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Avatars with child sexual abuse (vs. no abuse) scenarios elicit different emotional reactions

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Simulated avatar interview training has been proven to be effective in improving child sexual abuse interview quality. However, the topic of perceived realism of the avatars and whether they cause emotional reactions has not been previously investigated. Such reactions could affect both learning from the interview simulations as well as how actual interviews are conducted. We wanted to understand whether participants perceive allegedly sexually abused child avatars as realistic and how they emotionally respond to avatars revealing they were actually abused vs. not-abused. Psychology students and recent graduates ($N = 30$, $M_{age} = 27.9$ years) watched eight avatars (4 boys, 4 girls, 4 with a CSA and 4 with a no-CSA scenario) providing a series of details about what had happened. Before and after observing each avatar, the participants' emotional reactions and perceived realness of the avatars was measured. Also, during each observation the participant's facial expressions were recorded. The participants self-reported more negative (anger, sadness, disgust) and more positive (relief) emotions to confirmed CSA and disconfirmed CSA scenarios, respectively, while results for facially expressed emotions were less clear. Higher general emotionality related to CSA and higher perceived realness of the avatars made the differences generally stronger.

Keywords: Child sexual abuse (CSA), Emotional reactions, Simulation training, Investigative interviewing

RESEARCH HIGHLIGHTS

- Child Avatars elicit both self-reported and facially expressed emotional responses

- The emotional responses differ in a predictable way between Child Avatars with sexual abuse (vs. no abuse) scenarios

- These differences were more accentuated, the more real the participants perceived the Child Avatars to be

- Similarly, the differences were also more accentuated, the more emotional the participants' reactions to CSA were in general

- The study suggests that Child Avatar interviews are emotionally engaging opening the avenue to study how these emotions affect learning from the interview simulation as well as how emotions affect interviewing in actual CSA cases

- The results also add to the literature of human-AI interaction

1. Introduction

Child sexual abuse (CSA) is a world-wide social problem of serious extent (Azzaporadi et al., 2019). The best estimate of global CSA prevalence according to self-report studies is 12-13% (Stoltenborgh et al., 2011). However, victims of CSA may many times not get help because they do not feel that they can report the abuse to anyone. Further, cases where an allegation is made are difficult to investigate due to absence of strong evidence. In most alleged child sexual abuse cases details derived from the interview are the only available evidence that the prosecution can rely on (Lamb, Sternberg, & Esplin, 1998; Author, 2020). Interview quality in such cases remains low (Author, 2018) even though forensic interviewers most likely have knowledge of evidence-based interviewing advice (Lamb, 2016). In fact, research on child interviewing shows that interviewers generally do not follow best-practice techniques such as asking open questions, relying instead extensively on closed and suggestive questioning (Lamb, 2016; Thoresen et al., 2009; Author 2004) that might result in not eliciting all information the interviewee could provide or even eliciting incorrect information

Currently, the most common ways of training interviewers are theoretical face-to-face lectures, role-playing with an adult pretending to be a child or interviewing actual children exposed to mock events followed by feedback (Author, 2020). Theoretical training alone seems to have little impact on

actual interviewer behavior (Author, 2020) whereas a problem with adult actors pretending to be children is that they cannot accurately mimic the interview behavior of an actual child (Powell et al., 2008). Finally, providing ongoing feedback to actual interviews is demanding in terms of logistics and costs (Lamb, 2016). A suggested alternative is to use computer-generated child avatars or simulated avatar interviewing (Author, 2015; Author, 2017). Such training can be defined as serious gaming, that is, a game played within a safe environment with the goal of learning complex practical skill (Wouters et al., 2013). In such simulations participants get acquainted with the background story of the avatar (see Table 1) after which the computerized avatar is interviewed using oral questions. In the simulation (Author, 2012) the avatars 1) have different memory contents (abuse vs no abuse scenarios), 2) have probabilistic algorithms resulting in highly varied response patterns between the interviews, and 3) are being presented in a randomized order in terms of age, gender and abuse status (Author, 2020). Simulated avatar interviewing is effective in improving the use of open-ended questions in both students and professionals (Author, 2015; Author, 2021; Author, 2020) and the training effects transfer to mock and actual forensic interviews with children (Author, 2020). We aimed to explore whether participants perceive allegedly abused child avatars as realistic and how they emotionally respond to avatars with a CSA vs. a no-CSA storyline. If avatars are perceived as realistic, they may elicit emotional reactions among participants. Such emotional reactions may either facilitate (by increasing attention and interest as well as being more akin to the actual task) or impede (by disrupting cognitive processes) transfer of the learning to real interviews with actual children. Importantly, such emotional reactions may vary between individuals and these differences may in turn affect the extent to which the participants learn from the simulations in their own right. Also, there may be differences in perceived realism of the avatars with higher perceived realism expected to enhance emotional reactions. Also, emotions during actual forensic interviews with children could potentially affect the interview quality. For example, the emotions of XX could increase confirmation bias (Zhang et al., 2022). If the avatars elicit emotional reactions, it will allow their use in investigating such emotion-cognition associations in the context of CSA interviewing.

2. Perception of Avatar Realism

Research on internet based therapeutic interventions with simulated human presence shows that participants do experience a sense of rapport (Pinto et al., 2013; Pinto et al., 2016), one of the elements of therapeutic alliance, during such simulations. Another central element of therapeutic alliance is emotional reactivity and emotional engagement, but unfortunately little is known about whether interactions with virtual avatars result in emotional reactions (Noromies, 2019). The issue of interviewers' emotional reactions to allegedly abused avatars, that is, do the interviewers perceive the

virtual child avatars to be realistic in an emotional sense, also remains open. In our study, we wanted to find out to what extent the participants would perceive allegedly abused child avatars would emotionally react to abuse and non-abuse details provided by them. Such reactivity would suggest that the simulation is perceived to be realistic by the participants, an important feature increasing the chances of successful transfer of training effects to real interviews. Mohamad Ali and Hamdan (2017) in their study analyzed student`s emotional reactions to four talking-head characters with varying levels of realism. Their results suggest that participants respond with more emotions to more realistic stimuli. In line with this, we suggest that the more virtual child avatars will be perceived as realistic, the stronger emotional reactions we can expect.

3. Emotions in CSA Interviewing

An extensive amount of research has focused on factors that affect the cognitive aspects of investigative interviewing (e.g., Goodman, Melinder, 2007; Lamb et al., 2007; Author, 2015). However, very little research has been conducted on the role of emotions in child forensic interviewing. It is not known how emotions affect learning during simulated training. Also, nothing is known about how emotions potentially could affect interviewers' questioning style during actual CSA interviews or transfer of training to actual interviewers. The limited body of research suggests that emotional expressiveness by alleged victims of child abuse is associated with more information being elicited during the interview and with the value of children's testimony being enhanced (Katz, Paddon, & Barnetz, 2016; Visel et al., 2019).

