Peritraumatic Reactions and Intrusive Memories among Disaster Survivors: A Mixed Methods Investigation

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Thesis submitted for the degree of

Doctor of Philosophy

January 2021

Declaration

I, Alessandro Massazza, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Date: 19/01/2021

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Abstract

Intrusive memories represent a hallmark symptom of post-traumatic stress disorder (PTSD). Cognitive theories of PTSD hypothesize that intrusive memories result from disruptions in information processing during traumatic memory encoding. The affective, cognitive, and behavioural reactions taking place during trauma have been termed peritraumatic reactions. These include reactions such as peritraumatic dissociation and tonic immobility. Experimental evidence has supported the theoretical claims concerning the role of peritraumatic reactions in the development of intrusive memories.

This literature, however, presents a number of limitations. First, it relies on a conceptualisation of peritraumatic reactions based largely on quantitative measures with a large degree of conceptual overlap. Secondly, the identification of peritraumatic reactions has relied on clinical expertise, theory, and animal models, rather than on systematic investigations of survivors' lived experience. Finally, studies on peritraumatic reactions and intrusive memories, have generally assessed peritraumatic reactions for the entire trauma rather than for the specific moments experienced as intrusive memories.

This thesis set out to address these limitations. Firstly, I investigated the factorial structure of the six most widely used peritraumatic measures. This led to the identification of a psychometrically validated model comprising five distinct peritraumatic reactions. Secondly, I explored using a largely inductive analytical framework the lived experienced of peritraumatic reactions spontaneously reported in interviews. Finally, building on these findings, I confirmed the theory-informed claims that the specific moments of a trauma experienced as intrusive memories would be characterised by higher levels of peritraumatic reactions compared to

moments from the same trauma that did not intrude. All research was conducted among earthquake survivors.

The current findings hold various implications for the conceptualisation of peritraumatic reactions and intrusive memories. Additionally, they have a number of practical implications for the prevention and management of intrusive memories as well as for the wellbeing of disaster survivors more generally.

Impact statement

The current thesis has made a number of contributions to the academic literature on peritraumatic reactions and intrusive memories. It provides a new empirically tested conceptualisation of peritraumatic reactions, which represent key variables for the development of post-trauma psychopathology. Additionally, it contributes to the literature on intrusive memories through the development of an original study design whereby the specific moments of a trauma experienced as intrusive memories are compared to other moments from the same trauma experienced as normal, autobiographical memories.

This novel, naturalistic study design is already being replicated in an MRC-funded study whereby the relationship between peritraumatic reactions and intrusive memories is going to be investigated among adolescents exposed to high levels of community violence in Brazil.

Findings from this thesis have been shared at various academic conferences including the 2019 International Society for Traumatic Stress Studies conference and the 2019 European Society for Traumatic Stress conference. Additionally, results have been presented at various workshops such as the 2019 Memory Malleability Workshop at the University of Kent and the international conference of the Earthquakes and People Interaction Centre at UCL. Results from the current thesis have also been accepted for a flashtalk presentation at the 2020 International Society for Traumatic Stress Studies conference.

Additionally, two of the four empirical chapters (Chapter 2 and Chapter 4) have been accepted for publication at *Journal of Abnormal Psychology* and *Qualitative Health Research* respectively, and another empirical chapter (Chapter 3) has been sent for review at *Journal of Abnormal Psychology.*

Results of the current thesis have also been disseminated to the wider public. For example, I was a finalist in the ESRC national science writing competition "Better Lives" which aimed to transmit to the lay public how ESRC-funded research contributed to improving the wellbeing of people and communities.

Additionally, I have worked closely with the local mental health services in the region where research was conducted and will discuss with the services how the current findings could inform mental health provision and mental health response to possible future earthquakes in the region.

Acknowledgments

My utmost gratitude goes to the participants. This thesis would not have been possible without you and without your willingness to share with me your stories of suffering and strength. I sincerely hope this work will be meaningful to you and will improve our understanding of the mental health of people and communities exposed to disaster.

Additionally, I would like to thank the municipality and health centre of Amatrice and the psychiatric services of Rieti for their practical support in conducting the study, in particular Antonella Fabiano, Simone Lodovisi, Anna Desantis, Gianna Petrocco, Domenica Tomassoni, Gabriella Nobili, and Oriana D'Emidio.

The financial support from the Economic and Social Research Council was fundamental in conducting this research. In particular, I would like to thank the staff at the UBEL Doctoral Training Centre for their support throughout my PhD.

This work is the result of a joint effort together with my two supervisors: Helene Joffe and Chris Brewin. Thank you for believing in me from the start, for your guidance throughout this journey, and for your unremitting support.

To Anna, Jack, Jem, and Merit, thanks for being the best travel companions. To Martha, thanks for making the hard moments feel lighter. To Paolo and Leonardo, thanks for our walks across ponds, forests, and valleys and for taking care of me. To Lily, Honor, and David, thank you for our discussions on birds, relationships, and life. I have learned so much from all three of you. To Edoardo, thank you for everything we shared and for finding 137 Highbury New Park. To Maria Lucia, thank you for all the joy you always brought despite the circumstances. To I Guardiani, thanks for always being there.

