough, sore throat, breathing problems, fever, lung infection) to severe symptoms with hospitalization. These symptom severity ratings represent a self-assessment of the affected participants and will therefore be labeled as "self-reported" in the following paragraphs. To be able to exclude possible influencing factors, it was also asked whether relatives or people close to them are or have been severely ill with COVID-19 and whether subjects had witnessed dire situations or circumstances regarding COVID-19 or the pandemic, such as seeing a loved one suffer from the disease.

2.3 Statistical Analysis Plan

Risk Ratios were calculated using the IES-COVID-19 cut-offs to determine the extent of the risk factors surveyed. Confidence intervals determined the significance regions. A 2x2x2 ANOVA with the factors (self-reported infection no/yes) x (gender female/male) x (DSME no/yes) was used to determine the main and interaction effects on COVID-19-related PTSS. The focus of the analysis was on the influence of the three independent variables on the overall sum score of the IES-COVID-19 scale: A comparison was made between reported COVID-19 infected and non-infected subjects, males and females and the information on DSME. Chi-squared test were performed to test the group differences for significance. The Bonferroni correction was used to avoid alpha error accumulations. Post hoc tests and simple contrast estimators with a Bonferroni correction were used for analyzing in-depth group differences.

Power analysis using G*Power (Faul et al., 2007) showed that to find a small effect of $f = 0.1$ with 80% power and an alpha level of 0.05, it was necessary to sample at least 787 people in factorial ANOVAs. This power calculation holds for main effects (e.g., the impact of self-reported infection or gender) and interactions, as the denominator degrees of freedom were all 1 (all factors had 2 factor levels).

SPSS version 27 was used for the analysis. Additional testing of the calculation using the robust t3way anova (WRS2 package) with R (Version 4.1.2.) yielded comparable results. An alpha of 5% was considered statistically significant.

3 Results

The final sample consisted of 1368 participants, out of which the majority was female (61.7%), was between 20 and 29 years old (69.1%), stated to be in a relationship of some kind (72.0%) and was highly educated (48.1%). Austrian residents were the most likely to participate in this study (83.4%) and had a steady income of 1501 to 3000 Euro per month (35.8%). A detailed description is found in table 1.

Table 1. Sample characteristics

Characteristics	n	(%)
Gender		
Female	844	(61.7)
Male	524	(38.3)
Age in years		
14–19	84	(6.1)
20–29	361	(26.4)
30–39	303	(22.1)
40–49	282	(20.6)
50–59	205	(15.0)
60–69	86	(6.3)
70–79	29	(2.1)
≥ 80	17	(1.2)
Relationship status		
single	264	(19.3)
in a relationship	487	(35.6)
married/registered partnership	506	(37.0)
divorced	75	(5.5)
widowed	8	(0.6)
other	28	(2.0)
Highest level of education		
no compulsory education	7	(0.5)
compulsory education	79	(5.8)
apprenticeship	210	(15.4)
high school diploma	211	(15.4)
high school diploma plus apprenticeship	43	(3.1)
Bachelor or equivalent studies and higher	658	(48.1)
Monthly income		
Less than 500 €	102	(7.5)
501 € to 1100 €	264	(19.3)
1101 € to 1500 €	282	(20.6)
1501 € to 3000 €	490	(35.8)
more than 3000 €	177	(12.9)
no regular income	45	(3.3)
Country of residence		
Austria	1141	(83.4)
Germany	192	(14.0)
other	35	(2.5)

Out of the total sample, 14% ($n=194$) reported to have been infected with COVID-19; of these, 10% ($n=19$) reported no symptoms, 64% ($n=124$) reported mild-moderate symptoms, 20% ($n=38$) reported severe symptoms and 7% ($n=13$) stated severe symptoms requiring hospitalization.

Depending on the severity of the self-reported symptoms results in men and woman differed ($X^2(4, N=1359)=14.131, p=.007$). The widest difference was found in the reporting of no self-reported symptoms and particularly severe self-reported symptoms with hospitalization: 7% ($n=7$) of women and 13% ($n=12$) of men were infected with no self-reported symptoms ($p=.002$). Mild-moderate self-reported symptoms were slightly more common in women ($n=68; 67%$) than in men ($n=56; 60%$) ($p=.028$). Similarly, this was observed for severe self-reported symptoms, where women were affected in 22% ($n=22$) of cases and men in 17% ($n=16$) of cases ($p=.617$). However, in the case of severe self-reported symptoms with hospitalization, men ($n=9; 10%$) were more frequently impacted than women ($n=4; 4%$; $p=.021$).

Furthermore, 174 (13%) participants scored an IES-COVID-19 value of >0 , indicating having a COVID-19-related PTSS. COVID-19-related PTSS was more prominent in female ($n=127; 15%$), than in male participants ($n=49; 9%$).

Most of the participants used social media platforms, such as Facebook ($n=1196; 87%$), Instagram ($n=711; 52%$), Youtube ($n=912; 67%$), Pinterest ($n=289; 21%$), Twitter ($n=279; 20%$), LinkedIn ($n=209; 15.3%$), Snapchat ($n=197; 14.4%$) and com-

munication applications like WhatsApp ($n=1205; 88%$) and Telegram ($n=339; 25%$). Other platforms were used by less than 10% of the participants. On average, 2 hours per day were spent using social media platforms (M in minutes =120.30; $SD=128.62$). The majority of participants spent at least 1 hour ($n=979; 72%$), 22% even more than 2 hours daily ($n=300$) on social media platforms. Only 95 (7%) of participants reported spending less than half an hour per day on social media. On average, female participants spent 1.8 hours ($M=1.88; SD=2.12$) and male participants 2.2 hours ($M=2.16; SD=2.16$) daily on social media platforms. Mean values and correlations of the main variables and are displayed in table 2.

3.1 Self-Reported COVID-19 Infection and COVID-19-Related PTSS

All participants who reported a COVID-19 infection showed a 2.5 times increased risk to score above the cut-off criterion COVID-19-related PTSS, compared to non-infected participants (see figure 1). When classified according to self-reported COVID-19 symptom severity, the sole infection (without symptoms) with COVID-19 did not increase the risk for COVID-19-related PTSS. Participants self-reporting mild to moderate symptoms showed a 1.8 times higher risk for scoring above the cut-off for COVID-19-related PTSS. However, when self-reported symptoms were severe, the likelihood for COVID-19-related PTSS above the cut-off increased to a 4-fold risk as compared

Table 2. Spearman's Rho Correlation of variables and main outcomes

Variable	n	M	SD	1	2	3	4	5	6	7	8	9
Self-reported COVID-19 Infection ^a	1359	0.14	0.35	–								
Self-reported COVID-19 Symptom Severity ^b	1359	1.32	0.83	.99**	–							
Gender ^c	1359	0.38	0.49	.08**	.08**	–						
DSME ^d	1356	0.43	0.49	.13**	.14**	-.16	–					
Hours on social media platforms	1294	1.90	1.80	-.01	-.01	.05	.05	–				
COVID-19 related PTSS (Cut-off criterion) ^e	1355	0.13	0.33	.17**	.18**	-.09**	.19**	.02	–			
COVID-19 related PTSS Severity	1355	-2.10	1.68	.15**	.16**	-.35**	.34**	-.02	.58**	–		
Age in years	1359	39.24	15.26	.10**	.10**	.07*	-.10**	-.31**	.04	-.05	–	
Highest level of education ^f	1202	3.80	1.43	-.04	-.04	-.24**	.07*	-.07*	-.13**	.06	-.19**	–
Monthly Income ^g	1352	3.18	1.28	-.01	-.01	.09**	-.11**	-.18**	-.05	-.10**	.44**	.08**

^a 0 = reported no COVID-19 Infection and 1 = reported COVID-19 Infection

^b 1 = reported no COVID-19 Infection, 2 = reported COVID-19 Infection/asymptomatic, 3 = reported mild symptoms, 4 = reported severe symptoms, 5 = reported severe symptoms with hospitalisation

^c 0 = female, 1 = male

^d 0 = no DSME, 1 = DSME

^e 0 = no PTSS, 1 = PTSS (value was recoded following IES-COVID-19 regression values <0 for no PTSS and >0 equals PTSS)

^f 0 = no compulsory education, 1 = compulsory education, 2 = apprenticeship, 3 = high school diploma, 4 = high school diploma and apprenticeship, 5 = Bachelor or equivalent studies and higher

^g 0 = no income, 1 = less than 500 €, 2 = 501 € to 1100 €, 3 = 1101 € to 1500 €, 4 = 1501 € to 3000 €, 5 = more than 3000 €

* $p < .05$. ** $p < .01$.