It is especially important to study the question of emotions in relation to CSA interviews as CSA is a phenomenon that results in strong emotional reactions not only in alleged victims but in interviewers as well (Korkman et al., 2008). Related research from forensic interviewing and decision-making context suggests (Ask, Granhag, 2007; Oxburgh, Williamson, & Ost, 2006, Sambrano, Masip, & Blandon-Gitlin, 2020; Magnusson, Joleby, Luke, Ask, & Sakrisvold, 2021) that interviewers' emotional reactions affect the assessment of gathered information from the interviewee, for example, it might influence the interviewers 'attitudes towards the accused. Ask and Granhag (2007) experimentally induced anger or sadness in experienced police investigators and observed the impact on their investigative judgements. Results indicated that sad investigators - compared to the angry ones - engaged in a more thorough analysis of the case materials. They were also more likely to perceive the suspect to be guilty and that there was incriminating evidence after having read a witness statement confirming the guilt of the suspect. In contrast, the content of the statement did not affect

the judgement of angry participants. This underlines the importance to study emotional reactions in detail also in CSA cases.

Sambrano and colleagues (2020) demonstrated in their experiments that sad participants - compared to angry and happy participants - showed a stronger preference for empathetic interviewing tactics that promote open-minded thinking and action. In their experiments, the tendency to select hostile interrogation tactics was not affected by emotion. They also showed that participants in general were more willing to use benevolent tactics, though the effect size was larger for sad than for angry or happy participants.

Magnusson and colleagues (2021) in a recent study, examined Swedish and Norwegian police interviewers' self-reported goals, tactics, and emotional experiences when interviewing suspected CSA offenders. Similar to the previously mentioned studies, they found that interviewers who experienced more negative emotions, such as anger, frustration and disgust, tended to employ confrontational interviewing tactics which were associated with the goal of obtaining a confession and aggressive tactics such as raising the voice and emphasizing the seriousness of the crime. These results suggest that emotional processes during CSA interviewing may influence the tactics used in the interview.

From the studies conducted until now, it seems likely that different emotional states experienced by interviewers may also have effects on interviews with allegedly abused children. To our knowledge, no research on emotions has been conducted where the interviewers realize that the allegedly abused child was not sexually abused. There is a clear gap in the literature about differences in reactions between interviewers who uncover the child was abused as opposed to those who uncover that not being the case and the function of those emotions in the context of an investigative interview.

3.1 Anger and Disgust

When we are confronted with immoral acts, such as CSA, an active emotional response of anger may occur, especially if the act is self-relevant in any way. In a study by Hutcherson and Gross (2011), it was reported that out of six provided emotions anger and disgust got the highest scores and were equal when participants had to emotionally respond to descriptions of moral violations. Anger may increase one's willingness to pursue punishment and may increase concern for how to actively respond to immoral behavior (Hutcherson & Gross, 2011). Anger directed towards an alleged

transgressor may become a motivating force leading to punitive attitudes and more severe penalties (Hartnagel, Templeton, 2012; Johnson, 2009).

In addition to what was mentioned above, disgust is a relevant emotion in the CSA interview context for another reason as well. Research suggests that imagining sexual behaviors that are considered deviant by the person imagining them may also give rise to disgust (Antfolk et al., 2012), the function of which has been hypothesized to regulate sexual behaviors (Kresanov et al., 2018). It is also known that experiencing a disgusting taste affects third-party judgements (Eskine, Kacinik, & Prinz, 2011), that is, physical disgust elicits feelings of moral disgust when evaluating moral transgressions which may lead to harsher judgements (Schnall et al., 2008).

3.2 Sadness

Hearing and witnessing traumatized children often evokes empathy and sadness in professionals (Nen et al., 2011). Interview-based research with victim/survivors of child abuse can be difficult and challenging for investigators, because „inner experience" can be altered as a result of empathetic engagement (Coles & Mudaly, 2010). If a person has low levels of cognitive empathy, which is the ability to communicate understanding while maintaining affective distance or neutrality, emotional regulation can be affected (Ludick, Figley, 2017) and may lead to experience of negative emotions, such as sadness. Sadness reaction to child abuse phenomena can be painful and result in distancing oneself in order not to experience secondary trauma (Coles & Mudaly, 2010), that accounts for work-related stress experienced by those who work or live with the traumatized (Ludick & Figley, 2017). Such reactions may also affect the information-gathering processes as described above.

3.3 Surprise and Relief

One of the strongest influences on human decision-making is confirmation bias (Kahneman, Tversky, 1982) which in the context of interviewing means that professionals seek to prove the abuse hypothesis, which in a legal setting might lead to poor decision-making (Dror, 2020; Melinder, Brennen, & Husby, 2020, Zhang et al., 2022). When interviewing an allegedly abused child, interviewers know that one possibility is that the child has actually been abused which may give rise to an anticipation of emotions such as anger, disgust and sadness. We suggest that when the interviewed child instead turns out to be not abused, the fact that the interviewer's confirmation bias is disproved is likely to give rise to surprise whereas relief may follow because the negative anticipated emotions do not materialize.

Surprise is one of the fundamental emotions. Expectations predetermine a person's knowledge about a current event and contribute to his development (Kovaleva, 2021) and when things turn out opposite from the expected emotion of surprise may follow.. Relief is a unique positive emotion since it can occur only after a goal-incongruent situation will be resolved. In such scenarios a state of sudden relief may result. Thus, relief may be considered as alleviation of negative emotional state (Dolinski, Odachowska, 2018).

3.4 General Emotionality

Individual differences in responding to CSA can occur for different reasons. Personal trauma history, gender, cultural and social factors can determine the level of supportive reactions (Cromer, Goldsmith, 2010). General emotionality may also influence reactions and decisions made in CSA cases. People with higher level of child victim empathy tend to make favorable pro-victim judgements (Bottoms, 1993) which can potentially also play a role in how people react to and perform during alleged CSA interviews.

4. Current Study

We used virtual child avatars with either abuse or no-abuse scenarios to investigate how participants would react to the details provided by the avatar regarding what had happened to it. In this study, the participants did not need to interview the avatars, they simply needed to watch and listen to what the avatar "had to say". Every participant viewed and listened to eight avatars, one after another, half of them were abused and half were not with the presentation order being randomized. Each avatar told nine details about what had happened to it. In both conditions, confirmed CSA and disconfirmed CSA, first six details implied CSA and this suspicion was either confirmed or disconfirmed in details 7-9. We measured self-reported emotions before and after each avatar's narrative and facial expressions of emotions throughout the experiment.

