Post traumatic stress affects children's resistance to interrogative suggestibility and the ability to give answers with high discrepancy detection in repeated suggestive interviews

Valeria Giostra | Tiziana Maiorano | Sofia Morresi | Ilaria Ottaviani | Monia Vagni

Abstract

Traumatic events can lead to the development of post-traumatic stress with consequences on the cognitive, emotional and relational functioning of children and adolescents, impacting their suggestive vulnerability. The present study aims to verify how post-traumatic stress (PTS) can increase children's suggestibility by constantly reducing their ability to provide Resistant Behavioral Responses (RBR) when exposed to repeated suggestive interviews. Participants were 104 children aged 11-15 years recruited in various Italian middle and high schools. All children completed the Gudjonsson Suggestibility Scale (GSS 1 and GSS2), a nonverbal IQ test, and the Traumatic Symptoms Checklist for Children (TSCC). The results showed that PTS had significant positive correlations with suggestibility scores and negative correlations with "No" and "Direct Explanation" answers. Children with high PTS showed higher suggestibility scores on GSS1 and GSS2 than children with low PTS and provided fewer "no" and "direct explanation" responses. Multivariate analysis of variance models highlighted how high levels of PTS affected the ability to resist to yield and psychoemotional pressure in both repeated parallel interviews (Shift), leading children to provide fewer RBR responses with high discrepancy detection ability. Forensic implications are discussed in order to PTS on suggestibility.

Keywords: repeated suggestive interviews, interrogative suggestibility, misleading questions, resistant behavioural responses, children, trauma, post traumatic stress disorder

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Introduction

Interrogative Suggestibility in children witnesses

Suggestibility is an individual characteristic that leads people to accept misleading information involved in an interview with leading questions, related to psychological and social factors (Gudjonsson, 2018). Particular stressful situations, both internal and external factors, can lead to greater suggestive vulnerability. According to Gudjonsson and Clark's (1986) psychosocial model of interrogative suggestibility, three factors favor suggestive vulnerability: uncertainty, interpersonal trust and expectations of success. Exposing the interviewee to misleading questions together with socio-emotional pressure factors leads to experiencing uncertainty about one's performance and trust in the interviewer, considered more authoritative and competent, and the expectation of carrying out one's task well increase the tendency to accept misleading information (Yield) and to modify one's responses (Shift) after negative feedback (Gudjonsson, 2018; Vagni, Maiorano & Giostra, 2024). These factors have a greater influence in the forensic context, leading both witnesses (Vagni et al., 2017) and suspects (Gudjonsson, 2018) to be more suggestible. Suggestibility is related to compliance, but it is an independent and sometimes less conscious factor (Gudjonsson et al., 2024).

Among the cognitive factors involved in suggestibility, age is particularly important (Goodman et al., 2014). In fact, according to the literature, children under the age of 12 are more vulnerable to suggestibility (Gudjonsson et al., 2016; Vagni, Giostra & Simione, 2024). In several studies it has been found that younger children yield more easily to misleading questions and to the effect of misinformation (Goodman et al., 2014; Klemfuss & Ceci, 2012; Klemfuss, 2015).

Several studies have found that younger children also have weaker memory traces than adults and, remembering events worse, may be more inclined to accept suggestions also due to Memory Distrust Syndrome (Goodman et al., 2014; Gudjonsson et al., 2024; Gilbert et al., 2024; Pena et al., 2017). Additionally, younger children tend to be more influenced by social pressure, lack of social support, and the presence of authority figures. Children with less developed cognitive functions, or with intellectual disabilities, present a greater number of memory errors, such as distortions, fabrication and confabulation, and present greater suggestibility also due to a lower ability to cope with suggestive pressures, to discriminate correct information from misleading information and to provide resistant responses (Arterberry, 2022; Vagni, Maiorano &

Giostra, 2021; Gudjonsson et al., 2022; Giostra & Vagni, 2024; Maiorano & Vagni, 2020).

According to Gonzalves and colleagues (2022), it is also important to consider that the effects of age may depend on social and contextual factors, such as embarrassment, basic knowledge, anguish and familiarity, which are able to increase, eliminate or even reverse the effects of age.

During the evaluation of a minor for the purposes of suitability to testify, it is very important to measure the level of interrogative suggestibility, because this allows us to predict the behavior that the children might have when faced with suggestive questions during witness listening.