To Hanna, you are one of the bravest persons I know, I feel so very lucky to have met you and have you in my life, my *majnun* friend. To Nancy, Ranim, Rawan, Rita, Suzan, and Weeam, thank you for teaching me about resistance, justice, and hope. To Craig, thank you for having faith in me at the very beginning. To Meag, Paula, Delan, and Ligia, thank you for teaching me about the value of collaboration. To Inka, thank you for giving me many opportunities to grow. To Sharon, thank you for teaching me how to drive, no data would have been collected without you. To Teresa, thank you for helping me learn how to feel and think a bit better.

Mamma, Papà, Edo, and Nonni, thank you for always making me feel held, heard, and loved. This work was possible also thanks to you and your sacrifices. Thank you Silvia, Gianlu, and Arturo for all of your support and love. And thank you Stefano. This is a thesis about the power of memories, and I am so lucky to have been able to build so many beautiful ones with you. I look forward to the next ones.

Table of contents

1 Chapter 1: Introduction 19

1.1 Overview of the thesis 19

1.2 Memory in post-traumatic stress disorder 20

1.3 Intrusive memories 22

1.4 Theoretical models of memory in PTSD 30

1.5 Risk factors for intrusive memories 42

1.6 Peritraumatic risk factors for intrusive memories 49

1.7 Limitations in current literature 60

1.8 Earthquakes, peritraumatic reactions, and the 2016-2017 Central Italy earthquakes 65

1.9 Summary, thesis overview, and sample considerations 73

2 Chapter 2: The Structure of Peritraumatic Reactions and their Relationship with PTSD among Disaster Survivors 75

2.1 Introduction 75

2.2 Methods 83

2.3 Results 92

2.4 Discussion 114

3 Chapter 3: Intrusive Memories Following Disaster: Relationship with Peritraumatic Reactions and Phenomenology 124

3.1 Introduction *124*

3.2 Methods *130*

3.3 Results *142*

3.4 Discussion *160*

4 Chapter 4: Thoughts, Feelings, and Behaviours during Disaster: A Large Qualitative Study on Peritraumatic Reactions 172

4.1 Introduction *172*

4.2 Methods *177*

4.3 Results *180*

4.4 Discussion *213*

5 Chapter 5: Relationship between Peritraumatic Reactions, Intrusive Memories, and Gender among Earthquake Survivors in Italy: A Mixed-Methods Analysis 225

5.1 Introduction *226*

5.2 Methods *230*

5.3 Results *236*

5.4 Discussion *245*

6 Chapter 6: Summary and Conclusions 252

6.1 Summary *252*

6.2 Clinical and practical implications *255*

6.3 Methodological and practical considerations *276*

6.4 Future research directions *286*

6.5 Concluding remarks *291*

7 References 292

8 Appendices 383

8.1 Appendix A: Ethical approval from UCL Research Ethics Committee *383*

8.2 Appendix B: Approval from Comune di Amatrice *387*

8.3 Appendix C: Questionnaires in English *388*

8.4 Appendix D: Questionnaires in Italian *402*

8.5 Appendix E: Interview schedule *424*

8.6 Appendix F: Information sheet and consent form *427*

8.7 Appendix G: Coding framework *434*

8.8 Appendix H: Invitation letter to participants that had participated in previous study *440*

Table of figures

Figure 1.1 Visual Representation of the Neurological Model Underpinning the Revised Dual Representation Theory. From Brewin et al. (2010).....35

Figure 1.2 Schematic Visual Representation of the Cognitive Model of PTSD. From Ehlers and Clark (2000) 39

Figure 1.3 Schematic Representation of Risk Factors for Intrusive Memories Divided according to Pre-, Peri-, and Post-trauma Risk Factors 43

Figure 1.4 Geographical Location of the Epicentre of the 24th of August 2016 Earthquake 68

Figure 1.5 The Main Hamlet of Amatrice following the 2016-2017 Central Italy Earthquake Sequence 69

Figure 2.1 Number of Publications per Year on Google Scholar Using the Word "Peritraumatic" from 1990 onwards.....77

Figure 3.1 Schematic Representation of Study Design.....132

Figure 6.1 Visual Summary of Key Findings in the Current Thesis in the Context of Intrusive Memories' Predictors.....255

Figure 6.2 "Big Picture" Visual Summary of Practical Implication of Thesis 257

Figure 6.3 Example of Public Health Messaging on Peritraumatic Reactions by WHO Lebanon and Lebanese Ministry of Public Health in the Aftermath of the Beirut Explosion 272

Figure 6.4 Example of a Container Used as Temporary Shelter by Participants.....278

Figure 6.5 Local Health Facility where Majority of Data Collection Took Place...282

List of tables

Table 1.1 Characteristics of Intrusive Memories Following Trauma 28

Table 2.1 Outline of Different Peritraumatic Reactions with Corresponding Measures and Example Items from the Measure Used in Current Study 87

Table 2.2 Information on Demographic Variables and Earthquake Exposure 93

Table 2.3 Pearson Bivariate Correlations between the Standard Peritraumatic Measures 95

Table 2.4 Multiple Regression Analysis for Standard Peritraumatic Measures Predicting Total PCL-5 Scores 96

Table 3.1 Internal Reliability of Items Measuring the Five Peritraumatic Factors (Factor Loadings in Brackets).....135

Table 3.2 Content of Memory According to Memory Type with Percentage of Times Mentioned in Brackets 144

Table 3.3 Peritraumatic Reactions During Moments Experienced as Intrusive Memories and Control Memories (Same Participants).....146

Table 3.4 Peritraumatic Reactions During Moments Encoded as Intrusive Memories and Control Memories (Different Participants) 147