In terms of the subjective (self-reported) emotions, we had the following specific hypothesis: **Hypothesis 1.** While controlling for the level of the emotion in question before the avatar scenario was revealed, we expected avatars with a confirmed CSA (vs. disconfirmed CSA) scenario to result in the participants reporting more anger, sadness and disgust after the scenario. Similarly, we expected avatars with a disconfirmed CSA (vs. confirmed CSA) scenario to result in the participants reporting more surprise and relief.

In terms of the emotions assessed objectively via facial expressions of the participants, we had the following specific hypothesis:

Hypothesis 2. While controlling for the level of the emotion in question during the presentation of the unspecific six first details of the avatar's scenario, we expected avatars with a confirmed CSA (vs. disconfirmed CSA) scenario to result in the participants' faces showing more anger, sadness and disgust during the presentation of the last three details (7-9) revealing whether the avatar was abused or not. Similarly, we expected avatars with a disconfirmed CSA (vs. confirmed CSA) scenario to result in the participants' faces showing more surprise and relief during the sharing of those details.

We expected differences (a) between participants who had generally more (vs. less) emotional reactions to the phenomenon of CSA (assessed through a psychometric individual difference measure) and (b) between participants who thought that the avatars were more realistic (vs. less realistic).

Hypothesis 3. We expected that the effects (experience of sadness, anger, disgust, surprise and relief, respectively) outlined in hypotheses 1 and 2 would be stronger among the participants with stronger emotionality.

Hypothesis 4. We expected that the effects (experience of sadness, anger, disgust, surprise and relief, respectively) outlined in hypotheses 1 and 2 would be stronger among the participants who thought that the avatars were more realistic because the more avatars are perceived as realistic the more people can relate to them.

5. Method

5.1 Participants

The sample consisted of current psychology students and recent graduates ($N = 30$, mean age M = 27.87, $SD = 7.15$) recruited from XXX and XXX universities. The advertisement for participation in the study was published in several forums for current psychology students and alumni of both universities. The 8 male and 22 female participants were randomly assigned with eight avatars out of 16, so that four avatars were boys (2 with CSA and 2 with no-CSA scenario) and four were girls (2 with CSA and 2 with no-CSA scenario). No participants were excluded.

The data were collected at the Applied Psychology Research Laboratory of XXX University in Lithuania by the first author. The study received ethical approval from the Ethics Committee for Psychological Research at XXX University (project title "Emotional Responses to Avatars").

5.2 Materials

The data were collected using self-report printed measures (PANAS as a distractor with inserted items of interest about realness and five emotional states (sadness, anger, disgust, surprise and relieve), and Emotional Reactivity (ER) scale from the Cognitions and Emotions about Child Sexual

Abuse (CE-CSA) questionnaire and facial expression analysis software – iMotions. CE-CSA original version was created in German and was translated into English by the authors of the questionnaire. For this study, the first author translated the English version into Lithuanian. Afterwards a German speaking colleague did a back translation from Lithuanian to German to Lithuanian. PANAS questionnaire was already translated into Lithuanian by Šilinskas and Žukauskienė (2004).

5.3 Instruments

Positive and Negative Affect Scale (PANAS) (Watson, Clark, & Tellegen, 1988) is a 20-item scale with 10 positive and 10 negative affective descriptions. Responses were scored on a five-point scale (1-5) ranging from "very slightly or not at all" to "very much". Participants had to fill in this instrument nine times, so that every previous one would be a pre-measurement for the upcoming stimuli and post-measurement for the previous stimuli. „However, the actual PANAS items were not used in the analyses but only used as distractors. We inserted an additional statement about realness of avatars (had to be scored only after viewing the avatar) and five statements about the specific emotional states (sadness, anger disgust, surprise and relief) we had hypotheses about into the PAANAS with the aim of not drawing attention to these items. These were also responded to on a five-point scale. In our analyses, we only used the additional statements."

Participants baseline emotionality was measured using Attitudes and Emotions regarding Child Sexual Abuse questionnaire (Author, 2021), which consists of three subscales: (1) Naive Confidence (NC), (2) Emotional Reactivity (ER) and (3) Justice System Distrust (JSD). Responses were scored on a six-point scale ranging from 1 "fully disagree" to 6 "fully agree". In our analyses, we only used the Emotional Eeactivity (ER) scale. For the emotional reactivity (ER) scale, the Cronbach's α was .80. This questionnaire was filled in only once prior to the presentation of the avatars.

As described above, perception of avatar realism was measured using one-item, specifically created for this study. After each review of the avatar details, participants were asked to answer how realistic they perceived the avatar to be. Responses were scored on a five-point scale ranging from 1 „not realistic at all" to 5 „very realistic".

The participants' facial expressions were recorded during the presentation of each of the eight avatars. Every recording captured facial reactions to the nine details provided by the avatar resulting in a total of 2160 facial reactions. Videos were imported to iMotions Biometric Research Platform 8.1 software and analyzed using the Affectiva facial expression recognition engine. Affectiva emotion recognition software can identify facial expressions in a probabilistic way. The software has built-in recognition for anger, sadness, disgust, and surprise, however for relief we had to extract the most

common facial action unit – AU12 lip corner puller (Krumhuber, Scherer, 2011) and consider it as a reaction of relief. Emotion probabilities were exported for every provided detail by the avatar.

5.4 Avatars

In this study we used a software developed for simulations of investigative interviews in cases of alleged CSA (Author, 2012). It consists of sixteen child looking avatars. Four 4-year-old male, four 4-year-old female, four 6-year-old male, and four 6-year-old female avatars (Figure 1). Each avatar has his/her own scenario of alleged CSA which was translated and adapted to Lithuanian context. For half of the avatars, the scenario contained sexual abuse, for the other half, it did not.

Figure 1

Computer Generated Image of Miglė

5.5 Procedure

The participants arrived in a room used for the experiment. Upon arrival they were asked to sign an informed consent form and after this they had to complete the Cognitions and Emotions about Child Sexual Abuse (CE-CSA) questionnaire and answer the questions about their emotional state (PANAS and additional items) for the first time. Before the presentation of each avatar, participants were given a short description of the background to the case (Table 1). Afterwards, the nine details were presented one after another with an interval, so that the participant could fill in the

emotional state questionnaire after each presentation of the avatar details (Table 2). During every avatar presentation participant's facial expressions were recorded on HD camera.

Table 1

Example Scenario of Alleged CSA Presented to the Participants Before the Interview: The Case of Eglė

The case of Eglė
Background story
Eglė is a 6-year-old girl, whose parents are separating, the reason for the separation, on mother's request, is that Eglė`s father used physical violence on his wife. Eglė is in the custody of the mother throughout the process, while the father is allowed to see her every three weekends. Eglė attends first grade, has good relations with all the class, and the teachers, it's a girl, sociable and active at least until the separation. Eglė also attends weekly catechism with Sister Marija (60 years old) and Augustas the catechist (35 years old).
Alleged CSA
Eglė`s dad picks her up more than an hour late, after first asked Sr. Marija to be able to keep company with the child, the catechism, and then proceeds with the girl on Saturday evening and on Sunday until 5:00 pm. At the reunion with her mother, Eglė literally jumps in the arm saying, 'do not leave me anymore' after this episode, there are other attitudes of the girl that draw the attention of Eglė`s mother, for example, the girl begins to put in place sexualized behaviors, which were never been reported previously; including objects near the genital area of her mother. Concerned by this situation, the mother turns to a specialist to have some explanations about what happened.