Younger children faced with an interview with suggestive questions, due to their lower level of cognitive maturation compared to older children and adults, tend to give dichotomous "yes/no" answers, accepting or refusing the suggestion. More articulate and "I don't know" responses to suggestive questions are associated with higher cognitive and expressive skills (Waterman & Blades, 2011; Klemfuss, 2015). Such scientific evidence led Gudjonsson and colleagues (2021; 2022) to develop the Resistant Behavior Responses (RBR) model following the Source Monitoring paradigm (Johnson & Raye, 1981) classifying refusal responses to leading questions into simple "no"; "direct explanation" (with which the interviewee states that the misleading information was not originally present or by providing the correct information), and "Don't know". The answers "no" and "direct explanation" indicate a good ability of discrepancy detection which seems to be constant in different memory tasks (Gudjonsson, 2003; Schooler & Loftus, 1986; Vagni, Maiorano & Giostra, 2023).

Source monitoring ability tends to increase with age and be related to more mature cognitive abilities (Gudjonsson et al., 2021; 2022; Rossi-Arnauld et al., 2021) and it may be more difficult for a child to grasp discrepancies between what has been perceived and what has been suggested (Schooler & Loftus, 1986).

Repeated suggestive interviews as a risk factor

A risk factor to consider is that during investigations, child witnesses are often questioned multiple times by different interviewers, increasing the likelihood of exposure to leading questions and misleading information.

As summarized by La Rooy et al. (2010), the literature showed contrasting effects of repeated interviews (Bruck & Ceci, 2004; Goodman & Quas, 2008; La Rooy, Lamb & Pipe 2009). The controversy has persisted due to the coexistence of two distinct lines of psychological research:

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one emphasizing the benefits and the other highlighting the negative effects of repeated interviews (La Rooy et al., 2009).

Some studies highlighted that repeating an interview after a certain amount of time leads the witness to provide a greater amount of information and if the delay is short (less than 48 hours), a good percentage of the new information is accurate (Gilbert & Fisher, 2006). Repeated interviews can act as memory cues, support rehearsal and retrieval processes, minimize forgetting, and, in some cases, enhance resistance to misleading or leading questions (Gordon, Baker-Ward, & Ornstein, 2001; La Rooy et al., 2005; Omstein, 1995; Goodman & Quas, 2008; Hershkowitz et al., 2021).

However, the literature highlights that when the witness is a minor, multiple factors must be taken into consideration. For children a recall delay of months or years between interviews compromises both the completeness of the memory and the accuracy of the information reported.

Repeating suggestive interviews doesn't necessarily make children more susceptible to leading questions. However, conducting an excessive number of interviews using misleading questions could compromise the accuracy of their recall particularly when their memory of the event is weak (Warren & Lane,1995). Cassel et al. (1996) observed that in children the tendency to yield to repeated suggestive questions diminished with increasing age, resulting in 12-year-olds performing on par with adults and exhibiting consistent levels of suggestibility (La Rooy et al., 2009). With age, cognitive skills and coping strategies also increase, which allow for better management of misleading information (Vagni et al., 2025).

Vagni et al. (2023), in a study involving minors aged 10 to 15, found that being subjected to repeated interviews increased suggestibility levels at GSS2 in younger children, while older children showed a reduction in yield and a higher number of RBR responses, while the levels of shift related to negative feedback remained unchanged. Coping strategies that a minor employs during the interrogation process can serve as a protective factor against the effects of repeated interviews (Vagni et al., 2024). In fact, task-oriented coping strategies reduce vulnerability to suggestive questions and increase RBR responses, as they involve a greater capacity for source monitoring by the individual.

Trauma and suggestibility

Several factors may influence ability in children to accurately recalling experience events such as sexual abuse (Cleveland et al., 2022).

In the complex relationship between stress, memory and suggestibility, trauma plays a relevant role. Traumatic events can lead to the development of PTSD, a psychopathology that can influence the association between memory, trauma and suggestibility in children (Slonecker et al., 2023). Trauma-related psychopathology can produce several consequences on the cognitive, emotional and relational functioning of children and adolescents, as deficit of memory (Chae et al., 2011; Eisen et al., 2007; Melinder, Mirandola, & Gilstrap, 2020). According to some studies, children with PTSD tend to exhibit poor and inaccurate memory performance, as well as high levels of suggestibility (Chae et al., 2014). In their immediate and delayed recall there is a greater risk of memory errors such as distortions, fabrications and confabulations (Vagni, Maiorano & Giostra, 2021).

The consequences of trauma-related psychopathology on the cognitive and emotional functions of children and adolescents may influence immediate and delayed suggestibility (Vagni, Maiorano & Giostra, 2024).

Several studies focused on the analysis of the effects of trauma on memory and suggestibility founding mixed results. Some study found that children with PTSD showed high levels of suggestibility (Chae et al., 2014), while in other studies no significant relationship emerged (Eisen et al., 2007).