Table 3.5 McNemar's Tests of Within-Subjects Differences in Overall Phenomenological Characteristics between Intrusive and Non-Intrusive Control Memories 149

Table 3.6 Chi-square Test of Between-Subjects Differences in Overall Phenomenological Characteristics between Intrusive and Most Distressing Memories 150

Table 3.7 Chi-square Test of Between-Subjects Differences in Overall Phenomenological Characteristics between Non-Intrusive Control Memories and Most Distressing Memories 151

Table 3.8 McNemar's Test of Within-Subjects Differences in Visual Phenomenology between Intrusive and Non-Intrusive Control Memories 152

Table 3.9 Chi-square Test of Between-Subjecst Differences in Visual Phenomenology between Intrusive and Most Distressing Memory 153

Table 3.10 Chi-square Test of Between-Subjects Differences in Visual Phenomenology between Control Non-Intrusive Memory and Most Distressing Memory.....154

Table 3.11 Paired-Sample T-Tests of Differences in Phenomenological Characteristics Between Intrusive and Non-Intrusive Control Memories at Recall 155

Table 3.12 One-Way Between-Subjects ANCOVAs Testing for Differences in Phenomenological Characteristics Between Intrusive and Most Distressing Memory at Recall.....156

Table 3.13 One-Way Between-Subjects ANCOVAs Testing for Differences in Phenomenological Characteristics Between Non-Intrusive Control Memory and Most Distressing Memory at Recall.....157

Table 3.14 Emotions Experienced at Recall of Intrusive Memory Versus Control Non-Intrusive Memory 159

Table 3.15 Emotions Experienced at Recall of Intrusive Memories Versus Most Distressing Memories 160

Table 4.1 Content of Key Distressing Moments Identified by Participants, in order of Prevalence 182

Table 4.2 Descriptive Information on Codes under Each Code Group in order of Prevalence 186

Table 5.1 Content of Memory According to Memory Type with Percentage of Times Mentioned in Brackets 238

Table 5.2 Bivariate Pearson Correlation Matrix between Different Peritraumatic Composite Scores.....240

Table 5.3 One-way Between-Subjects ANCOVAs with Peritraumatic Composite Scores as Dependent Variables and Memory Type as Independent Variable .242

Table 5.4 One-Way Between-Subjects ANCOVAs with Peritraumatic Composite Scores as Dependent Variables and Gender as Independent Variable.....244

Table 6.1 Items of the Peritraumatic Behaviour Questionnaire by Agorastos et al. (2013).....260

Glossary and abbreviations

ANCOVA	Multivariate analysis of covariance
ANOVA	Multivariate analysis of variance
ASD	Acute Stress Disorder
BIC	Bayesian Information Criterion
C-reps	Contextual representations (in the context of DRT)
CFI	Comparative Fit Index
DDPS	Data-Driven Processing Scale
DRT	Dual representation theory of PTSD
DSM	Diagnostic and Statistical Manual for Mental Disorders
EFA	Exploratory factor analysis
ESEM	Exploratory structural equation modelling
ICD	International Classification of Diseases
M_w	Moment magnitude (in relation to earthquakes)
MANCOVA	Multivariate analysis of covariance
MANOVA	Multivariate analysis of variance
MDQ	Mental Defeat Questionnaire
NACM	Negative alterations in cognition and mood
NDMA	N-Methyl-D-aspartic acid
PBQ	Peritraumatic Behaviour Questionnaire
PCL-5	PTSD Checklist for DSM-5
PDEQ	Peritraumatic Dissociative Experiences Questionnaire
PDI	Peritraumatic Distress Inventory
PFA	Psychological First Aid
PTSD	Post-traumatic Stress Disorder
PTG	Post-traumatic Growth
RMSEA	Root Mean Square Error of Approximation

S-reps	Sensory representations (in the context of DRT)
sAA	Salivary alpha amylase
SDQ-P	Somatoform Dissociation Questionnaire-Peritraumatic
SRMR	Standardised Root Mean Square Residual
TI	Tonic immobility
TIS	Tonic Immobility Scale
TLI	Tucker Lewis Index
UCL	University College London
WHO	World Health Organization
WLSMV	Weighted Least Squares Mean- and Variance-adjusted

Note to the reader

Each of the empirical chapters (Chapters 2, 3, 4, and 5) within the thesis have been written such that they are standalone, and thus can be read in isolation. Therefore, some overlap with the introduction is to be expected but repetition has been reduced to the minimum.

1 Chapter 1: Introduction

1.1 Overview of the thesis

Intrusive memories represent a hallmark symptom of the diagnosis of post-traumatic stress disorder (PTSD). Cognitive theories of PTSD suggest that intrusive memories are the result of disrupted information processing at the time of the trauma. Cognitive, behavioural, and affective phenomena taking place at the time of traumatic memory encoding have been collectively termed peritraumatic reactions. These include reactions such as peritraumatic dissociation, distress, tonic immobility, data-driven processing, and mental defeat. Despite the key importance of intrusive memories and peritraumatic reactions for the understanding and treatment of PTSD, important gaps remain in the literature concerning their relationship as well as their phenomenology. The current thesis will address some of these gaps by using mixed methods and a novel, naturalistic design among disaster survivors.