Table 2

Example of Confirmed CSA and Disconfirmed CSA Avatar Details from 1 to 6 and 7 to 9

CSA avatar details 1 to 6	Non-CSA avatar details 1 to 6
1. If someone made a mistake, he punished us (sad)	1. Mom doesn't get on well with him
2. He is really strict (sad)	2. I do not want to play anymore with him (sad/cry)
3. He pulled down our pants and spanked us (sad)	3. Last time he hurt me (sad/cry)
4. I am afraid of him (sad)	4. He told me not to say anything
5. The children who behaved bad were sent into the balls warehouse	5. Otherwise, mom gets angry
6. Sometimes I was alone in the warehouse. Sometimes with other children	6. He pulled me by the arm (sad/cry)
Key details 7 to 9 confirming abuse	Key details 7 to 9 confirming non-abuse
7. He made me touch the other children's willies when I was punished (sad)	7. I was running away from him
8. He had his hands in his pants	8. We did something that my mother did not want me to do (sad/cry)

| 9. He was touching his penis | 9. We were playing tag near the road (sad/cry) |

5.6 Statistical Analyses

To analyze the self-report emotions, we used a generalized estimation equation (GEE) model, where pre-level was used as a covariate and post-level was used as a dependent variable while the CSA or non-CSA status of the avatar was the independent variable. In the GEE we controlled for the fact that each participant viewed eight avatars introducing dependencies into the data. To analyze emotions extracted from iMotions facial expression analysis software, we used the average level of the first six details as a covariate and as a dependent variable we used the average level during the last three details. The independent variable was again the CSA or non-CSA status of the avatar. In this analysis we controlled for the participant`s baseline emotionality. To create high and low emotionality and realism groups we used median-split method.

To enhance transparency, prevent positive publication bias and facilitate replicability, we pre-registered this study in https://aspredicted.org. The pre-registered project is publicly available at (THE LINK TO THE PRE-REGISTRATION WILL BE ADDED AFTER ACCEPTION, IN ORDER NOT TO VIOLATE BLIND REVIEW PRINCIPLE, PRE-REGSITERED DOCUMENT FOR REVIEW PURPOSE IS ADDED TO THE APPENDIX). We pre-registered our study hypotheses, methods and procedures, and data analysis plan. Our pre-registration was submitted prior to data collection. Our analyses deviate from the pre-registration in two ways. First, in our calculations, instead of dividing relevant details into 7+2, we divided them 6+3 (the 7+2 division was a mistake). Second, instead of using a pre-post multilevel analytical approach, we used GEE with the pre-level as a covariate due to GEE not allowing repeated measures designs.
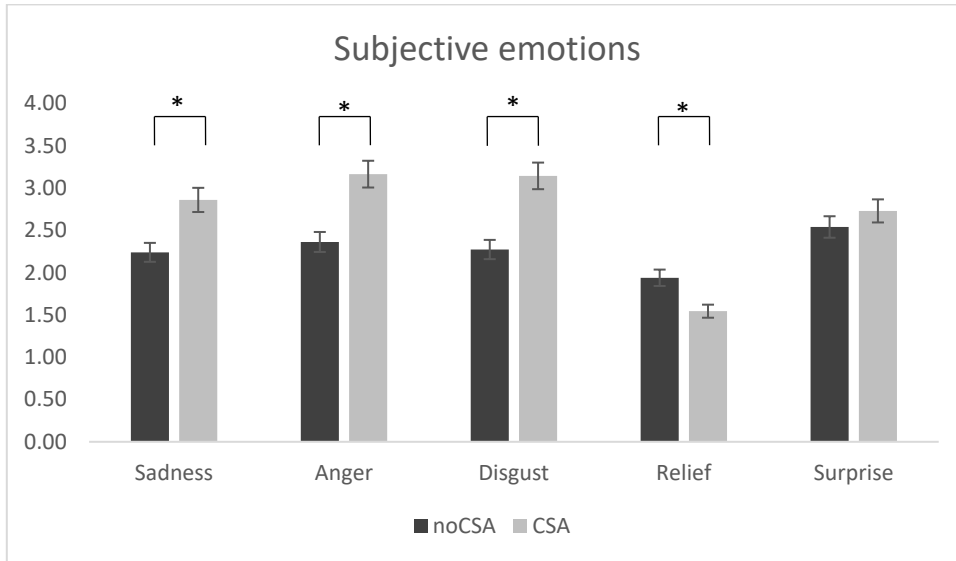
6. Results

6.1 Emotional Reactions to Allegedly Abused Avatars

We expected that according to self-report (subjective) data participants would react with more negative emotions (sadness, anger and disgust) to confirmer CSA avatar scenarios and with more positive emotions (surprise and relief) to disconfirmed CSA avatar scenarios (**Hypothesis 1**). All expected negative emotional reactions were significant: sadness (Wald χ^2 (1) = 48.67, $p < .001$), anger (Wald χ^2 (1) = 28.43, $p < .000$), disgust (Wald χ^2 (1) = 35.52, $p < .000$). Positive emotional reactions were significant for relief (Wald χ^2 (1) = 8.17, $p = .004$) but not for surprise (Wald χ^2 (1) = 1.87, $p = .172$).

Figure 2

Self-reported Emotional Reactions to confirmed CSA and disconfirmed CSA Avatar Scenarios


Note. Higher values mean higher levels of the emotion in question (Scale: 1-5)

We expected that according to iMotions (objective) data participants would react with more negative emotions (sadness, anger and disgust) to confirmed CSA avatar scenarios and with more positive emotions (surprise and relieve) to disconfirmed CSA avatar scenarios (**Hypothesis 2**). Only the anger response was significant: sadness (Wald χ^2 (1) = 2,58, p = .108), anger (Wald χ^2 (1) = 6.61, p = .010), disgust (Wald χ^2 (1) = .13, p = .719), relief (Wald χ^2 (1) = .46, p = .499), surprise (Wald χ^2 (1) = 1.51, p = .219). Although sadness reaction was not significant, it was still in the expected direction.