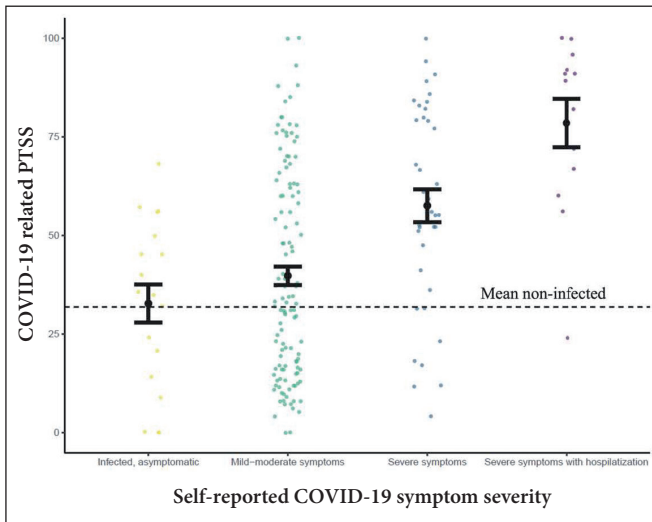


Figure 1. Mean differences in self-reported COVID-19 symptom severity regarding COVID-19 related PTSS sum scores.

Note. Reported numbers are mean differences in COVID-19-related PTSS. Graphs show IES-COVID-19 means and standard error of the mean. Dotted line represents the mean of all participants reporting to have had no COVID-19 infection.

to non-infected participants and to a 7-fold risk when patients showed severe self-reported symptoms and were hospitalized.

As seen in figure 1, COVID-19-related PTSS values were similar in self-reported non-infected individuals ($M=31.84$; $SEM=0.67$) and in patients reporting an asymptomatic COVID-19 infection ($M=32.68$; $SEM=4.82$). In patients with self-reported mild-moderate symptoms, mean values were higher compared to self-reported non-infected or infected, but self-reported asymptomatic patients ($M=39.73$, $SEM=2.34$). Patients suffering from self-reported severe symptoms with hospitalization showed markedly higher levels of COVID-19-related PTSS ($M=57.51$; $SEM=4.18$ and $M=78.46$; $SEM=6.12$, respectively).

There was a non-significant increase in COVID-19-related PTSS between self-reported no COVID-19 infection and self-reported asymptomatic COVID-19 infection (mean difference: 0.06, $p=1.000$, $LCI=-1.12$, $UCI=1.01$). Similarly, the difference between self-reported asymptomatic COVID-19 infection and self-reported mild-moderate symptoms was marginal (mean difference: 0.41, $p=.080$, $LCI=-0.84$, $UCI=0.02$). The comparison between self-reported mild-moderate symptoms and self-reported severe symptoms yielded significant group differences (mean differences: 1.23, $p\leq.001$, $LCI=-2.13$, $UCI=-0.42$). The comparison between self-reported severe symptoms and self-reported severe symptoms with hospitalization yielded a weakly non-significant difference (mean differences: 1.42, $p=.068$, $LCI=-0.05$, $UCI=2.90$).

3.2 Gender and COVID-19-Related PTSS

As compared to women, men face a 1.4 times higher risk to experience COVID-19-related PTSS when a COVID-19 infection was reported (see figure 3). Notably, in the non-infected population, the probability of suffering from COVID-19-related PTSS above the cut-off was 3.4 times higher in women as compared to men. When compared to non-infected individuals, the risk for infected individuals to score above the cut-off for COVID-19-related PTSS was 1.6 higher for women and 7.4 times higher for men.

Interestingly, 11% ($n=122$) of the individuals who have not reported a COVID-19 infection scored above the cut-off for COVID-19-related PTSS, which seems especially relevant for women. As seen in figure 2a, simple contrast estimators with a Bonferroni correction showed significant mean difference of 20.39 ($p\leq.001$, $LCI=16.96$, $UCI=23.81$) between self-reported non-infected males and females and a non-significant difference of 6.54 ($p=.159$, $LCI=-14.62$, $UCI=1.54$) between males and females when a COVID-19 infection was reported.

3.3 Distressing Social Media Exposure and COVID-19-Related PTSS

Individuals who reported a COVID-19 infection were more likely to report DSME (59%; $n=114$) compared to non-infected (40%; $n=464$), whereas time spent on social media differed barely (self-reported COVID-19 infection: $M=1.95$; $SD=1.87$; Non-infection: $M=2.02$; $SD=2.19$). If DSME was reported, 20% ($n=117$) of participants scored above the cut-off for COVID-19-related PTSS. Only a small number of participants (7%; $n=56$) suffered from COVID-19-related PTSS without DSME.

When DSME was reported, the risk to score above the cut-off for COVID-19-related PTSS was found to be increased by a 2.8-fold, as seen in figure 3. Simple contrast estimators with a Bonferroni correction yielded a significant mean difference of 18.39 ($p\leq.001$, $LCI=20.79$, $UCI=15.99$) between DSME and no DSME in COVID-19-related PTSS.

As seen in figure 2a, both genders showed significantly increased COVID-19-related PTSS values when DSME was reported (females: mean difference=2.67, $p\leq.001$, $LCI=-8.63$, $UCI=3.31$; males: mean difference=29.59, $p\leq.001$, $LCI=23.15$, $UCI=36.02$), but there was no significant gender difference (mean difference=6.54, $p=.159$, $LCI=-14.62$, $UCI=1.54$).

3.4 Influence of Self-Reported COVID-19 Infection, Gender and DSME on COVID-19-Related PTSS Severity

To test whether there were significant differences between self-reported COVID-19 infection, genders and DSME in the manifestation of COVID-19-related PTSS severity, a univari-

ate analysis of variance was calculated, using age as a covariate. The total model was found to be significant ($F(8,1343)=65.568$, $p \leq .001$). As shown in table 3, gender predicted significant differences in COVID-19-related PTSS severity ($F(1,1343)=15.433$, $p \leq .001$), as well as a self-reported COVID-19 infection ($F(1,1343)=42.807$, $p \leq .001$) and DSME ($F(1,1343)=139.352$, $p \leq .001$). Interaction effects of males and females and a self-reported COVID-19 infection indicated significant differences in PTSS symptom severity ($F(1,1343)=28.324$, $p \leq .001$), just as the interaction of males and females with DSME ($F(1,1343)=19.143$, $p \leq .001$) and a self-reported COVID-19 infection and DSME ($F(1,1343)=8.028$, $p=.033$). Age did not show any effects on COVID-19-related PTSS severity ($F(1,1343)=0.111$, $p=.739$).

4 Discussion

The aim of this study was to evaluate potential risk factors for COVID-19-related PTSS in the context of the COVID-19 pandemic. The main question was whether a self-reported COVID-19 infection leads to significant differences in COVID-19-related PTSS and, if so, whether self-reported symptom severity can predict these differences. Furthermore, gender differences concerning COVID-19-related PTSS were analyzed. In addition to that, we examined whether the consumption of social media content affects the participants' trauma-related COVID-19 stress symptoms scores.