Chapter 1 will provide an overview of the theoretical and empirical literature on memory in the context of trauma and PTSD and an overview of the literature on intrusive memories and their link to peritraumatic reactions. It will also provide some brief background on the 2016-2017 Central Italy earthquake sequence, which represent the event to which all participants were exposed. Chapter 2 will introduce the first empirical study. The six most widely used standard peritraumatic scales were administered to a sample of earthquake survivors (N = 308). I assessed the underlying structure of these measures to devise a psychometrically informed model of distinct peritraumatic reactions using exploratory factor analysis and exploratory structural equation modelling. Chapter 3 will build on the statistical findings from

the previous chapter and assess the relationship between the newly identified distinct peritraumatic factors and intrusive memories using a novel design with a subset of the total sample (N = 104). I will investigate whether the moments of the trauma experienced as intrusive memories differ in terms of peritraumatic reactions in comparison with moments of the same trauma experienced as normal autobiographical memories, both among the same participants with intrusions and also among participants without intrusions. As in Chapter 2, Chapter 4 will use a bottom-up approach to investigate the nature of peritraumatic reactions. However, I will use a different method and explore, using thematic analysis, the qualitative accounts of peritraumatic reactions as described in the accounts of disaster survivors using a largely inductive approach to capture spontaneously reported peritraumatic reactions. Chapter 5 will build upon this previous chapter and, as in Chapter 3, investigate the relationship between the newly identified qualitative peritraumatic codes and intrusive memories using a mixed-methods analysis. Finally, Chapter 6 will summarize findings and draw the overarching conclusions from the previous four empirical studies, assess possible practical implications of the findings, discuss methodological and practical considerations, and indicate future directions in the study of intrusive memories and peritraumatic reactions.

1.2 Memory in post-traumatic stress disorder

Post-traumatic stress disorder (PTSD) is a psychiatric disorder that can develop following exposure to traumatic and/or extremely stressful events and that is characterised by re-experiencing the event through intrusive memories or nightmares, avoiding internal and/or external reminders of the event, and by a state

of hyper-arousal (American Psychiatric Association, 2013; Bryant, 2019; World Health Organization, 2018).

In recent decades, PTSD has been conceptualised as a "disorder of memory" (McNally, 2003; van der Kolk & Fisler, 1995). Indeed, the diagnosis of PTSD is associated with overall, rather than trauma-specific, deficits in memory, even memory for emotionally neutral stimuli (Brewin, Kleiner, Vasterling, & Field, 2007). Additionally, the memory for the traumatic event itself appears to be altered in two differential ways (Brewin, 2018). Firstly, involuntary memories of the trauma can be spontaneously triggered and re-experienced as highly sensory and affective recollections of the traumatic event, sometimes defined as "intrusive memories" or "flashbacks".

Intrusive memories are present across many psychiatric disorders from obsessive-compulsive disorder to major depressive disorder (Brewin, Gregory, Lipton, & Burgess, 2010). However, what appears to distinguish intrusive memories in PTSD from intrusive memories in other psychiatric disorders is that they are re-experienced as if re-living the traumatic moment in the here and now (Bryant, O'Donnell, Creamer, McFarlane, & Silove, 2011; Kleim, Graham, Bryant, & Ehlers, 2013). Re-experiencing is thought to exist on a continuum with mild to moderate levels of re-experiencing characterising intrusive memories and more intense forms of re-living leading to dissociative experiences characterising flashbacks (American Psychiatric Association, 2013; Kvavilashvili, 2014). A more detailed description of the phenomenology and development of intrusive memories following trauma will be provided later in this chapter.

Additionally, clinicians working with trauma-exposed populations tend to agree that the voluntary memory of the traumatic event can be disorganised and

fragmented (Brewin, 2018). When voluntary trauma narratives from patients with PTSD are rated by independent judges they consistently tend to be rated as more disorganised than both non-trauma narratives of the same patients with PTSD and also of the trauma-narratives of patients without PTSD (Brewin, 2014). Indeed, evidence from experimental studies indicates that negative affect can disrupt the coherence of episodic memories (Bisby, Burgess, & Brewin, 2020; Bisby, Horner, Bush, & Burgess, 2018) as well as making memory representations stronger, but less rich (Spachtholz, Kuhbandner, & Pekrun, 2016). However, various studies have failed to replicate these differences in degree of fragmentation and disorganisation of voluntary traumatic narratives between individuals with and without PTSD (Rubin et al., 2016). Nonetheless, these latter studies tend to rely on global ratings of memory fragmentation for the entire traumatic narrative rather than focusing on specific sections of the narrative. Methodological differences in the measurement of disorganisation and fragmentation are therefore likely to be responsible for the distinct set of findings (Brewin, 2016).

The current thesis will only focus on the involuntary trauma memories characteristic of the diagnosis of PTSD rather than on voluntary trauma narratives. In the following section I will therefore provide a more detailed account of the phenomenon of intrusive memories. This section will be followed by an overview of the theoretical models that have addressed the relationship between memory and PTSD in past decades.

1.3 Intrusive memories

Pierre Janet, one of the first psychologists to systematically investigate the psychological consequences of exposure to highly distressing events, had long

hypothesized that the inability to integrate memories of the traumatic experience into pre-existing cognitive schemes could lead fragments of such memories to intrude as pathological automatisms and persist as subconscious fixed ideas (Janet, 1889; van der Kolk & van der Hart, 1989). According to Janet, events accompanied by "vehement emotions" could lead to the "destruction of the psychological system" and, as a result, were bound to leave behind what he termed "traces" engraved in memory that would continue to haunt the survivor until they were fully integrated within one's personal narrative (Janet, 1909: 128). Sigmund Freud was also perplexed by the repetitive intrusion of nightmares and reliving among the "war neuroses" observed in the aftermath of World War I. Freud suggested that the unremitting intrusion of memories of the trauma into consciousness was the result of the mind constantly attempting to find meaning for an event that was perceived as intrinsically inexplicable (Caruth, 1996; Freud, 1920).