Figure 3

Facially Expressed (iMotions) Emotional Reactions to confirmed CSA and disconfirmed CSA Avatar Scenarios
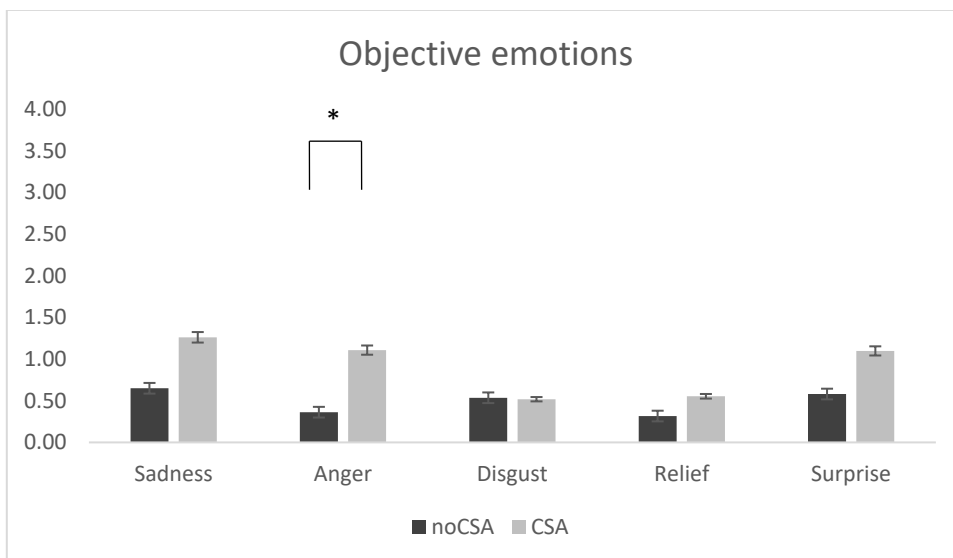
6.2 Emotional Reactions to Allegedly Abused Avatars – role of emotionality and realism

We expected that the effects outlined in hypotheses 1 and 2 would be stronger among the participants with more emotional reactions to CSA (**Hypothesis 3**). Figures 4 and 5 shows that according to self-report data (subjective) the expected interaction between abuse (confirmed CSA vs. disconfirmed CSA) and emotionality (less emotional vs. more emotional) was significant for anger (Wald χ^2 (1) =5.35, p = .021,) and relief (Wald χ^2 (1) =7.34, p = .007).

Figure 4

Effect of Emotionality about Child Sexual Abuse on Self-Reported Anger Reactions to confirmed CSA and disconfirmed CSA Avatar Scenarios
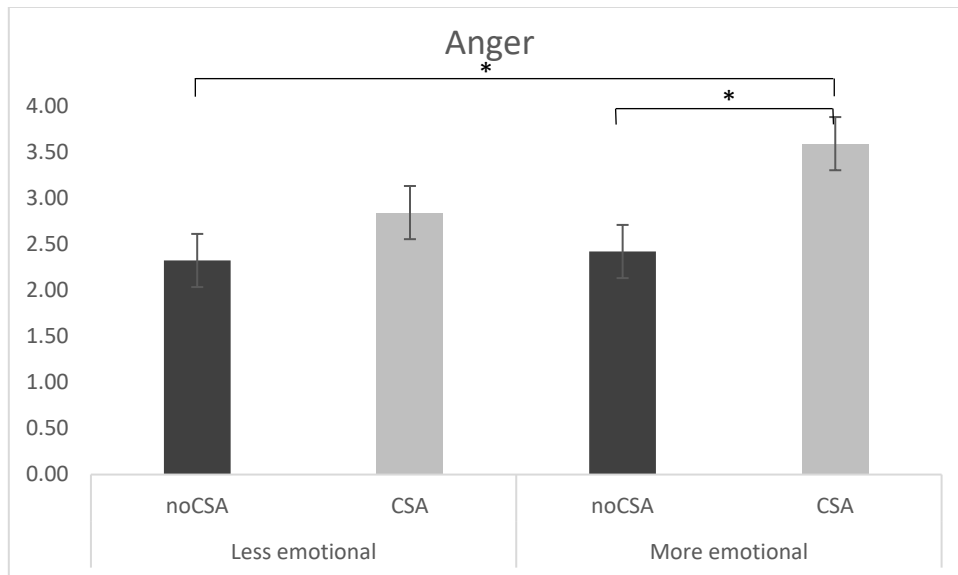
Statistically significant difference in anger reaction to confirmed CSA and disconfirmed CSA avatars was found in more emotional participants (disconfirmed CSA 2.42 [95% CI: 2.10, 2.73]; confirmed CSA 3.59 [95% CI: 3.18, 4.01]), while the difference in anger reaction among less emotional participants was not significant (disconfirmed CSA 2.32 [95% CI: 2.03, 2.61]; confirmed CSA 2.84 [95% CI: 2.55, 3.14]).
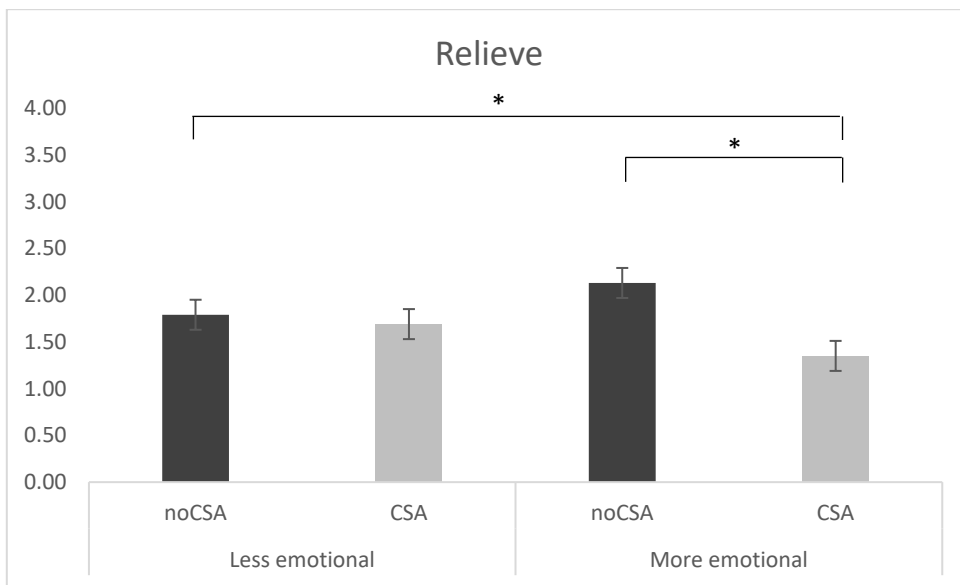
Figure 5