The analyses have shown that a self-reported COVID-19 infection increased the likelihood of reporting COVID-19-related PTSS. A thorough examination has further revealed that the presence of a COVID-19 infection alone, as well as self-reported mild-moderate symptoms, had little impact on the self-reported severeness of COVID-19 related PTSS symptomatology, but the presence of self-reported severe COVID-19 symptoms, as well as hospitalization, significantly increased the likelihood of COVID-19 related PTSS. When considering the effect of gender, women were exposed to a higher risk of COVID-19-related PTSS among the non-infected participants. However, there was no significant difference between gender when a COVID-19 infection was reported. Additionally, an association between DSME and COVID-19-related PTSS could be shown. Based on the analysis of the data, it is reasonable to assume that heightened DSME increases the likelihood of developing COVID-19-related PTSS. Concerning gender, both males and females showed a higher risk to score above the cut-off for COVID-19-related PTSS when DSME was reported. Nevertheless, values increased considerably greater in men. Regardless of gender, it has been shown that high DSME levels interact with a self-reported COVID-19 infection and possibly lead to particularly high COVID-19-related PTSS scores.

Previous studies showed a strong association between a self-reported COVID-19 disease and increased COVID-19-related PTSS (Bridgland et al., 2021; Ren et al., 2020; Wang et al., 2020). Furthermore, it was reconfirmed that a confrontation with

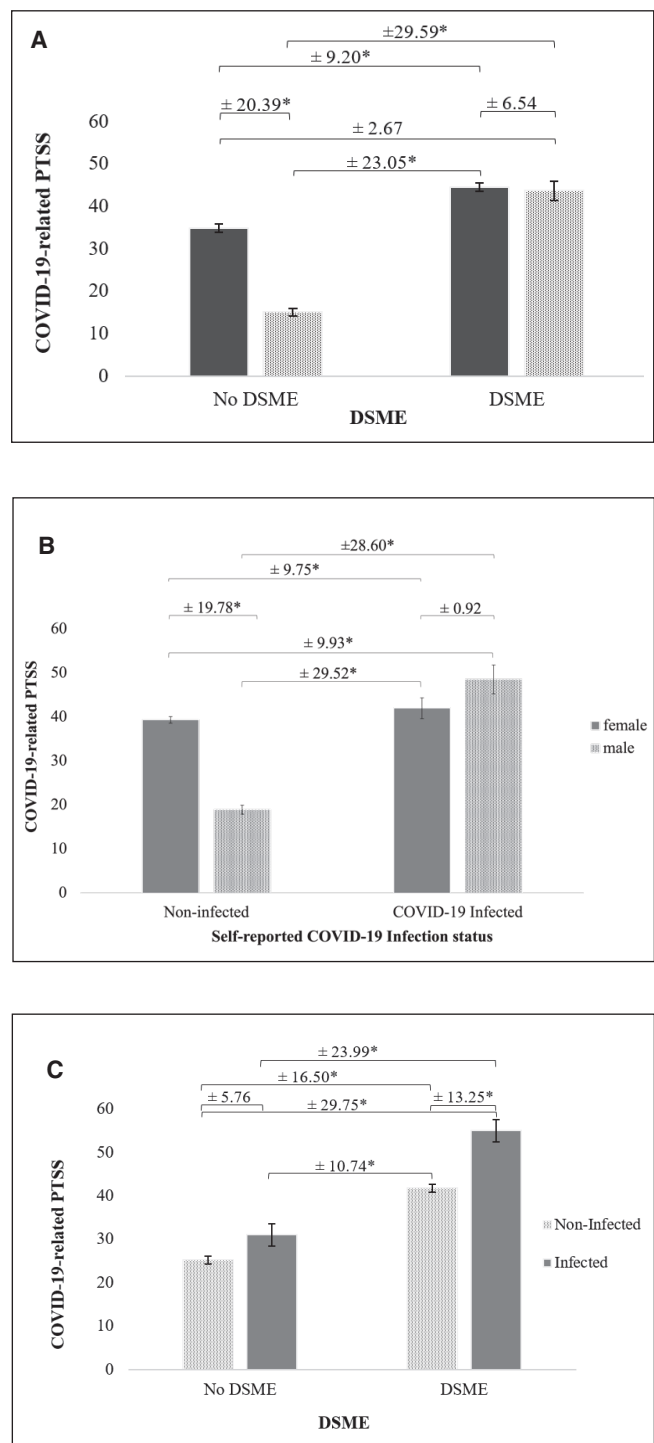


Figure 2ABC. Mean differences of A) self-reported infection status and gender, B) DSME and gender and C) DSME and self-reported infection status regarding COVID-19 related PTSS.

Note. Reported numbers are mean differences in COVID-19-related PTSS. Bar graphs show IES-COVID-19 means and standard error of the mean. Bonferroni adjustment was used.

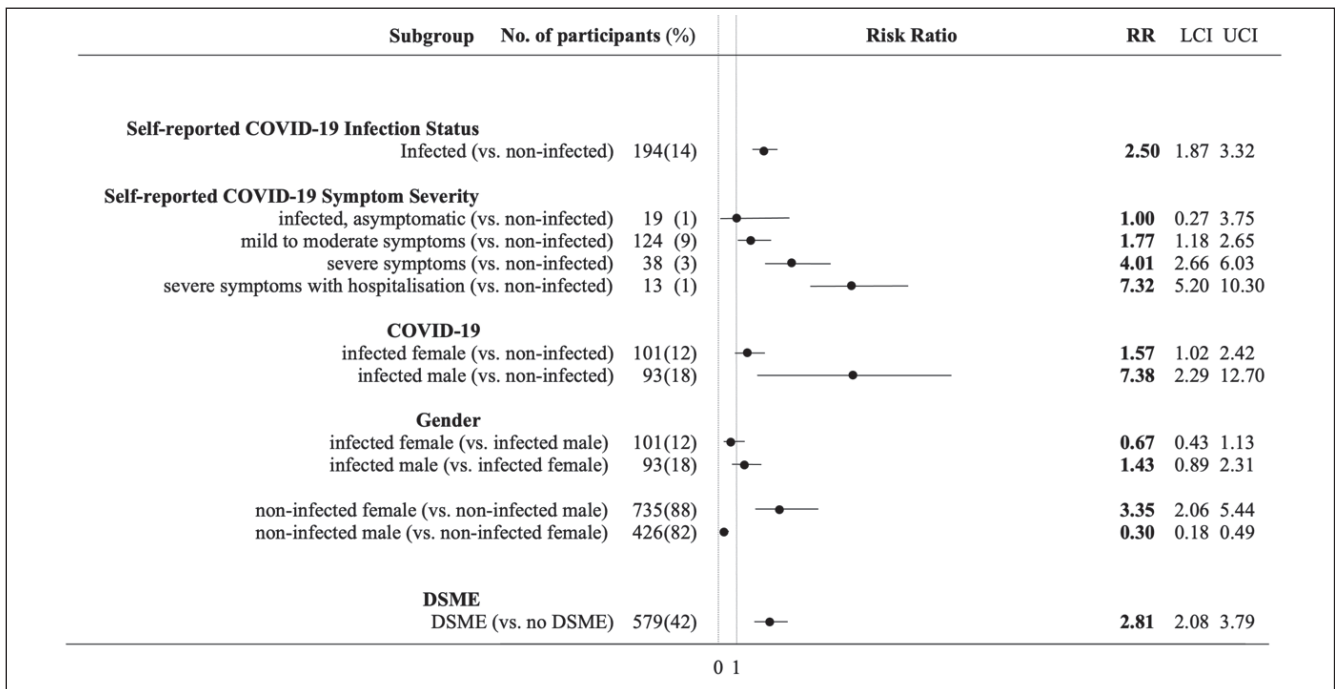


Figure 3. Risk Ratios on COVID-19-related PTSS.