Since its introduction into the third edition of the Diagnostic and Statistical Manual for Mental Disorders in 1980 (American Psychiatric Association 1980), the diagnosis of PTSD has been conceptualised as being uniquely characterised by intrusive recollections of the traumatic event (Brewin, 2015). Within the fifth edition of the Diagnostic and Statistical Manual for Mental Disorder (DSM-5) these are included as "unwanted upsetting memories" within the re-experiencing symptom cluster together with nightmares and flashbacks (American Psychiatric Association, 2013). Intrusive memories have also been recognised as being part of the unique core symptom presentation of PTSD in the 11th edition of the International Classification of Diseases (ICD-11) (Brewin et al., 2017; Maercker et al., 2013; WHO, 2018). Network models of PTSD symptoms also indicate how intrusive memories are centrally connected and have the potential to activate other symptom

clusters characteristic of the disorder (Bryant et al., 2017; Haag, Robinaugh, Ehlers, & Kleim, 2017). Additionally, addressing intrusive memories specifically in therapy is associated with improved overall outcomes (Nijdam, Baas, Olff, & Gersons, 2013).

Although some research regards intrusive memories as not being significantly different from other autobiographical memories (Rubin, Berntsen, & Bohni, 2008), intrusive memories differ from standard episodic memories for emotional events in several ways (Ehlers & Steil, 1995; Hackmann, Ehlers, Speckens, & Clark, 2004). Firstly, intrusive memories are unwanted, uncontrollable, and involuntary in nature and "pop" into consciousness without any attempt at deliberate memory retrieval. They tend to be highly associative memories easily triggered by either external (objects, sensory stimuli, conversations) or internal (thoughts or emotions) reminders of the traumatic experience.

Triggers often do not share any meaningful relationship with the actual trauma besides some, often minimal, sensory overlap (Kleim, Ehring, & Ehlers, 2012). This contributes to the perception that intrusive memories are coming "out of the blue". For example, a survivor of a train accident might feel as if they are re-living their trauma after hearing the sound of a loud noise that shares sensory similarities with the noise the train made during the accident. This characteristic of intrusive memories is thought to be due to selective attention to threat cues, perceptual priming, poor memory elaboration, and generalized associative learning leading to impaired discrimination between reminders in a safe context and original trauma cues (Ehlers, 2010; Keane, Zimering, & Caddell, 1985; Kleim et al., 2012; Michael & Ehlers, 2007; Michael, Ehlers, & Halligan, 2005; Sündermann, Ehlers, Böllinghaus, Gamer, & Glucksman, 2010).

Secondly, intrusive memories tend to be relatively brief, sensory-based, vivid, and detailed "snapshots" representing moments of the trauma rather than the entire traumatic event (Ehlers, Hackmann, & Michael, 2004; Hackmann et al., 2004; Speckens, Ehlers, Hackmann, Ruths, & Clark, 2007). An additional characteristic that is thought to distinguish intrusive memories from more common involuntary autobiographical memories is their high level of repetition, whereby the same "snapshot" is re-experienced over and over again (Kvavilashvili, 2014). Individuals can remember with great accuracy smells, sounds, and especially sights they perceived during the trauma. Visual recollections appear to be the most common form of intrusive memories, followed by other sensory impressions such as auditory-based or olfactory-based intrusions (Ehlers et al., 2002; Hiskey, Luckie, Davies, & Brewin, 2008), or combinations of different senses. Sections of written trauma narratives corresponding to flashbacks have been shown to be characterised by greater use of perceptual detail (Hellawell & Brewin, 2004) and contain a greater percentage of total sensory content (Parry & O'Kearney, 2014) than section of the same trauma narrative corresponding to voluntary autobiographical memory among participants with PTSD.

Thirdly, intrusive memories tend to be poorly elaborated, lacking in contextual information, and disjointed from the rest of autobiographical memories (Kleim, Wallot, & Ehlers, 2008). This disjointedness from other relevant autobiographical information is thought to be responsible for the prolonged sense of current threat characteristic of PTSD and to poor inhibition of cue-driven retrieval. Intrusive memories remain stand-alone memories that struggle to be subsequently integrated and updated with newly formed post-trauma memories that indicate the danger has subsided (Ehlers & Clark, 2000).

The fourth characteristic of intrusive memories is their highly affective nature which contributes to their "attention hijacking" potential (Clark & Mackay, 2015). Although evidence exists concerning intrusive memories of positive events (Brewin, Christodoulides, & Hutchinson, 1996; Bywaters, Andrade, & Turpin, 2004), they predominantly tend to be about highly distressing events and associated with negative affect and distress. Indeed, while experiencing such memories, people display heightened emotional and physiological reactivity, often corresponding to the emotions and sensations felt during the trauma (Brewin, Huntley, & Whalley, 2012; Grey & Holmes, 2008) such as fear, helplessness, and horror. These trauma-specific emotions have been collectively termed "primary emotions" (Brewin, Dalgleish, & Joseph, 1996) to distinguish them from emotions such as anger, guilt, and sadness, *i.e.* "secondary emotions", that are more likely to arise from later appraisals when the person reflects on the traumatic events and their causes. Indeed, naturalistic evidence indicates that intrusive memories among patients with PTSD are more likely to be accompanied by primary emotions and less likely to be accompanied by secondary emotions than non-intrusive memories (Hellawell & Brewin, 2004).