Effect of Emotionality about Child Sexual Abuse on Self-Reported Relief Reactions to confirmed CSA and disocnfirmed CSA Avatar Scenarios
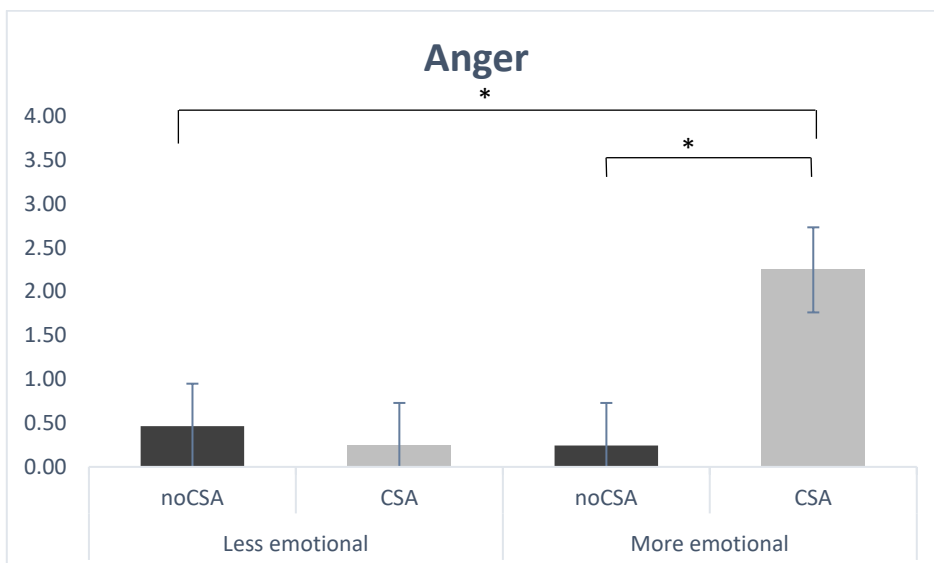
Statistically significant difference in relief reaction to confirmed CSA and disconfirmed CSA avatars was found in more emotional participants (disconfirmed CSA 2.13 [95% CI: 1.74, 2.53]; confirmed CSA 1.35 [95% CI: 1.03, 1.68]), while the difference in relief reactions among less emotional participants was not significant (disconfirmed CSA 1.79 [95% CI: 1.55, 2.02]; confirmed CSA 1.69 [95% CI: 1.31, 2.07]).

Figure 6 shows that according to iMotions data (objective) the expected interaction between abuse (confirmed CSA vs. disonfirmed CSA) and emotionality (less emotional vs. more emotional) was significant only for anger (Wald $\chi2$ [1] =6.66, p = .01).

Figure 6

Effect of Emotionality about Child Sexual Abuse on Facially Expressed (iMotions) Anger Reactions to confirmed CSA and disconfirmed CSA Avatar Scenarios
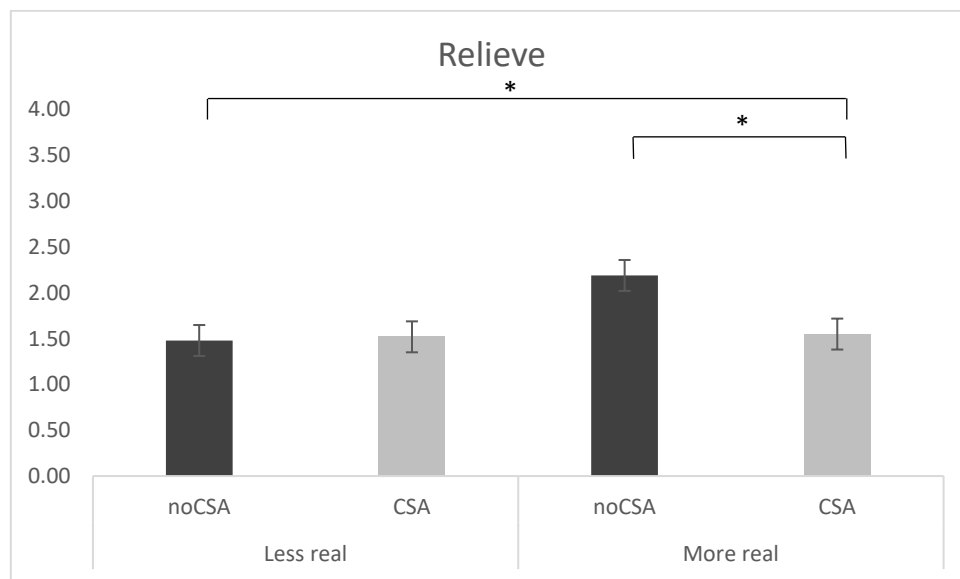
Statistically significant difference in anger reaction to confirmed CSA and disconfirmed CSA avatars was found in more emotional participants (disconfirmed CSA 0.24 [95% CI: 0.06, 0.43]; confirmed CSA 2.25 [95% CI: 0.74, 3.75]), while the difference in anger reactions in less emotional participants was not significant (disconfirmed CSA 0.46 [95% CI: 0.18, 0.75]; confirmed CSA 0.24 [95% CI: -0.12, 0.61]).

We expected that the effects outlined in hypotheses 1 and 2 would be stronger among the participants who thought that the avatars were more realistic (**Hypothesis 4**). Figure 7 shows that according to self-report data (subjective) the expected interaction between abuse (confirmed CSA vs. disconfirmed CSA) and perceived realness of avatars (less real vs. more real) was significant for relief (Wald $\chi2$ [1] =4.74, *p* = .03).

Figure 7

Effect of the Perceived Realness of the Avatars on Self-Reported Anger Reactions to confirmed CSA and disconfirmed CSA Avatar Scenarios.
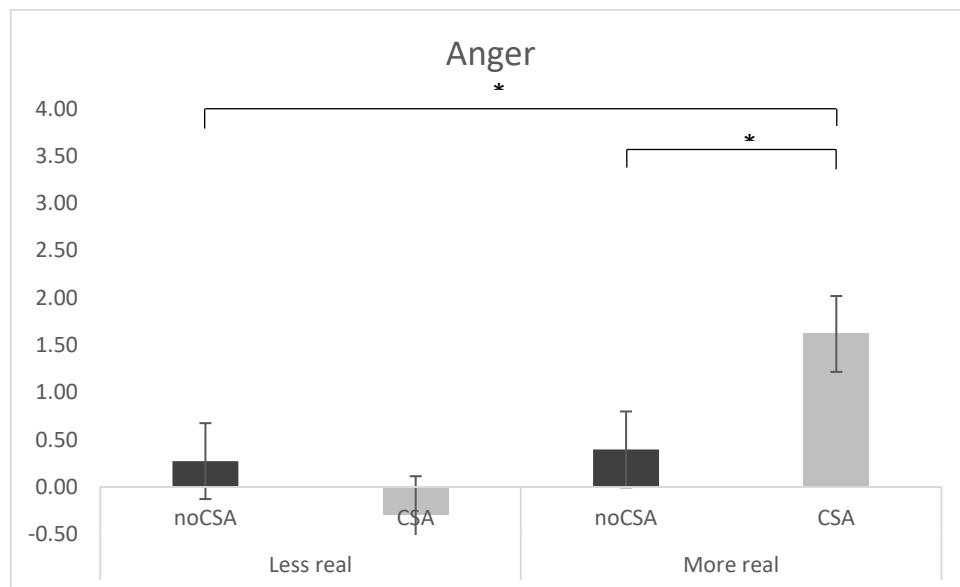

A statistically significant difference in the relief reaction to confirmed CSA and disconfirmed CSA avatars was found between participants who perceived avatars as more realistic (disconfirmed CSA 2.19 [95% CI: 1.9, 2.47]; confirmed CSA 1.55 [95% CI: 1.26, 1.84]), while the difference in relief reaction among participants who perceived avatars as less realistic was not significant (disconfirmed CSA 1.48 [95% CI: 1.26, 1.7]; confirmed CSA 1.52 [95% CI: 1.01, 2.04]).