Note. Risk ratios were calculated and presented using their CIs. Values <1 indicate an increased risk for the respective category. Reference groups are indicated in parentheses. Overall sample size is $N = 1355$, except for the comparison DSME vs. no DSME ($n = 1352$).

COVID-19, in this case, an infection yielded higher COVID-19-related PTSS values than an indirect confrontation (e.g. solely DSME) (Bridgland et al., 2021). A novelty in this study is the differentiation of self-reported COVID-19 infections according to self-reported symptom severity. The analysis revealed a clear difference in the extent of the COVID-19-related PTSS depending on the self-reported severity of the disease symptoms. Thus, it seems that the sole diagnosis with COVID-19 does not seem to lead to a significant increase in COVID-19-related PTSS risk. COVID-19 disease appears to be a risk factor for COVID-19-related PTSS only when severe COVID-19 symptoms are reported. Once this is the case, the risk increases steeply and in a linear manner with higher symptom severity.

Gender differences in the development of COVID-19-related PTSS have been the subject of various studies and may be attributable to physiological and psychological behavioral tendencies in traumatic experiences (Irish et al., 2011a). Consistent with previous literature, the risk of non-infected individuals developing COVID-19-related PTSS above cut-off is higher in women than in men (Brivio et al., 2021; Cénat et al., 2021; Irish et al., 2011a), as shown in this study it increased by 1.4. This result is particularly interesting in direct comparison to infected individuals. When a COVID-19 infection has occurred, men appear to be at a slightly greater risk than women. As such, women seem to have a generally higher tendency to develop PTSS and COVID-19-related PTSS (Brivio et al., 2021; Irish et al., 2011a). Specifically, (Brivio et al., 2021) found women to be at greater psychological and emotional risk during a traumatic event, such

as the COVID-19 pandemic. However, it is important to note the heterogeneity of the findings. (Cao et al., 2020) found that stressors were perceived similarly by men and women during the pandemic. (Cénat et al., 2021) on the other hand found an increased prevalence for women to report anxiety and depression symptoms but found no gender difference in the development of COVID-19-related PTSS. One possible cause might be demographic factors: for example, the gender difference in the development of COVID-19-related PTSS might be less pronounced in Asian countries (Cao et al., 2020; Cénat et al., 2021; Chen et al., 2021; Gao et al., 2020; Huang & Zhao, 2020) than in Central and Western European countries (Mazza et al., 2020; Moghanibashi-Mansourieh, 2020). However, based on the results of this study it is more likely that the gender effects are particularly prominent when a distinction is made between self-reported infected and non-infected individuals. So, although an increased risk in the development of COVID-19-related PTSS was shown in women, it was solely in self-reported non-infected ones. When self-reported COVID-19 infected individuals were considered, males showed higher risk ratios than females, whereby group differences were not significant.

The indirect experiences of traumatic events through DSME have been linked to the development of COVID-19-related PTSS. (Wang et al., 2021) argued that the frequency of DSME (more than five times per day) predicts COVID-19-related PTSS. For this purpose, (Bendau et al., 2021) defined the critical cut-off of seven accesses per day and 2.5 hours of daily exposure to distinguish between the likelihood of mild-moderate or

Table 3. Fixed effects univariate ANOVA results using COVID-19-related PTSS as the criterion

Predictor	Sum of squares	df	Mean Square	F	partial η^2
Intercept	673296.27	1	673296.27	1602.62	0.54*
Age	46.70	1	46.70	0.11	0.00
Self-reported COVID-19 Infection	17984.15	1	17984.15	42.81	0.03*
Gender	6483.86	1	6483.86	15.43	0.01*
DSME	58544.94	1	58544.94	139.35	0.09*
Self-reported COVID-19 Infection x Gender	11899.48	1	11899.48	28.32	0.02*
Self-reported COVID-19 Infection x DSME	3372.89	1	3372.89	8.03	0.01*
Gender x DSME	8042.46	1	8042.46	19.14	0.01*
Self-reported COVID-19 Infection x Gender x DSME	345.25	1	345.25	0.82	0.00
Error	564224.59	1343	420.12		

Note. * $p \leq .001$

moderate expressions of psychological distress, such as depression and anxiety disorders. Wang et al. (2021) even argue that as few as five accesses per day significantly increase the likelihood of COVID-19-related PTSS. Surprisingly, the quantity of time spent on social media between individuals with and without COVID-19-related PTSS showed no group differences in our analysis whatsoever. DSME as such increased the likelihood of COVID-19-related PTSS. This might rather be due to the quality of the content than the quantity of time spent online. Social media represents one of the most used sources to receive information about the Covid-19 pandemic. Simultaneously, increased information-seeking behaviors promote increased symptoms of anxiety and post-traumatic stress disorder (Brivio et al., 2021). Hence, DSME can promote COVID-19-related PTSS and result in intensified information seeking behaviors. Thus, a self-promoting dynamic might evolve.

One possible cause of the increased COVID-19-related PTSS strain in men with a COVID-19 infection may be due to the coping strategy used. Problem-focused coping is more frequently used by men than women (Endler & Parker, 1990; Matud, 2004). Since the pandemic outbreak, a high density of information has circulated, including many ambivalent recommendations and misinformation on social media. An infection with the disease means an uncertain prognosis for the individual and may be in the way of engaging in solving, altering or mentally restructuring the issue, which is typical for the problem-focused coping strategy (WHO, 2020; Folkman, 2013).

The way women and men use social media may provide insights into why males show significantly higher COVID-19-related PTSS than females when reporting DSME. Women are more likely to use social media to share feelings and engage in social interactions and generally report higher perceived social support via social media use than men do (Tifferet, 2020). Since perceived social support can serve as a buffer for stressful and traumatic circumstances (Cohen & Wills, 1985), this could prevent negative effects on COVID-19-related PTSS.

Moreover, individuals who feel more stressed, such as after a diagnosis, are more tempted to seek DSME (Thompson et al., 2020) to find information to address their feelings of uncertainty (Lachlan et al., 2009). If there is a high exposure to COVID-19 related information, there is a high chance that risk perception will be biased, promoting an increased risk (Zeballos Rivas et al., 2021). This is contrary to reducing the stress response and minimizing the feeling of uncertainty. Since no chronological sequence can be inferred from these results, it is also possible that the increased time spent on social media reflects an initiated coping strategy (Cauberghe et al., 2021), possibly resulting from experienced PTSS. Yet, the “infodemic” (WHO, 2020) contributes to social media platforms being swamped with pandemic-related information. This uncontrollability of information may have an intensified traumatizing effect on the individual, thus jeopardizing the use of DSME as a coping strategy.

5 Limitation

When interpreting the results, the following be considered: Although a balanced sample was aimed for, more women than men agreed to participate in the study. As a result, the ratio of 1:1.6 is not demographically matched. In addition, the study did not include individuals who belong to a gender other than male or female. In past studies, gender diverse individuals have been associated with a higher PTSS prevalence compared to their male or female counterparts (Loeb et al., 2018). The greater experience of adverse lifetime events, such as experienced discrimination, is seen as one of the possible causes (Loeb et al., 2018; Roberts et al., 2012).

Substantiated statements about the mental health of COVID-19 infected were aimed for, which requires a large sample of those affected. Although the affected individuals in this sample consisted of only 194 participants, they nonetheless accounted for 14% of the total sample, which was more than twice the per-

centage of affected individuals in the Austrian population at the time (31. March 2021; *AGES Dashboard COVID19*, n.d.).