Finally, all of the above-mentioned characteristics contribute to what is arguably the most salient characteristic of intrusive memories following trauma, *i.e.* the sense that the person is re-living the trauma in the here and now while experiencing the intrusive memory (Michael, Ehlers, Halligan, & Clark, 2005). This sense of "nowness" is a core component of the symptom and contributes to the lack of autonoetic awareness, *i.e.* the human ability of consciously situating oneself in the past, present or future, in individuals experiencing intrusive memories. Intrusive memories appear to lack a fundamental component present in most other episodic

memories; that is the awareness that the memory is about something that has already happened in the past (Tulving, 2002). Indeed, sections corresponding to flashbacks in trauma narratives among patients with PTSD are characterised by more use of the present tense than normal autobiographical sections of the same trauma narratives (Hellawell & Brewin, 2004).

This sense of re-living the traumatic event has been conceptualised by DSM-5 and ICD-11 as lying on a continuum from a mild to moderate fleeting perception of re-experiencing the event in the "here and now", characteristic of intrusive memories, to a more severe complete loss of contact with one's surrounding, as in dissociative flashbacks (Brewin, 2015). Indeed, Brewin et al. (1996) defined flashbacks as actual *re-enactments* of the trauma rather than simple cases of re-living. Importantly, while intrusive memories can be experienced by both individuals with and without PTSD, flashbacks appear to be unique to individuals with PTSD (Kvavilashvili, 2014). Due to the focus in the current thesis on a non-clinical population of disaster survivors, we will focus on intrusive memories of the traumatic event experienced by individuals with and without PTSD rather than limiting the investigation to flashbacks experienced only among individuals with PTSD.

A summary of the phenomenological characteristics of intrusive memories with examples is provided in Table 1.1.

Table 1.1 *Characteristics of Intrusive Memories Following Trauma*

Characteristics	Example
1. Involuntary retrieval, usually due to triggers	*"I was walking down the road when I saw a man that looked just like my aggressor and everything came back to my mind"*
2. Highly sensory, detailed, and vivid	*"I can perfectly and vividly remember every single detail, from the sound of the fire crackling to the smell of the smoke filling my nostrils"*
3. Disjointed from rest of autobiographical memory and remains unchanged in face of evidence	*"I forget that I am safe at home and that nothing can happen to me here, it is as if I was going back in time"*
4. Highly affective component	"*When these memories come back, I feel the same terror and physical sensations of when the gun was pointed at me"*
5. Sense of "nowness" and lack of autonoetic awareness	*"Whenever I have these memories, it feels as I am there again, my heart starts pounding and I begin sweating"*

As mentioned above, intrusive memories are not always associated with PTSD or psychopathology. For example, independently from PTSD, intrusive memories tend to be common occurrences immediately after trauma, although for most people they are likely to disappear naturally over time (McFarlane, 1988; Shalev, 1992). In a study following motor vehicle accidents, 76% of survivors reported intrusive memories in the first weeks, dropping to 25% at 3 months, and diminishing to 24% at 1 year (Mayou, Bryant, & Duthie, 1993). Therefore, what

appears to be unique to PTSD is the persistence of intrusive memories through time rather than the presence of the symptom soon after exposure to trauma.

It has been suggested that intrusive memories might actually play an evolutionary adaptive role for the survival of the psychological and physical self (Krans, Näring, Becker, & Holmes, 2009). For example, it has been theorised that intrusive memories might operate as "warning signals" to prevent exposure to future harm (Ehlers et al., 2002) or that they may safeguard a perception of self-coherence in autobiographical memory (Conway, Singer, & Tagini, 2004). According to Ehlers et al. (2002), the content of intrusive memories tends to represent brief snippets of the trauma that generally correspond to the moments when the person first realized they were actually in danger or when the meaning of the traumatic event changed for the worse. Ehlers et al. (2002) suggest that the disproportionate importance given to the first moments of a traumatic event would make evolutionary sense as it would allow individuals to be conditioned into quickly recognising in the future a similar event from the start and avoid it. On the other hand, Holmes, Grey, and Young (2005) propose the alternative hypothesis that the content of intrusive memories corresponds to the worst and most distressing moments of the trauma, what they term "hotspots".

Importantly, however, the fact that intrusive memories can be experienced independently from a full diagnosis of PTSD does not mean that they cannot be associated with clinically meaningful levels of distress or perceived impairments in functioning (Iyadurai et al., 2019). They might, for example, contribute to the presentation of a sub-threshold PTSD where symptoms still lead to significant psychological distress, although criteria for the disorder are not fully met (Zlotnick, Franklin, & Zimmerman, 2002). As a result of this, the current thesis will not limit

itself to intrusive memories only among survivors with PTSD but will consider intrusive memories independently from meeting criteria for the full disorder.

Having provided an overview of the characteristics of intrusive memories, I will now introduce the major theoretical frameworks that have been devised to explain the role of memory in the development and maintenance of PTSD symptomatology. Particular attention will be given to how those theories address the development and maintenance of intrusive memories of the traumatic event.