Having experienced traumatic events does not necessarily lead to the development of a full-blown post-traumatic disorder and in many victims, both children (Vagni, Maiorano & Pajardi, 2022) and adults (Drake, 2010; Condino et al., 2022), it is possible to trace a condition of post-traumatic stress without satisfying all the psychopathological criteria of PTSD. Post-Traumatic Stress (PTS) in Briere's studies (1996) takes into account more the intrusive aspects and less the symptoms of avoidance and hyperactivation and for this reason it cannot be considered a clinical condition similar to that of PTSD. In several studies, PTS has been found to be associated with child victims of abuse and maltreatment (Marc, 2016; Lanktree et al., 2008) and for this reason its application in the criminological field can be useful.

Several studies (Gudjonsson et al., 2020, 2022; Vagni et al., 2015, 2017, 2018; 2022) have analyzed the impact of post-traumatic stress disorder on immediate and delayed suggestibility in children and adolescents. In some studies emerged that symptoms of trauma significantly increased delayed suggestibility (Gudjonsson et al., 2020; Vagni et al. (2022).

PTSD is a factor that can also impact the ability of discrepancy detection by reducing responses with a high level of source monitoring (Gudjonsson et al., 2021; Otgaar et al., 2017). No study has tested whether PTS has a similar effect as PTSD in reducing the ability to detect discrepancy between originally present information and misleading information.

Previous studies have demonstrated the effect of repeated suggestive interviews on children (Vagni, Giostra & Maiorano, 2023; Vagni & Giostra, 2024), but no studies have examined the effect of posttraumatic stress on suggestive interviews repeated over time. Furthermore, several studies have examined the impact of trauma on the ability of discrepancy detection and on RBRs, but no study has examined whether this effect remains constant even in subsequent suggestive interviews. Furthermore, no study has found whether even children who do not have full-

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blown PTSD but only PTS show limited ability to provide Resistant Behavioural Responses and whether this maintains its effect in repeated interviews.

The Current Study

The present study aims to verify how levels of post-traumatic stress (PTS) can impact children's ability to cope with a suggestive interview and to give resistant responses, and whether it remains constant over time. Several studies have found how the presence of post-traumatic stress disorder can increase vulnerability to suggestive questions, limiting the ability to provide resistant answers, especially those with high discrepancy detection (Vagni et al., 2017; Vagni, Maiorano & Pajardi, 2022; Gudjonsson et al., 2020, 2021, 2022).

In this study, the same sample was subjected to two parallel forms of suggestive interviews administered 6 months apart. The levels of suggestibility and the Resistant Behavioural Responses (RBRs) were associated with the measurement of post-traumatic stress levels and their effect was verified on both parallel scales:

– Hypothesis 1: children with high post-traumatic stress levels show greater immediate suggestibility in both repeated suggestibility scales.
– Hypothesis 2: high posttraumatic stress increases immediate suggestibility scores on both repeated suggestibility scales.
– Hypothesis 3: high post traumatic stress levels reduces resistant responses with correct and high discrepancy detection (NO and DE responses).

Materials and Methods

Participants and Procedures

The sample included 104 participants with ages ranged from 11-15 years old (*M* = 12.38 and *SD* = 1.12 (61 females, 58.7%; 41.3% males) recruited in several Italian middle and high schools. The sample has an average age IQ (M = 100.67; SD = 8.50; min – max = 80 – 110).

Participants were admitted after their parents/guardians signed consent forms and after verification of the following admission criteria: a) absence of severe medium and severe intellectual delay which could compromise the understanding of the verbal stimuli presented; b) sufficient understanding of the Italian language for foreign children. Children with low or no knowledge of the Italian language were indicated by the teachers. Foreign children who provided less than 2 items in the immediate recall task were excluded; c) absence of developmental pathologies and sensory deficits (autism, severe intellectual disability, deaf-mutism, severe language delay, etc.).

Procedure

Participants were administered the two parallel forms of the immediate suggestibility scale validated by Gudjonsson (1997) and adapted to the Italian language (Vagni et

al., 2015; Gudjonsson et al., 2016). The same administration procedure was followed with all participants. The Gudjonsson Suggestibility Scale 2 (GSS2), originally validated for even younger children, was administered first, and 6 months later the Gudjonsson Suggestibility Scale 1 (GSS1) was administered, which presents a more complex verbal stimulus, but already administered in other studies to pre-adolescents and adolescents (Curci & Bianco, 2014; Vagni, Giostra & Maiorano, 2023; Vagni & Giostra 2024).

At the first session, between the first and second part of the administration of the GSS2, the participants' IQ and level of post-traumatic stress were measured.

Data were collected from all participants in the same location on both sessions. The first administration took place at the end of November 2023 and the second at the end of May 2024. All tools were administered individually. The study was conducted following and respecting the ethical principles in accordance with ethical research involving children. The study conformed to all ethical guidelines for research with human participants and followed the Declaration of Helsinki. The research project was approved by the Human Experimentation Ethics Committee of the University of Urbino (minute 28; March 18, 2020) The informed consent was signed before the inclusion of the children in the study, and it contained information on the objective of the study, methods of conduct, anonymity, and information on the conservation of sensitive data.