Thus, set of relevant predictors of COVID-19-related PTSS were identified, a magnitude of other possible predictors has not been considered in this study. For example, socioeconomic status, not just income, has been an established predictor on multiple levels (Chi et al., 2021; Paxson et al., 2012; Peverill et al., 2021). Following Peverill et al. (2021), the socioeconomic status is a significant vulnerability factor in the development of mental health problems, particularly in prolonged public health emergencies extending six months (Chi et al., 2021). Considering women being affected more often by a low socioeconomic status (*Gender Equality in the Labour Market and Socioeconomic Equality – Federal Chancellery of Austria*, n.d.) and given the gender differences found in this study, it's possible that there may be a bias at play. Further gender-relevant predictors include the individual's psychiatric history previous to the traumatic incident as well as being in "lockdown" a restrictive isolating measure taken to limit the spread of the virus. Both of which have shown to play a significant role in predicting COVID-19-related PTSS (Coloma-Carmona & Carballo, 2021; Kalaitzaki et al., 2022).

Furthermore, due to economic considerations, the IES-COVID-19 measurement tool has been used, instead of diagnostic interviews. Although the IES-R is a widely used and validated measurement, with satisfying reliability and validity criteria, it is based on self-assessments (Chew et al., 2020; González Ramírez et al., 2020; Luceño-Moreno et al., 2020; Rossi et al., 2020; Vanaken et al., 2020).

Results of past surveys have varied in their assessment of the accuracy of self-assessments compared to clinical instruments. In their study, Griffin et al., 2004 found generally promising performance of the PDS compared to the CAPS in diagnosing PTSD, with a tendency to over-diagnose. Creamer et al. (2003) compared IES-R and CAPS, and found a very satisfactory sensitivity and specificity rates in favor of the IES-R. Nevertheless, it must be assumed that these results, which refer to PTSD and other measurement instruments, may not be transferrable onto this survey and the assessment of the COVID-19 related PTSS. This is especially important to consider as Shakespeare-Finch and Armstrong (2010) have showed the success of self-report measurement instruments may differ depending on the specific trauma.

Also, subjects were asked if they had *ever* been infected with COVID-19 and if so, how they would rate the symptom severity. The information regarding their infection status as well as their symptom severity is based on self-assessment and neglects to address both the duration of infection itself and the time gap between being infected and filling out the survey. The more immediate the infection, the more accurate are estimations of infection-related characteristics (Coolbrandt et al., 2011). For example, Coolbrandt et al. (2011) showed that in self-reports fewer symptoms and less severe symptoms are reported. Additionally, the impact of the symptom may be under- or overestimated, depending on the nature of the symptom (Coolbrandt et al., 2011).

Future research projects would benefit in validity from diagnosis, documentation of symptom progression during illness and its severity, based on a professional.

Due to the nature of the survey, it should also be noted that it was not possible to ensure that the information on time spent on social media in minutes per day or week was always accurately reported. In many cases, this may not have been more than an estimate.

Moreover, this study is based on an online survey, it may only make conclusions about people who use the social media channels mentioned in the recruitment process. Nevertheless, it was essential to precisely reach this target group to determine the impact that DSME might have when using social media platforms. Although the presence of DSME is based on only one item, efforts were made to ensure that framework factors were collected in detail, such as the duration of social media platform use per day or week as well as the choice of channels.

6 Conclusion

In conclusion, individuals with self-reported COVID-19 infection, especially when severe symptoms are reported, are at high risk of developing COVID-19-related PTSS. In principle, women are at a higher risk of developing COVID-19-related PTSS. Nonetheless, the risk increased markedly in men infected with COVID-19. DSME has emerged as a prominent risk factor, especially in interaction with a COVID-19 infection. Both, males and females were at increased risk with DSME, although the effect increased significantly more in males. Both, future research and public health prevention should pay special attention to those with self-reported severe COVID-19 symptoms and emphasize DSME as a risk factor. Measures that target the likelihood of the occurrence of severe COVID-19 symptoms, such as vaccination, could subsequently be a preventive measure to address COVID-19-related PTSS. Since it could be shown that not the time on social media spent alone, but rather the perception of distressing content led to an increased COVID-19-related PTSS risk, the question arises whether and how content differs in its potential contribution. Warnings, guidelines for social media content or ethical codes could thus reduce the possible occurrence among social media users and may represent important preventive measures to combat COVID-19-related PTSS.

7 References

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* Corresponding author

Mag. Dr. Oswald Kothgassner, Department of Child and Adolescent Psychiatry, Medical University of Vienna, Vienna, Austria, oswald.kothgassner@meduniwien.ac.at

Conflict of Interest

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Overcoming Pain with Virtual Reality: Exploring the Potential of VR as a Tool for Pediatric Pain Management

Lisa Weiss^{1,2} & Anna Felnhöfer^{1,2*}

¹ Department of Pediatrics and Adolescent Medicine, Division of Pediatric Pulmonology, Allergology and Endocrinology, Medical University of Vienna, Vienna, Austria

² Comprehensive Center for Pediatrics, CCP, Medical University of Vienna, Austria

Highlights

Virtual Reality interventions are a relatively new approach in pain management for children and adolescents, however, research in this field is growing.

Two not mutually exclusive theories emerged on how VR can decrease acute and chronic pain:

(1) via distraction – VR has been repeatedly tested as a distraction tool in experiments as well as in clinical contexts, especially for acute pain. There are strong indications in literature pointing towards a pain-relieving effect of VR, however the evidence is weak and relevant studies are not systematically comparable due to unstandardized methods and different age groups, as well as partially insufficient sample sizes and open questions regarding the used paradigms.

(2) via embodiment – experimental studies indicate that ownership and visual modification of a virtual body part may decrease pain perception in this body part, however this approach has not been sufficiently tested in a clinical context yet; in particular, more evidence for children and adolescents and with regards to acute versus chronic pain is needed.

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Pediatric medical interventions are unavoidably associated with stress and anxiety for children, and are often connected to some level of pain (Franck et al., 2000; McGrath et al., 2008; Racine et al., 2016). Pain during medical procedures is related to higher levels of stress and anxiety, which in turn can increase pain perception in future procedures as well as induce health care avoidance behavior (Blount et al., 2006; Racine et al., 2016; Sajeev et al., 2021; Verschueren et al., 2019). Furthermore, higher pain levels are linked to a decrease in children's and adolescents' adherence as well as longer recovery periods (Sajeev et al., 2021; Verschueren et al., 2019). This all renders pain management a crucial element in successful pediatric patient care. Especially with children, studies show that pain reducing interventions and medication often do not suffice in the management of health care related pain (Lambert et al., 2020; Schug et al., 2020). This is why non-pharmacological techniques are being developed in order to improve pharmacological pain administration (Sajeev et al., 2021).

One relatively new approach in the optimization of pain management for children and adolescents is a Virtual Reality (VR) intervention. VR in general is a relatively old technology

that has been developed decades ago (Greengard, 2019; Szäkely & Satava, 1999). The implications of a virtual environment that can be altered in any way or form imaginable are clearly endless, and as such it is of no surprise that VR has gained importance as an application in medicine as well (Greengard, 2019). VR is currently tested and used as an educational and training tool, in operational planning, diagnostics, rehabilitation and therapy (Greengard, 2019; Javaid & Haleem, 2020; Szäkely & Satava, 1999). One of the largest fields of research in this regard is the usage of VR as a tool in pain reduction, as this technology is becoming increasingly accessible and sophisticated. However, the exact mechanisms by which VR reduces pain levels are still subject of ongoing research. In general, two types of mechanisms are highlighted: distraction and embodiment.

1 VR as a distraction

The main paradigm suggests that VR decreases pain reception by distraction (Eijlers et al., 2019; Lambert et al., 2020). Distraction is a common instrument in clinical contexts to reduce pain

and stress (Koller & Goldman, 2012). The distracting stimulus is competing for cognitive resources and therefore, less capacity is left for an active perception of the painful input (Gaultney et al., 2021; Koller & Goldman, 2012; Moont et al., 2010). This effect has been shown in several imagery studies where pain associated brain activity was suppressed, whereas areas that are connected to attention and conscious control were more active instead (Bantick et al., 2002; Lambert et al., 2020; Morris et al., 2009; Petrovic et al., 2000; Valet et al., 2004).