1.4 Theoretical models of memory in PTSD

There are many theoretical models concerning the development and maintenance of PTSD symptoms (see Brewin & Holmes, 2003; Dalgleish, 2004 for comprehensive reviews) ranging from psychodynamic (Horowitz, 1986) to social-cognitive models (Charuvastra & Cloitre, 2008; Janoff-Bulman, 1992).

Additionally, a large amount of literature exists concerning the association between memory and affect, suggesting that, in general, memories for highly emotional events tend to be more vivid and persistent (Christianson, 1992). Similarly, cognitive and neuroscientific theories concerning the relationship between stress and memory indicate that, generally, emotionally arousing experiences will lead to the encoding of a more persistent and durable memory as a result of greater activation in the amygdala modulating the hippocampal encoding process (McGaugh, 2015; Phelps, 2004).

Due to the relevance for the current thesis, I will only provide an overview of the theoretical models that focus on memory following trauma as a mechanism for PTSD development and maintenance, with a particular focus on intrusive memories. Each model will be presented separately below.

1.4.1 Emotional processing theory

Rooted in the conceptualisation of anxiety disorders, the emotional processing theory developed by Foa and Kozak (1986) was initially based on Lang's (1977) concept of fear structures. It was then updated and adapted in response to the expanding knowledge base for trauma exposed populations, particularly rape and assault survivors (Foa & Rothbaum, 1998).

According to emotional processing theory, fear structures exist in memory linking together stimuli (*e.g.* a car approaching), responses (*e.g.* heart racing), and meaning attributions (*e.g.* I am going to get injured) and leading to various cognitive, affective, and behavioural reactions when activated. The stimuli, responses, and meaning are inter-connected within the fear structure in memory so that inputs matching one part of the structure will activate the entire structure. While these fear structures are largely adaptive in linking possible threats with appropriate responses, they are hypothesized to malfunction in PTSD by building associations between non-threatening stimuli and fearful responses. According to Foa and Cahill (2001), natural recovery following trauma occurs when the fear structure is repeatedly activated (*e.g.* driving a car following a motor vehicle accident) in the absence of the feared consequences (*i.e.* getting injured). On the other hand, avoidance of the traumatic memory and trauma-related stimuli are thought to sustain and reinforce the fear structure in memory leading to PTSD symptom development and maintenance.

Emotional processing theory has been foundational for the development of prolonged exposure therapy for PTSD (Foa & McLean, 2016). According to prolonged exposure, in order to address PTSD symptoms, the fear structure must be activated, *i.e.* retrieved in memory, through deliberate and systematic exposure to

trauma-related stimuli either *in vivo* or through imaginal exposure so that it becomes available for modification. Once activated, new corrective information can be integrated into the fear structure that is incompatible with the pathological elements of the fear structure itself.

Importantly for the current thesis, emotional processing theory was among the first theories of PTSD to suggest that PTSD symptomatology might be the result of inadequate processing of the traumatic memory leading to a disarticulated and disorganised memory representation of the traumatic event (Foa & Riggs, 1993). In particular, the experience of peritraumatic reactions such as peritraumatic dissociation, was hypothesized to be partially responsible for the creation of disorganised and fragmented memories resistant to streamlining and organisation (Zoellner, Alvarez-Conrad, & Foa, 2002).

However emotional processing theory did not specifically address the mechanisms underlying the development and maintenance of involuntary memories of the traumatic event among individuals with PTSD. More recent cognitive theories of PTSD, on the other hand, have been more grounded within research on autobiographical memory and have made specific predictions concerning the development of intrusive memories. According to these theories, intrusive memories are, in part, the result of disruption in information processing mechanisms taking place at the time of the encoding of the traumatic memory. These theories will now be presented below.

1.4.2 Dual representation theory

In the most precise theoretical description of the cognitive and neural mechanisms underpinning the development of intrusive memories Brewin et al.

(2010), drawing upon the dual representation theory (DRT) of PTSD (Brewin et al., 1996), propose that intrusive memories result from the relationship between two different types of memory representations during the memory encoding phase of the trauma. Sensory representation, S-reps, are responsible for encoding the sensory stimuli the person perceives during the trauma and can only be retrieved involuntarily. Contextual representation, C-reps, on the other hand, encode more high-level conscious contextual information such as time and location of the trauma and can be retrieved both voluntarily and involuntarily. Furthermore, unlike S-reps, an individual can communicate and consciously direct attention to C-reps, making them potential objectives of re-appraisal strategies.

Individuals that, following trauma, do not develop intrusive memories are thought to have S-reps that match corresponding C-reps meaning that the S-reps are associated with a context in autobiographical memory. On the other hand, in individuals who do end up developing intrusive memories following trauma, S-reps are thought to be encoded disproportionally to the detriment of C-reps and not be linked with corresponding C-reps. Therefore, when S-reps are cued involuntarily by external or internal triggers, the person re-experiences the trauma as the sensory-heavy S-reps cannot be contextualised in time and space due to their disconnection from C-reps. Intrusive memories are therefore hypothesized to result from disproportionate encoding of sensory information at the time of the traumatic memory encoding, while contextual information and the links between contextual and sensory information remain frail (Brewin, 2014).