Instruments

Gudjonsson Suggestibility Scales GSS 2 (Gudjonsson, 1987,Gudjonsson, 1997)

The Gudjonsson Suggestibility Scale (GSS) is an instrument designed to assess immediate suggestibility levels. It has two parallel versions: Gudjonsson Suggestibility Scale 1 and 2 (GSS1 and GSS2; Gudjonsson 1984, 1987,1997). The primary distinction between these two forms lies in the stimulus material used. Specifically, GSS1 is more complex and is typically administered to adults or older children.

In this study, the GSS1 version validated by Curci and Bianco (2014) was employed, demonstrating internal consistency scores exceeding 0.60 in an adolescent sample. The GSS2 form (Vagni et al., 2015; Gudjonsson et al., 2016), also used in this study, has been validated on a large sample of children and adolescents and has been applied in multiple studies ((Vagni et al. 2017, 2018, 2021, 2022). It has shown strong reliability and internal consistency, as reflected by Cronbach's alpha coefficients: Yield 1 (α = 0.81), Yield 2 (α = 0.83), Shift (α = 0.71), and Total Suggestibility (α = 0.77) (Gudjonsson et al., 2016)

Both GSS1 and GSS2 consist of a brief narrative describing a boy involved in a bicycle accident. After listening to the story, the participant is asked to recall everything he remembers. Immediate recall score is determined by the number of correct items reported by the subject and it also allows for the measurement of confab-

ulation that is assessed based on distortions and fabrications (Gudjonsson, 1997; Clare et al., 1994). Distortions refer to the total number of significant modifications made to an existing detail from the original story. Fabrications, on the other hand, represent the total count of new elements introduced during recall that were not present in the original narrative.

Following a delay of approximately 40-50 minutes, during which other unrelated tasks are completed, the participant is presented with 20 questions about the story. Of these, 15 are misleading, meaning the necessary information to answer them is not provided in the story, while five are neutral. The Yield 1 score represents the number of misleading questions to which the participant provides affirmative responses. After the initial questioning, the participant is informed that they have made errors, and all questions are repeated. This process generates two additional measures: Yield 2, which represents the number of misleading questions accepted after receiving negative feedback, and Shift, which accounts for the number of responses altered after feedback, regardless of direction. Finally, the Total Suggestibility score is obtained by summing Yield 1 and Shift.

According to the RBR model (Gudjonsson et al., 2021, 2022), Resistant Behavioral Responses in both GSS1 and GSS2 were categorized as follows: Responses such as "No" and "Neither" were classified under "No" (NO). If the participant stated that the requested information was not present in the story or had not been mentioned, the response was categorized as "Direct Explanation" (DE). When the participant responded with "I don't know" or "I don't remember", the answer was labeled as "Don't Know" (DK). Only responses to the leading questions in both the first and second interviews were considered for analysis in both scales.

Raven's Matrices (Belacchi et al., 2008;Giunti, 2008; Raven, 1954; Raven, 1984)

The Raven's Progressive Matrices is a non-verbal intelligence test designed to assess abstract reasoning and problem-solving abilities. It presents a series of visual patterns with a missing piece, and the subject must select the correct answer from multiple choices.

There are two main versions of the test: the Standard Progressive Matrices (SPM), the original version, consisting of black-and-white matrices that gradually increase in difficulty for children age 12 years and overt, and the Coloured Progressive Matrices (CPM), a simplified version with colored matrices, intended for children up to the age of 12 years. Both versions measure fluid intelligence, which refers to cognitive abilities that are independent of language, culture, and formal education.

TSCC-A (Briere, 1996; Di Blasio et al., 2011)

Trauma Symptoms Checklist for Children-A (TSCC-A; Briere, 1996; Di Blasio et al., 2011) is a self-report that measures post-traumatic distress and related psychological symptomatology on children and adolescents aged 8–16.

The instrument consists of 44 items evaluated on a 4-point scale (from 0 = Never to 3 = Almost always). The cutoff for all scales is 65 T points. TSCC contains two control scales, Underresponse and Hyperresponse , and six clinical scales, Depression, Anger, Post-Traumatic Stress, Open Dissociation and Fantasy Dissociation. The PTS scale used in this study evaluates the presence of trauma-related symptoms, which include: Cognitive avoidance, numbness, hyper-arousal, nightmares, and intrusive. The scale measures mainly the intrusive and persistent aspects of memories related to traumatic events, but does not allow a complete measurement of PTSD according to the DSM5TR criteria.