Several studies have researched different distraction strategies that can be categorized as active and passive distraction (Koller & Goldman, 2012). Passive distractions like music or movies, where no action by the patient is necessary, have significantly reduced pain in several pediatric studies (Birnie et al., 2018; Eijlers et al., 2019; Koller & Goldman, 2012). Methods of active distraction, in turn, integrate the patients in the activity, for example video games or breathing techniques; these forms of distraction have also been proven useful in pain reduction (Birnie et al., 2018; Dahlquist et al., 2002; Koller & Goldman, 2012). In their meta-analysis, Koller and Goldman (2012) concluded, that both forms generally work, however there is some ambiguity as to which one works better and for which age group. Generally, several experimental studies have shown advantages of strong distractions that require greater cognitive resources for pain reduction in children in comparison to easy tasks (Dahlquist et al., 2020; Gaultney et al., 2021), however there is a lack of validation for the clinical context. VR is a promising tool in this regard because it combines auditory, visual, and often also tactile components to an intensive and immersive experience that makes it especially effective in distracting patients (Dahlquist et al., 2009; Koller & Goldman, 2012).

Nevertheless, it is not completely clear that the pain reducing ability of VR is completely due to the distraction it enables. Especially in research about the effects of VR on chronic pain relief, another mechanism is hypothesized (Keefe et al., 2012; Loreto-Quijada et al., 2014).

2 Pain reduction through embodiment

The concept of embodiment assumes that visual manipulations of the patient's body modulate pain perceptions (Matamala-Gomez et al., 2019a; Schug et al., 2020). Being embodied in a virtual body offers the opportunity of making visual changes to the affected body part and hence, induce analgesia via the so-called embodiment illusion. The actual control of a virtual self in a VR environment could additionally cause a sense of control over the real body and thereby increase self-efficacy and reduce the feeling of helplessness (Loreto-Quijada et al., 2014; Matamala-Gomez, et al., 2019a). Embodiment is not a new concept and has been tested repeatedly with rubber or mannequin hands and arms for adults (Botvinick & Cohen, 1998; Matamala-Gomez, et al., 2019a; Petkova & Ehrsson, 2008). In 2008, this effect could be replicated by Slater and colleagues for VR and has been tested

for chronic pain since (Matamala-Gomez, et al., 2019a; Slater et al., 2008). Based on the meta-analysis of Matamala-Gomez et al. (2019a), however, it becomes obvious that this approach to pain is still in an early phase of research. The majority of studies work only with healthy patients and experimental thermal pain (Matamala-Gomez, et al., 2019a), nevertheless, they are successfully debunking the mechanisms of this paradigm: The important factor in pain threshold decrease is the feeling of ownership of the virtual body part, which can be induced by synchronous movements of virtual to real body part and is affected by size, transparency and positioning of the virtual representation (Martini et al., 2014, 2015; Pozeg et al., 2017; Romano et al., 2016). Matamala-Gomez et. al (2019b) could replicate these findings in their study with chronic pain patients. Another study including patients with chronic pain found that ownership induced by synchronization with their own heartbeat could reduce pain and improve function of the affected limb depicted virtually (Solcà et al., 2018).

Even though there are indications that the ownership of a virtual body part reduces pain and increases the pain threshold in experimental studies, the question of the replicability in clinical contexts is yet to be answered. Pozeg and colleagues (2017) for example found that patients with a spinal cord injury could not achieve the same level of ownership in the VR as healthy patients, whereas in another study, the patients with complex regional pain syndrome achieved the same ownership of the virtual limb as the healthy control group (Matamala-Gomez, et al., 2019b). Only one study was found using VR-embodiment as a pain reducing therapy in children and adolescents with chronic headaches, however this was a pilot study with only ten patients and without an immersive HMD (Shiri et al., 2013). More evidence is needed from experimental studies with chronic and acute pain patients. Additionally, investigations of this model in a clinical context are crucial in developing possible rehabilitation concepts for chronic pain and finding effective applications for acute painful procedures, especially in children.

3 Pain reduction in clinical contexts

Regardless of the actual way VR reduces pain perceptions, the question remains if it really works in a medical context. Experimental laboratory studies have already shown a significant pain relieving effect of VR in children and adults (Dahlquist et al., 2009; Malloy & Milling, 2010; Patterson et al., 2006). Corresponding studies using VR in a clinical context show that immersive VR delivered via head-mounted-displays (HMDs) with a 360° field of view may significantly reduce pain compared to simple analgesia during painful physiotherapy for pediatric burn victims (Das et al., 2005; Hoffman et al., 2019; Schmitt et al., 2011). Similarly, a virtual environment was able to reduce fear and pain during dental procedures, which are particularly feared by children (Shetty et al., 2019; Zaidman et al., 2022). During routine medical procedures like venipunctures and

Table 1. Characteristics of studies in children and adolescents using VR distraction techniques in a clinical context.

Study	Mechanism	Sample	VR Technology	Control group	Study Design	Clinical Intervention	Outcomes	Effect Size
<i>Althumairi et al., 2021</i>	Passive distraction	4–6 years (N=104, n _{VR} =53)	HMD with 3D adventure movie	No distraction reported	Between-group quasi-experimental design	Vaccination	FPS; sign. reduced pain in VR (p<.001)	Not reported
<i>Clerc et al., 2021</i>	Passive distraction	6–16 years (N=64, n _{VR} =35)	HMD with 'Rollercoaster'	DVD movie, tablet or smartphone, music, jokes, discussion, handholding	RCT	Minor plastic surgery procedures (Excisions, Biopsies, Scar revisions, partial wound closure, steroid injections, ...)	FPS; no sign. reduced pain in VR (p=.60)	Not reported
<i>Das et al., 2005</i>	Active distraction	5–18 years (N=9)	HMD with 'Quake' Game	No distraction reported	Within-subject design	Dressing change for burn victims	FPS; sign. reduced pain in VR reported (p<.001)	Not reported
<i>Erdogan & Aytekin Ozdemir, 2021</i>	Passive distraction	7–12 years (N=160, n _{VR} =37)	HMD with 3D dinosaur animation	No distraction reported	RCT	Venipuncture	VAS & FPS; sign. reduced pain in VR (p<.001)	VAS: η ² =.157; FPS: η ² =.215
<i>Gold & Mahrer, 2018</i>	Active distraction	10–21 years (N=143, n _{VR} =70)	HMD with 'Bear Blast' Game	Television with a cartoon movie	RCT	Blood draw	VAS; sign. reduced pain in VR (p=.001)	Not reported
<i>Gold et al., 2006</i>	Active distraction	7–17 years (N=20, n _{VR} =10)	HMD with 'Street Luge' Game	No distraction reported	RCT	Venipuncture	VAS; sign. increased pain in control group (p<.05) and no sign. increased pain in VR group	Non reported
<i>Goldman & Behboudi, 2021</i>	Passive distraction	6–16 years (N=66, n _{VR} =33)	HMD with 'Rollercoaster'	Videos, Television, iPad, child life specialist	RCT	Venipuncture	FPS; no sign. reduced pain in VR (p=.93), however significantly lower median pain score after procedure (p=.004)	Not reported
<i>Hoffman et al., 2019</i>	Active distraction	6–17 years (N=48)	HMD with 'SnowWorld' Game	No distraction reported	Within-subject design	Wound care for burn victims	GRS; sign. reduced pain in VR reported (p<.001)	d=.82 to 1.03
<i>Kipping et al., 2012</i>	Active distraction	11–17 years (N=41)	HMD with 'Chicken Little' Game (under 14); 'Need for Speed' Game (over 14)	Television, stories, music, caregivers, or no distraction	Within-subject design	Dressing change for burn victims	VAS; no sign. reduced pain in VR (p=.16)	Not reported