Figure 8 shows that according to iMotions data (objective) the expected interaction between abuse (confirmed CSA vs. disconfirmed CSA) and the perceived realness of avatars (less real vs. more real) was significant for anger (Wald $\chi2$ [1] =7.32, *p* = .007).

Figure 8

Effect of the Perceived Realness of the Avatars on Facially Expressed (iMotions) Anger Reactions to confirmed CSA and disconfirmed CSA Avatar Scenarios.

Statistically significant difference in anger reaction to confirmed CSA and disconfirmed CSA avatars was found among participants who perceived avatars as more realistic (disconfirmed CSA 0.4 [95% CI: 0.16, 0.64]; confirmed CSA 1.62 [95% CI: 0.74, 2.5]), while the difference in anger reaction among participants who perceived avatars as less realistic was not significant (disconfirmed CSA 0.27 [95% CI: 0.05, 0.5]; confirmed CSA -0.29 [95% CI: -1.0, 0.43]).

7. Discussion

The purpose of the current study was to investigate whether participants emotionally respond to virtual child avatars with an alleged CSA scenario. Specifically, we aimed to measure subjective (using self-report measures) and objective (by analyzing facial expressions) emotional responses to confirmed CSA and disconfirmed CSA scenario details and to check whether emotional responses to confirmed CSA and disconfirmed CSA scenarios are different between participants who are generally more emotional vs. less emotional and perceive virtual child avatar as more realistic vs. less realistic.

7.1 Subjective and objective emotional responses to avatars

The first important set of findings suggests that participants emotionally react to allegedly abused virtual child avatar scenario details. Overall self-reported (subjective) emotional reactions were relatively high (higher than the mid-point of the Likert scale used), except for relief (mean score for relief was lower than the mid-point). Importantly, participants reported more anger, sadness and disgust to confirmed CSA scenario details and relief to disconfirmed CSA scenarios (Figure 2). Furthermore,

in some cases emotional reactions were especially strong, specifically, participants who were more generally emotional about the topic of CSA reported stronger anger reactions to confirmed CSA details. Interestingly, by objectively analyzing facial expressions, it was notable that participants overall tended to restrain from showing visible emotions, except anger. According to iMotions (objective) facial expression data analysis we found that participants express more anger to confirmed CSA vs. disconfirmed CSA scenarios (Figure 3). However, emotional reactions such and sadness, disgust, surprise, and relieve were not significantly different in the facial expression analyses. This went against our expectation that participants will show strong facial emotional reactions as well.

7.1.1 Anger

For the emotion of anger our predictions were supported by both the self-reported and objectively measured emotions. Seeing and hearing proof of immoral behavior, such as sexual abuse details, from a virtual child avatar resulted in increased anger. This is in line with Hutcherson and Gross (2011) study. Anger may increase willingness to pursue punishment, employ confrontational interviewing tactics and promote confirmation-seeking behaviors (Magnusson et al., 2021; Sambrano et al., 2020).

7.1.2 Sadness

For the emotion of sadness our predictions were supported only by the self-reported measured emotions. Hearing and witnessing traumatized children often evokes empathy and sadness. This result is in line with Nen and colleagues (2011) study.

7.1.3 Disgust

For the emotion of disgust our predictions were supported only by the self-reported measured emotions. This result is in line with Antfolk and colleagues (2012) research, that suggests that deviant behavior, such as child sexual abuse, may give rise to disgust, which in turn may lead to harsher judgements (Schnall et. al, 2008).

7.1.4 Relief

For the feeling of relief our predictions were again only supported by the self-reported measured emotion. We suggested that when an allegedly abused child turns out not to be abused and this fact disproves the interviewer's confirmation bias, it is likely that the interviewer should feel relief because the negative anticipated emotions did not materialize.

7.1.5 Surprise

According to self-reported measured emotions surprise reaction did not differ between confirmed and disconfirmed CSA scenarios. This went against our hypothesis, that disproven interviewer's confirmation bias is likely to give rise to surprise. A possible explanation could be that

the participants in this study were not interviewing the virtual avatar children, but only observing the provided relevant details, thus they were not actively involved in confirming or disproving the abuse hypothesis.

Importantly, the hypotheses related to surprise and relief were not backed up by a well-established theoretical models regarding how confirmation bias may be related to emotional reactions. Instead, we based these hypotheses on our experience with CSA investigations and suggest these connections be researched further in future studies.

7.2 Individual differences on emotional responses to avatars

The second important set of findings suggests that participants who are generally more emotional about the phenomenon of CSA and who perceive virtual child avatars as more realistic have stronger specific emotional reactions to allegedly abused virtual child avatar scenarios.

7.2.1 General emotionality on emotional responses to avatars

According to self-report (subjective) data analysis, more emotional participants report stronger anger reactions to confirmed CSA scenario details (Figure 4) and stronger relief reactions to disconfirmed CSA scenarios (Figure 5). The interaction is due less emotional participants having a slight increase in their anger reaction and no difference in their relief reaction between abused and non-abused avatars, whereas the emotional individuals show a large increase in anger reaction and a large decrease in relief reaction between abused and non-abused avatars. According to iMotions (objective) facial expression data analysis, we found that emotional participants react with stronger anger reactions to CSA scenario details (Figure 6). Less emotional participants have no difference in their anger reaction between abused and non-abused avatars, whereas the emotional individuals show a large increase in anger between non-abused and abused avatars. These results partially support Hypothesis 3.