Scores $\geq$ 65T indicate the presence of a clinically relevant PTSD. Protocols with a score $\leq$ 2 standard deviations to the control scales were excluded from the present study. Descriptive scores of the all sample and of the children with low and high PTS obtained on the TSCC scales are reported in the appendix (see table A1).

Statistical Analyses

Some preliminary paired t-tests were performed between the suggestibility scores in the two parallel scales. We used Cohen's d (Cohen, 1992) to measure effect sizes regarding the differences between the two scale scores (t-tests): .20, .50 and .80 were used to detect small, medium and large effect sizes, respectively. A Pearson correlation was performed between the memory tasks and suggestibility scores of the two scales, PTS and IQ.

The sample was divided based on the score on the PTS scale (1 = scores lower than 65T; 2 = scores equal to and higher than 65T). A t-test comparison was performed between subjects with low and high PTS. Pearson correlations were performed between both the immediate suggestibility scales, PTS, age and IQ scores.

A G*Power analysis For MANOVA using Pillai's Trace and a priori power analysis was conducted, with 2 groups, 6 dependent variables (Yield 1; Yield2 and Shift for two parallel scales), α=0.05, power (1-β err. prob.) = 0.95, and medium effect size.

A Multivariate Analysis of Variance (MANOVA) model was conducted assuming the GSS2 and GSS1 scores as dependent variables, PTS (low vs high level) was fixed factor and Age and IQ as covariates.

Comparisons between subjects with low and high PTS were performed for Resistant Behavioral Responses and Pearson's correlations were generated between RBRs at the two scales with PTS scores and age.

MANOVA analysis was generated to test the effects of PTS level on RBRs, assuming all No, Direct Explanation and Don't Know answers as dependent variables, PTS group ad fixed factor and Age as covariate.

Results

Preliminary Analysis
Paired *t*-test was performed between the Memory tasks

and suggestibility scores of the two scales (table 1). The results showed large and medium effect for memory errors with increased distortions, fabrications and confabulations in GSS1. The results also showed medium and small effect for Yield 1, Yield2 and Total Suggestibility with decreased in GSS1.

Tab. 1 – Differences in scores on the Suggestibility between the GSS2 and GSS1 scales (N = 104).

Variable	GSS2	GSS1	t	d
Immediate recall	16.21 (4.99)	16.73 (6.06)	-.80	.09
Distortion	.76 (.90)	1.52 (1.22)	-4.98***	.71
Fabrication	.30 (.54)	.62 (1.01)	-3.24**	.40
Confabula-tion	1.06 (1.11)	1.98 (1.29)	-5.33***	.76
YIELD1	7.39 (2.79)	6.54 (2.79)	2.90**	.30
YIELD2	9.14 (3.53)	7.49 (3.24)	4.98***	.49
SHIFT	5.80 (3.04)	5.49 (2.64)	1.01	.11
Total Sug-gestibility	13.20 (4.81)	12.08 (4.93)	2.53*	.23

*p<.05; **p<.01; ***p<.001; GSS1 and GSS2 = Gudjonsson Suggestibility Scale 1 and 2

Pearson's correlations were performed between the both immediate suggestibility scales, PTS, age and IQ scores (table 2). PTS showed significant positive correlations with the scores of the parallel scales of suggestibility, and fabrication on memory task of the GSS1, and negative correlations with immediate recall of the GSS1. Age showed significant negative correlations with Yield 2 of the GSS2 and immediate suggestibility scores of the GSS1. Finally, IQ showed positive correlations with both immediate recalls and negative correlations with memory errors of the first scale and Yield1 to the second scale.

Tab. 2 – Pearson's correlations between GSS2, GSS1, PTS, age and OQ scores (N = 104)

	PTS	AGE	IQ
GSS2			
Immediate recall	-.064	.055	.337**
Distortion	-.002	.122	-.197*
Fabrication	.160	.066	-.351***
Confabulation	.076	.130	-.335**
Yield1	.501***	-.139	-.194*
Yield2	.471***	-.187*	-.088
Shift	.394***	-.123	-.036
Total Suggestibility	.548***	-.157	-.138
GSS1			
Immediate recall	-.267**	.142	.282**
Distortion	-.090	.080	.164
Fabrication	.205*	.055	-.075
Confabulation	-.063	.025	.164
Yield1	.463***	-.305**	-.218*
Yield2	.374***	-.307**	-.127
Shift	.387***	-.285**	-.119
Total Suggestibility	.460***	-.329**	-.192
PTS	-	-.035	.005

*p<.05; **p<.01; ***p<.001; GSS1 and GSS2 = Gudjonsson Suggestibility Scale 1 and 2; PTS = Post Traumatic Stress

Hypothesis 1: children with high post-traumatic stress levels show greater immediate suggestibility in both repeated suggestibility scales

In order to Hypothesis 1, *t* -test comparisons were carried out between children with low and high PTS scores (law PTS = 1; high PTS = 2) for memory tasks and for immediate suggestibility scores (table 3). Regarding the memory tasks, only a difference emerged in the immediate memory of the GSS1 where children without PTS had a higher performance. Significant differences with large effects were recorded for children with high PTS on all suggestibility scores and both the GSS scales.