Table 1. continued

Study	Mechanism	Sample	VR Technology	Control group	Study Design	Clinical Intervention	Outcomes	Effect Size
Mohanasundari et al., 2021;	Passive distraction	3–12 years (N=105, n _{VR} =35)	HMD with TV cartoon comics	Storytelling, verbal diversion	RCT	Venipuncture, blood draw, intramuscular injections	FPS; sign. reduced pain in VR ($p<.001$)	Not reported
Özalp Gerçeker et al., 2020	Passive distraction	5–12 years (N=136, n _{VR} =90)	HMD with 'Ocean Rift' or 'Rollercoaster'	No distraction	RCT	Blood Draw	FPS; sign. reduced pain in VR ($p<.001$)	Not reported
Piskorz & Czub, 2018)	Active distraction	7–17 years (N=38, n _{VR} =19)	HMD with self-designed game (Multiple Object Tracking)	No distraction	Between-group quasi-experimental design	Venipuncture	VAS; sign. reduced pain in VR ($p<.02$)	$d=.863$
Schmitt et al., 2011	Active distraction	6–19 years (N=54)	HMD with 'SnowWorld' Game	No distraction reported	Within-subject design	Physical therapy for burn victims	GRS; sign. reduced pain in VR ($p<.05$)	Not reported
Shetty et al., 2019	Passive distraction	5–8 years (N=120, n _{VR} =60)	HMD with TV cartoon show	Conversation, Tell-Show-Do, voice control, ...	RCT	Dental treatment (vital pulp therapy)	FPS; sign. reduced pain in VR ($p<.001$)	Not reported
Shiri et al., 2013	Embodiment	10–17 years (N=10)	2D self-representation	No control group	Single arm pilot study	Chronic headache	VAS; sign. reduced pain in VR ($p<.05$)	Not reported
Zaidman et al., 2022	Passive distraction	4–12 years (N=34)	HMD with "age-appropriate content"	No distraction reported	Within-subject design	Dental treatment (rubber dam placement)	FPS; sign. reduced pain in VR ($p=.005$)	$\eta=.52$

FPS = Face Pain Scale, GPS = Graphic Pain Scale, HMD = head mounted display, RCT = randomized controlled trial, VAS = Visual Analog Scale

Note: As this article does not constitute a systematic review of literature, the depiction of studies in this table is not exhaustive; it only details the studies mentioned in the text.

other injections (Erdogan & Aytekin Ozdemir, 2021; Gold et al., 2006; Mohanasundari et al., 2021; Piskorz & Czub, 2018), as well as during blood draws (Gold & Mahrer, 2018; Mohanasundari et al., 2021; Özalp Gerçeker et al., 2020), vaccinations (Althumairi et al., 2021), the effects of VR as a pain reducing agent for children and adolescents have been shown. Additionally, the use for chronic pain management was studied more intensely in recent years (Wong et al., 2022). However, there are also some studies that could not replicate these effects in clinical contexts for children (Clerc et al., 2021; Goldman & Behboudi, 2021; Kipping et al., 2012). For an overview of mentioned studies see Table 1.

Considering the probable publication bias, a closer look into these findings is necessary to assess the true effect of VR in pain management. A meta-analysis by Eijlers et al. (2019) included 14 studies on children and adolescents and found a significant reduction of pain with VR compared to the Standard of Care (SoC) with a medium to high effect size. This analysis included only HMDs, whereas a Cochrane Review (Lambert et al., 2020) allowed any kind of VR technology, including also 2D-screens. This publication included 17 RCTs and discovered a low to very low certainty of evidence for the effectiveness of VR for pain reduction in children and adolescents. These vast differences in two very recent meta-analyses reveal pending open issues in this field of research. All the above reported studies on VR-based pain relief for children and adolescents in a clinical context are summarized in the supplementary material (see supplementary table 1). Please note, that this letter is not a systematic review and therefore the list of studies presented here is not exhaustive.

Most of the studies published on this topic are not standardized with regards to the VR technology they are using. The level of immersion (i.e., HMD vs. 2D-screen) is not consistent across different studies, which supposedly affects the level of distraction a VR system is able to induce (Felnhofer & Kothgassner, 2022; Triberti et al., 2014; Won et al., 2017). Even though some studies control for the level of immersion, there is no definite evidence that suggests an advantage of an immersive VR technology vs. non-immersive VR in the context of pain management (Eijlers et al., 2019; Won et al., 2017).

In addition, the question of whether active engagement vs. passive distraction is more effective has yet to be resolved (Dahlquist et al., 2020; Eijlers et al., 2019; Koller & Goldman, 2012). Furthermore, the level of engagement could depend on the type of game that is played in the virtual environment. Most research groups program their own game or use a preexisting one, except for studies with burn patients which mostly implement the “SnowWorld” non-profit VR game (Eijlers et al., 2019; Hoffman et al., 2019; Lambert et al., 2020; Won et al., 2017). At the same time it is important to notice that a meta-analysis from 2016 could not find significant differences between the pain reduction of various software (Kenney & Milling, 2016). Another problem with comparing previous studies is the definition of Standard of Care (Eijlers et al., 2019). Some hospitals may have a television in the room and watching a movie is part of the routine pain

management. Additionally, the pharmacological pain management might differ.

The second main problem that affects the comparability of studies on VR-based pain-management are the different age groups in the samples. There is no standardization of age across research, which can reach from five-year-old children to eighteen-year-olds (Eijlers et al., 2019; Lambert et al., 2020). Furthermore, small sample sizes within each age group hamper reliable between-group comparisons. Some evidence suggests that VR interventions reduce pain more efficiently in younger children, possibly because they engage more in a technology that might feel more exciting to younger age groups (Eijlers et al., 2019). However, Dahlquist et al. (2009) found, that children under the age of ten do not benefit from VR distraction as compared to the older age group possibly due to differences in cognitive development, attention regulation and size of available HMDs. These interactions with age make it difficult to explore true effect sizes and therefore, Lambert et al. (2020) suggest to clearly define age groups in future studies as suggested by the US National Institutes of Health, which would separate children up to twelve years from adolescents ranging from thirteen to seventeen (National Institutes of Health, 2022).

4 Conclusion

Overall, existing research on the topic has systematical problems regarding study quality. Further high-quality research is needed that includes adequate sample sizes and hence, allows in-depth analysis of involved mechanisms (Lambert et al., 2020). This would facilitate the differentiation of effects on various age groups and provide a clearer picture of the true effect sizes, which are questionable at the moment (Eijlers et al., 2019; Lambert et al., 2020). There is a lack of control for cost-effectiveness and comparison of immersive VR to other, less immersive distraction tools like tablets or handheld gaming consoles, as well as a research gap in the contrast between active and passive distraction (Koller & Goldman, 2012; Lambert et al., 2020). Similarly, it is unclear whether embodiment-based techniques may be superior to distraction methods, and whether specific visual modifications to affected body parts may be contingent on specific types of pain perceptions (Matamala-Gomez et al., 2019a). Accordingly, it has been suggested that tailored embodiment experiences may be particularly effective in addressing patients’ unique pain perceptions and provide the most successful analgesia among non-pharmacological approaches.

Generally, this field of research is relatively new and the limited number of trials with limited types of experimental pain induction procedures and pain levels does not yet allow for solid conclusions. This is why, in summary, the question of whether VR is actually effective, particularly in clinical settings, cannot be definitively answered (yet), even though many studies categorically point in the direction of VR as a useful and exciting new tool in pain management.