7.2.2 Perceived realness on emotional responses to avatars

One of the important concepts of virtual stimuli is the experience of presence, which in turn is related to emotional experience (Diemer et al., 2015). The avatar simulation was created, and the experiment designed, so that participants would have a feeling of an actual child present in front of them. Overall reported realism of the avatars was relatively high (higher than average). According to self-report (subjective) measures participants who perceive virtual child avatars as more realistic report stronger relief reactions to disconfirmed CSA scenarios (Figure 7). Participants with lower feeling of realness have no difference in their relief reaction between abused and non-abused avatars, whereas the participants with more feeling of realness show an increase in relief reaction between non-abused and abused avatars. According to iMotions (objective) facial expression data analysis, participants who perceive virtual child avatars as more realistic report stronger anger reactions to confirmed CSA

scenarios (Figure 8). Participants with lower feeling of realness have no difference in their anger reaction between abused and non-abused avatars, whereas the participants with more feeling of realness show an increase in anger reaction between non-abused and abused avatars. These results partially support Hypothesis 4.

7.2.3 Simultaneous expression of subjective and objective emotions

The results of this study were less clear for the objective indicators. A possible explanation could be that a person can experience and feel (subjectively) different emotions simultaneously (Carrera & Oceja, 2007), but when analyzing facial emotional expressions, the question is how much of the subjectively felt simultaneous emotions can a person channel into a facial expression. This idea is in line with Izard (1997) who suggested that the expressive/neuromuscular components of emotion do not necessarily result in observable facial expressions. Some research indicates (Fernando, Kashima, & Laham, 2014; Hoemann, Gendron, & Barrett, 2017) that a person can experience mixed or multiple emotions at the same time, but that these subjectively experienced emotions do not necessarily result in observable facial expression (Izard, 1997). Another important aspect of objective measurement of facial expression is that automated facial recognition platforms, such as iMotions, use predictions to infer an emotion gathered from a series of detected AUs (action units), and are generally limited to six or seven emotions (Mortillaro, Meuleman, & Scherer, 2015). As mentioned previously, iMotions software has built-in recognition for a series of emotions, including anger, sadness, disgust and surprise, but not for relief, thus we had to construct relief reactions from the most common action unit present in relief – AU12 lip corner puller (Krumhuber, Scherer, 2011). This may have been less than ideal.

8 Strengths and weaknesses

The present study has a number of weaknesses. The present study only focused on participants emotional reactions when listening to a series of details narrated by the avatars. The results might differ if the participants would actually have been interviewing the avatars. The interview simulations from which the avatars used in the present experiment were taken last up to 10 min. In that time frame we can expect more pronounced emotional reactions. Also, actual child interviewing requires more engagement and effort from the interviewers and allows the formation of rapport. Thus, it can be expected that emotional reactions would be clearer in those situations. However, the presence of mostly expected effects in the current study suggest that it provides clues to such reactions. Another potential problem with the current study is that each participant viewed several avatars, one after the other. The carry over effects may have reduced differences between the confirmed CSA and disconfirmed CSA cases. Finally, it is worth mentioning that the Cognitions and Emotions about Child

Sexual Abuse (CE-CSA) scale has yet to be validated. The study has some strengths as well: The avatars provide a relatively standardized manner to investigate emotional reactions regarding a phenomenon that is otherwise difficult to investigate. Also, both subjective and objective emotion measures were used with some convergence in the findings.

9 Conclusions and implications

Results of the current study suggests that virtual child avatars elicit a variety of predictable emotional responses. This means that they can be used to study the impact of these emotions in the context of CSA interviewing. One important set of question relates to the process of learning to interview and how emotions may be involved in this process. On one hand emotions may facilitate learning as the result in higher attention. On the other hand, they might interfere with learning if the emotional processes are too overwhelming. An especially important issue relates to transfer. According to research on transfer of training effects, the similarity between the learning situation and the actual task is important in promoting transfer. The fact that the avatars elicit emotions should be especially beneficial in promoting transfer to actual CSA interviews. Also, in what way emotions should be addressed during CSA interview training is an important open question as is whether some individuals due to strong emotionality related to CSA may not be suitable to conduct CSA interviews. The second set of questions relates to how the emotions impact the process of interviewing itself. We are particularly interested in investigating how the different emotions impact confirmation bias (in the context of interviewing this amounts to question formulation). There seem to be reasons to believe that strong emotions could make confirmation bias first. However, the literature on the connection between emotions and confirmation bias is relatively under-developed especially in the forensic context and the results suggest that this question may be fruitfully studied using avatars providing experimental control while still being sufficiently realistic to elicit emotional responses.

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Pre-registration As Predicted: *„Emotional Responses to the Avatars"*

Created: 04/29/2020 01:38 AM (PT)

1) Have any data been collected for this study already?
No, no data have been collected for this study yet.

2) What's the main question being asked or hypothesis being tested in this study?
Participants will react with more negative emotions of sadness, anger and disgust to the child sexual abuse (CSA) scenarios and with more surprise and/or relief to the non-CSA scenarios.

3) Describe the key dependent variable(s) specifying how they will be measured.

Participants facial expressions measured with iMotions biometric research platform and self- report on emotions using PNAS questionnaire+additional questions regarding above mentioned emotions and feeling of realness. In addition, we will test the participants emotional reactivity to CSA with a psychometric instrument (Gewehr et al., 2020) translated into Lithuanian.

4) How many and which conditions will participants be assigned to?

Participants will be presented with the relevant details (7+2 details) for both CSA and non-CSA scenarios while their facial expression (iMotions) and afterwards self-report emotions (PNAS) are recorded. Each participant will be randomly allocated 4 CSA and 4 non-CSA Avatars of whom half are boys and half are girls. The order of presentation will be randomized within individual.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

1. Comparison 1: compare means on PNAS scores for CSA and non-CSA avatars - significant differences expected.
2. Comparison 2: check if the emotions change from pre to post in different ways between the CSA and non-CSA avatars - significant interaction time x emotions expected.
3. Comparison 3: compare the mean emotion scores between CSA and non-CSA avatars for the last two details - significant differences expected (iMotions).
4. Comparison 4 (control comparison): compare the mean emotion scores between CSA and non-CSA avatars for the seven first details - no differences expected (iMotions).
5. Comparison 5: Check if the emotions change from first 7 to last 2 in different ways between the CSA and non-CSA avatars - significant interaction time x emotions expected.
6. We expect that feeling of realness will moderate the effects so that effects 1, 2, 3, and 5 will be stronger for those with high realness scores compared to those with low realness scores (median split).
7. We expect that emotional reactivity to CSA will moderate the effects so that effects 1, 2, 3, and 5 will be stronger for those with high reactivity scores compared to those with low reactivity scores (median split).

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

We will exclude participant`s whose facial expressions would not be captured by iMotions or who will fail to fill in the at least one of the questionnaires.

7) How many observations will be collected or what will determine sample size?
No need to justify decision, but be precise about <u>exactly</u> how the number will be determined.

We will stop data collection once 30 participants will have been tested.

8) Anything else you would like to pre-register?

(e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

Background variables will be collected regarding the participants: age, gender, CSA knowledge, own CSA experiences, question about realness of the Avatar details.