Tab. 3 – Differences in scores on the Memory Tasks and Suggestibility between low and high PTS (N = 104).

	Low PTS (N = 56)	High PTS (N = 48)	t	d
GSS2				
Immediate recall	16.11 (4.97)	16.33 (5.05)	-.23	.04
Distortion	.79 (.87)	.73 (.94)	.32	.07
Fabrication	.25 (.51)	.35 (.57)	-.99	.18
Confabula-tion	1.04 (.97)	1.08 (1.27)	-.22	.04
Yield1	6.16 (2.49)	8.83 (2.44)	-5.52***	1.08
Yield2	7.66 (3.41)	10.88 (2.83)	-5.18***	1.03
Shift	4.77 (2.89)	7.00 (2.77)	-4.00***	.79
Total Sug-gestibility	10.93 (4.27)	15.85 (4.00)	-6.04***	1.19
GSS1				
Immediate recall	18.14 (5.34)	15.08 (6.47)	2.64*	.52
Distortion	1.55 (1.33)	1.48 (1.07)	.31	.06
Fabrication	.46 (.76)	.79 (1.22)	-1.67	.32
Confabula-tion	1.98 (1.46)	1.98 (1.06)	.01	.01
Yield1	5.48 (2.07)	8.00 (2.98)	-5.06***	.98
Yield2	6.34 (2.60)	8.83 (3.42)	-4.22***	.82
Shift	4.43 (2.40)	6.73 (2.54)	-4.91***	.93
Total Sug-gestibility	9.91 (3.63)	14.60 (5.08)	-5.47***	1.06

*p<.05; **p<.01; ***p<.001; GSS1 and GSS2 = Gudjonsson Suggestibility Scale 1 and 2; PTS = Post Traumatic Stress

Hypothesis 2: high post traumatic stress level increases immediate suggestibility scores on both **repeated suggestibility scales**

The results highlighted in table 3 showed greater suggestibility in children with high post-traumatic stress. To test the significant impact of the PTS on the suggestibility scores on the parallel scales, a MANOVA model was performed taking the Yield1, Yield 2 and Shift scores of both scales as dependent variables. PTS group was as fixed factor (low PTS = 1; high PTS =2) and Age and IQ as covariates. Total suggestibility scores were excluded to avoid collinearity because they are given by the sum of Yield1 and Shift. The G*power analysis indicated a sufficient sample of 56 participants and therefore the model can be analyzed.

The model showed main effects for PTS Group (Pillai's trace: Val 0.370; $F_{(6; 95)}$ = 9.306; p< 0.001; η^2 = 0.370), and for Age (Pillai's trace: Val 0.153; $F_{(6; 95)}$ = 2.859; p< 0.05; η^2 = 0.153). Between subject effects for PTS Group were on all variables: Immediate Recall (F = 88.61; p<0.001; $\eta^2$0.60), Distortion (F = 11.92; p<0.001; $\eta^2$0.17), Yield1$_{GSS2}$(F = 32.151; p<0.001; $\eta^2$0.243), Yield2$_{GSS2}$ (F = 27.380; p<0.001; $\eta^2$0.215), Shift$_{GSS2}$ (F =15.769; p<0.001; $\eta^2$0.136), Yield1$_{GSS1}$ (F = 29.617; p<0.001; $\eta^2$0.228), Yield2$_{GSS1}$ (F = 19.396; p<0.001; $\eta^2$0.162), and Shift$_{GSS1}$ (F = 26.015; p<0.001; $\eta^2$0.206). Between subject effects for Age were on Yield2$_{GSS2}$(F = 4.343; p<0.05; $\eta^2$0.042), Yield1$_{GSS1}$ (F = 14.074; p<0.001; $\eta^2$0.123), Yield2$_{GSS1}$ (F = 12.525; p<0.01; $\eta^2$0.111), and Shift$_{GSS1}$ (F = 11.51; p<0.01; $\eta^2$0.100). No effect obtained for IQ.

Hypothesis 3: the high post traumatic stress level reduces resistant responses with correct and high discrepancy detection (NO ed DE responses).

t-tests were carry out for RBRs between subjects with low and high PTS and Pearson's correlations were performed between RBRs at the two scales, PTS score, and age (table 4).

Tab. – 4 Differences and Correlations in scores on the Suggestibility between low and high PTS (N = 104).