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Contact information

Anna Felnhofer: anna.felnhofer@meduniwien.ac.at
(ORCID: 0000-0002-0081-7489)
Lisa Weiss: lisa.weiss@meduniwien.ac.at

*Corresponding author

Anna Felnhofer, Department of Pediatrics and Adolescent Medicine, Division of Pediatric Pulmonology, Allergology and Endocrinology, Medical University of Vienna, Vienna, Austria, Waehringer Guertel 18–20, 1090 Vienna, Austria, T: +43-(0)1-40400-32720
e-mail: anna.felnhofer@meduniwien.ac.at

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Call for Papers

Extending Human Cognition: Extended Reality for Cognitive Assessment and Assistance Applications

Guest Editor

Katharina Krösl (katharina@kroesl.at)

Recent advances in hardware and software for extended reality (XR), which includes virtual reality (VR), augmented reality (AR), and mixed reality (MR), have made immersive technologies more accessible and efficient for various applications in education, healthcare, entertainment, and psychology. In particular, they have created new opportunities for objectively assessing cognitive abilities, as well as for cognitive assistance applications, using AR glasses or smartphones.

XR applications can be used to assess spatial awareness, perception, memory, attention, or social cognitive skills, such as emotion recognition, empathy, or the ability to describe and predict people's mental states. VR-based tools have already proven to be effective in assessing and rehabilitating executive functions. VR can provide a controlled testing environment, precise control over stimulus presentation, and real-time data acquisition for performance analysis. However, not all cognitive abilities can be improved with training or therapy, but cognitive assistance applications, such as those using modern AR devices, can provide support for everyday tasks. Due to the varying impacts of cognitive limitations on individuals, reliable assessment methods for cognitive abilities are crucial for the development of effective assistance applications.

Cognitive assistance in XR is a relatively young field of research and despite the increased use of XR in psychology over the last decade, most of the focus has been on interventions for specific disorders, with relatively little attention given to XR-based assessment of cognitive abilities.

For this *Digital Psychology* special issue, we are seeking contributions that explore the potential of extended reality technologies, including virtual, mixed, and augmented reality, for assessing cognitive abilities and developing cognitive assistance applications.

Type of Articles

We seek original papers on XR-based assessment of cognitive abilities and cognitive assistance applications. Letters and Commentaries are also welcome. For eligible manuscript categories see the *Digital Psychology* author guidelines.

Possible topics might include, for example, but are not limited to:

- Assessment methods for cognitive abilities, such as spatial awareness, perception, memory, attention, executive function, or social cognition, using XR technologies
- Development and validation of XR-based assessment tools and applications for cognitive abilities
- Theoretical frameworks and models for XR-based assessment of cognitive abilities
- Comparison of traditional methods and XR-based methods for assessing cognitive abilities
- Use of XR technologies for cognitive assistance in specific populations, such as the elderly or individuals with cognitive impairments
- Development and implementation of XR-based cognitive assistance applications for specific disorders or conditions
- Ethical and legal issues related to XR-based assessment of cognitive abilities

If you are interested in submitting a manuscript to this *Digital Psychology*'s Special Issue entitled "Extending Human Cognition", please read the *Digital Psychology* submission guidelines carefully.

Contact

If you have further questions, please contact Guest Editor Katharina Krösl (katharina@kroesl.at).

Manuscripts can be submitted via the *Digital Psychology* website (Note: **please indicate the special issue "Extending Human Cognition" in the Comments to the Editor field!**).

Deadlines

Submission of papers: January, 15th 2024

Expected Publication: April 2024

Publication Fee – Option for Open Access Publication

There is no publication fee for a regular publication in this Special Issue.

However, authors may request that their accepted article is made available as an open-access publication, in which case a publication fee of € 349,- per article is required.

Guest Editor Short Bio

DI Dr. Katharina Krösl (Orcid: 0000-0002-9939-0517) is head of the research area “Immersive Analytics” at VRVis Zentrum für Virtual Reality und Visualisierung Forschungs-GmbH and

external lecturer at TU Wien. Her current research interests include extended reality (XR), and its applications in interdisciplinary projects on perception, psychology, and medical simulations, in particular, to support accessibility and accessible design. She is a founding member of IEEE Women in Engineering Austria and serves as a reviewer and committee member for several international computer science journals and conferences, such as VRST, ISMAR, VR (poster chair 2022), EGSR, or SIGGRAPH. Further information can be found [here](#).

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Digital Psychology

Author Guidelines

A biannual Journal of Psychology in the Digital Age

The Journal “*Digital Psychology*” is conceptualized as a scholarly journal and a platform for knowledge transfer at the interface between digitalization, new media and psychology and related disciplines (e.g. psychiatry, communication science). The topics include current research, applied science and practice as well as upcoming technological developments. The main focuses are put on systematic quantitative research synthesis, children and adolescents and technology-based interventions. Yet, the journal’s scope is not limited to these subjects; we also invite contributions from other topics in the broader field of Digital Psychology (e.g. e-Learning, computer-based assessments, computer-mediated communication, Virtual Reality/Augmented Reality) for submission. The journal is comprised of two issues per year and includes articles (reviews and original research, letters and spotlight-communications) in English and in German. Therefore, professionals with an interest in a psychological perspective on digital media will find this journal to be of high interest.

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The category “review article” includes reviews, theoretical/opinion reviews, systematic reviews, scoping reviews, or quantitative research syntheses (e.g., meta-analyses), 5.000 words excl. reference list, but including the 250 words abstract. Digital Psychology encourages authors of review articles to link underlying datasets in the submitted manuscript to a data repository (DOI or other identifier should be included in the manuscript as well as in the cover letter). Systematic Reviews and Meta-Analysis should follow PRISMA-Guidelines and contain PRISMA checklist and related other material incl. Flow-Charts (<http://www.prisma-statement.org/>). Scoping reviews should adhere to the PRISMA extension for scoping reviews (<http://www.prisma-statement.org/Extensions/ScopingReviews>). A maximum of 8 tables and figures are allowed for a review article. A review article may be submitted in English or in German.

Original Article

Original articles include original empirical research, and are not to exceed 4.500 words including the reference list and a 250 word abstract. If the original article includes clinical trials (e.g. RCTs), it should be registered in an official trial register, authors should report the registration number and database. RCTs should follow CONSORT guidelines (incl. CONSORT checklist and flow diagram). See <http://www.consort-statement.org> for according guidelines and forms. An original article may be submitted in English or in German.

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A letter comprises a response to a recently published work in an issue of Digital Psychology, and should not exceed 1.500 words. Letters go through editorial review upon invitation by either the EIC or a member of the Editorial Board. A Letter has to be submitted in English (or in German if it refers to a German article).

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Spotlight-communications include recent developments and are reserved for delivering empirical evidence in a short and concise fashion. They should not exceed 2.000 Words incl. references and must be submitted in English.

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Book reviews are restricted to a maximum of 1.000 words, will go through editorial review, and must be based on a book recently published in the field of Digital Psychology. A book review may be submitted in English or in German.

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Case studies may be considered for publication in Digital Psychology if they are unusually innovative and refer to the fields of Digital Psychology & Clinical Psychology. Case studies should not exceed 2.500 words. A case study should be submitted in English or in German.

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All submissions will first be screened regarding the degree to which they match the aims and scope of Digital Psychology before they are sent for peer-review. Only research with an appropriate study design and suitable statistical analyses are considered for publication. Study participants may be healthy subjects, patients, yet, research including animals is not considered for publication.

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Mag. Dr. Anna Felnhofer
(anna.felnhofer@meduniwien.ac.at)

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Univ.-Prof. Dr. Thomas Probst
(thomas.probst@donau-uni.ac.at)

Mag. Dr. Michael Zeiler
(michael.zeiler@meduniwien.ac.at)

The views expressed in the various contributions are only those of the undersigned authors.

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Liam Whittington
liam.whittington5@gmail.com

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