	Low PTS (N = 56)	High PTS (N = 48)	*t*	PTS	Age
GSS2					
NO1	6.71 (2.33)	5.21 (2.26)	3.34**	-.276**	-.046
NO2	4.23 (2.08)	4.17 (1.99)	.16	-.106	-.142
DE1	1.61 (2.75)	.56 (1.50)	2.35*	-.279**	.143
DE2	1.96 (2.93)	.90 (1.81)	2.19*	-.204*	.007
DK1	.54 (1.10)	.42 (1.03)	.57	-.075	.170
DK2	.29 (.76)	.44 (1.17)	-.80	-.029	.079
GSS1					
NO1	6.84 (2.59)	5.48 (1.88)	3.02**	-.277**	.006
NO2	5.96 (2.63)	4.56 (2.10)	2.97**	-.227*	.095
DE1	2.02 (2.67)	1.17 (1.64)	1.92*	-.195*	.361***

DE2	2.02 (2.89)	1.31 (1.889	1.45	-.172	.308**
DK1	.63 (1.21)	.35 (.89)	1.28	-.152	.024
DK2	.55 (1.28)	.31 (1.04)	1.05	-.106	.032

*p<.05; **p<.01; ***p<.001; GSS1 and GSS2 = Gudjonsson Suggestibility Scale 1 and 2; PTS = Post Traumatic Stress; DE 1 and 2 = Direct Explanation answer on Yield 1 and Yield2, respectively; DK 1 and 2 = Don't Know answer on Yield 1 and Yield2, respectively

Appendix
A1 - TSCC descriptive scores (N = 104)

	All sample (N = 104)	Low PTS (N = 56)	High PTS (N = 48)
	Mean (SD; min – max)	Mean (SD; min – max)	Mean (SD; min – max)
Anxiety	52.62 (10.35; 35 – 85)	48.81 (8.61; 35 – 77)	57.92 (10.34; 35 – 85)
Depression	53.88 (10.88; 35 – 82)	49.72 (9.73; 35 – 78)	59.68 (9.77; 41 – 82)
Anger	52.15 (10.72; 35 – 87)	50.17 (10.14; 35 – 78)	55.06 (11.02; 35 – 87)
Post Traumatic Stress	58.45 (12.55; 35 – 88)	48.59 (6.74; 35 – 60)	71.45 (5.25; 65 – 88)
Dissociation	52.19 (9.15; 35 – 87)	49.47 (7.98; 35 – 66)	55.97 (9.42; 41 – 87)

Given the significant differences compared to the PTS group (see table 4), a MANOVA model was generated to test its effect on all Direct Explanation and No answers to the parallel scales. Age was a covariate and PTS group ad fixed factor.

The model showed main effects for PTS group (Pill's trace: Val. = 0.311; $F_{(8, 94)}$ = 5.298; p<0.001; $\eta^2$0.311) and for Age (Pill's trace: Val. = 0.177; $F_{(8, 94)}$ = 2.533; p<0.05; $\eta^2$0.177). PTS showed significant between subject effects on NO1$_{GSS2}$ (F = 11.143; p<0.01; $\eta^2$0.099), DE1$_{GSS2}$(F = 5.403; p<0.05; $\eta^2$0.051), DE2$_{GSS2}$ (F = 4.752; p<0.05; $\eta^2$0.045), NO1$_{GSS1}$(F = 9.048; p<0.01; $\eta^2$0.082), NO2$_{GSS1}$(F = 8.657; p<0.01; $\eta^2$0.079), and DE1$_{GSS1}$(F = 3.792; p<0.05; $\eta^2$0.036). Age showed significant between subject effects for DE1$_{GSS1}$(F = 15.307; p<0.001; $\eta^2$0.132), and DE2$_{GSS1}$(F = 10.575; p<0.01; $\eta^2$0.095).

Discussion

The present study aimed to test the impact of post-traumatic stress on the resistance of children to leading questions and give RBRs to two parallel forms of the suggestibility scale.

The two scales were administered 6 months apart and present similar characteristics and exposure properties to

the factors of suggestive vulnerability and socio-emotional pressure. The difference is in the verbal stimulus and the GSS1, administered second, can be more complex. All participants showed sufficient understanding of the story.

The preliminary results confirmed, in agreement with other previous studies (Vagni, Maiorano and Giostra 2023), how immediate recall was similar between the two scales, while the number of memory errors, such as distortions, fabrications and confabulations, was greater in the second administration.

According to previous studies (Vagni, Giostra & Maiorano, 2023; La Rooy et al., 2009), yield scores at the second scale were lower. Vagni and colleagues (2023) explained this apparent counter-tendency by arguing that older children and those over 12 years of age can develop more effective coping skills to deal with suggestive interviews and reduce levels of acceptance of misleading information.

The results of the present study with t- test comparisons showed that children with higher post-traumatic stress (PTS) had higher immediate suggestibility, showing a large effect size on the scores of both scales, while performance on the memory tasks were similar, except for a small reduction in immediate recall at the second administration GSS1 for children with higher PTS (see table 3).

These results allowed us to test the second hypothesis to verify whether the presence of the PTS led to an increase in immediate suggestibility.

The Multivariate Analysis of Variance (MANOVA) model confirmed the impact of PTS on suggestibility scores in both scales. Most of the literature (Klemfuss & Olangues, 2018; Vagni, Maiorano & Giostra, 2024; Gudjonsson et al., 2020; Slonecker et al., 2023) has demonstrated how post-traumatic stress can increase children's suggestive vulnerability, although until now studies have not considered the incidence of this variable in repeated suggestive interviews.

The effects of PTS appeared to be greatest on GSS2 scores administered first. This seems to suggest that even children with high post-traumatic stress are able to activate management strategies for misleading questions and socio-emotional pressure, albeit less effective than other children. Age showed a smaller effect while IQ showed no effect. These results seem to confirm that the main incidence is due to the presence of a high level of PTS.

The results suggest important forensic implications since if the PTS has a greater impact on the first suggestive interviews, then it becomes important that in the first investigative phases there is greater attention to avoiding the use of misleading information, leading questions and social and emotional pressures during the first testimony of children suspected victims of abuse. This is even more so if the children have developed stress post traumatic as their ability to deal with suggestive interviews will tend to remain less to other children.

With the third hypothesis, the study aimed to verify the impact of PTS on children's ability to discriminate and reject misleading information. The results of table 4

showed how children with high PTS had fewer "no" and "direct explanation" answers.

"No" and "direct explanation" responses also had a significant negative correlation with PTS. The MANOVA model showed a significant effect of PTS on the reduction of these Resistant Behavioral Responses, especially those with high discrepancy detection capability. This result seems to suggest how the presence of a high PTS in repeated interviews attenuates the discrepancy detection capabilities relating to source monitoring which is a fundamental testimonial skill. No difference was found with respect to the "don't know" answers, which therefore seem associated with other psychological variables not taken into consideration in this study.

The presence of PTS therefore seems to lead children to have a lower ability to resist pressure and suggestive influences and also to have a lower ability to discriminate with safe source monitoring the information originally present in the memory and the misleading information.

Considering these vulnerabilities that post traumatic stress seems to have especially in the first interviews and suggestive pressures, it seems important to highlight the importance of avoiding suggestibility factors during the first testimonial collection. It seems that upon first exposure to mislead questions and the social and emotional pressures that may be involved in a suggestive interview, children with post-traumatic stress may be more vulnerable also to the subsequent suggestive interviews. Furthermore, as is known in the literature, younger children tend to have a lower source monitoring skill.

Limitations

This study has some limitations. The first limit is linked to the size of the sample, which does not allow for generalizations, the second limit concerns the use of a self-report instrument to measure post-traumatic stress disorder and this may have implied in young children, who may not have understood all the elements contained in the items. The children's self-assessment of the presence of symptoms had no other confirmation with certifications or confirmation from reference adults. Furthermore, PTS was detected only at the first administration and this does not allow us to estimate how the clinical functioning has evolved 6 months later. Traumatic symptoms can affect children's cognitive and emotional functioning. The study did not take into consideration the measures of other cognitive functions that could intervene in relation to the trauma

Conclusion

The main aim of the present study was to examine the effects of PTSD on suggestibility levels in children subjected to repeated interviews. The results showed that higher levels of PTSD increase the tendency to yield to leading

questions and reduce the ability to provide Resistant Behavioral Responses, especially in those with high discrepancy detection ability.

These findings have important practical implications. In the forensic context, children witnesses and crime victims are often interviewed multiple times by police officers and judges, frequently using suggestive questioning and subjecting them to criticism and social pressures. On the other hand, children witnesses are often direct or indirect victims of traumatic events and may consequently develop significant levels of post-traumatic stress and this makes them even more vulnerable to suggestive pressures. It is therefore crucial that during judicial hearings children witnesses are interviewed following main recommendations for best interview practices, avoiding suggestive and repetitive questioning providing them with "ground rules". Their suggestive vulnerability and their difficulty in discrepancy detection tend to persist over time. Maximizing the amount of relevant information obtained during the first forensic interview is essential, ensuring that the interview is conducted by properly trained professionals. Additionally further research is needed to explore the connection between suggestibility using the GSS within the RBR model and other psychological variables, such us source monitoring or memory distrust, that could influence the complex relationship between suggestibility and trauma.

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