Brewin et al. (2010) also provide a corresponding neurological model to the revised DRT by highlighting how, under stressful conditions, activity in the dorsal visual stream is enhanced to the detriment of activity in the ventral visual stream and

the medial temporal lobe. While the dorsal visual stream is responsible for creating images of the surrounding environment from a first-person perspective (egocentric) in order to allow for quick motor responses to threat, the ventral visual stream is responsible for binding together the different elements in a scene to create an abstract summary. This abstract summary forms the basis of higher-cognitive appraisal by allowing individuals to think about the experience, incorporate it in autobiographical memory, and imagine the scene from different (allocentric) perspectives. Overall, the enhancement of the visual and content-rich dorsal stream and the corresponding downregulation of the contextual ventral stream and the allocentric medial temporal lobe is what is thought to lead to intrusive memories from a neurological perspective.

Indeed, individuals with PTSD have been shown to display specific deficits in allocentric spatial memory during experimental tasks (Miller, McDougall, Thomas &, Wiener, 2017; Smith, Burgess, Brewin, & King, 2015). Furthermore, acute stress has been shown to impair performance in spatial tasks requiring involvement from the medial temporal lobe in both individuals without PTSD (Meyer, Smeets, Giesbrecht, Quaedflieg, & Merckelbach, 2013) and PTSD patients (Smith et al., 2015). A visual summary taken from Brewin et al. (2010) of the neurological model underpinning the revised dual representation theory is shown below in Figure 1.1.

Figure 1.1 *Visual Representation of the Neurological Model Underpinning the Revised Dual Representation Theory. From Brewin et al. (2010)*

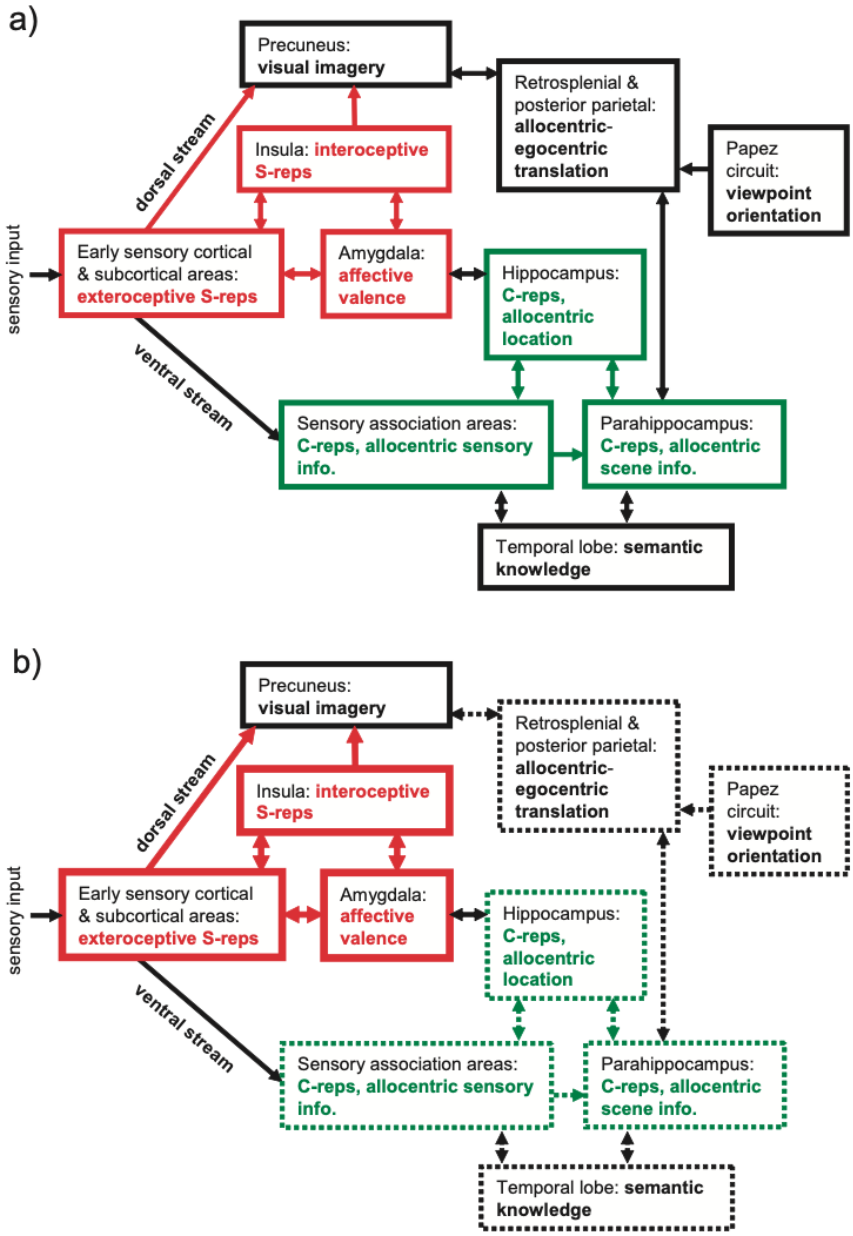


Figure 1. A schematic model of memory encoding, showing the approximate regions and pathways involved in, and the areas supporting, abstracted contextual representations (C-reps, in green) and sensory-bound representations (S-reps, in red). a: Normal encoding of a traumatic event. b: Pathological encoding of a traumatic event, showing up-regulation of S-reps, down-regulation of C-reps, and disconnection between S-reps and C-reps. Heavy lines indicate stronger representations and pathways; dashed lines, weaker representations and pathways. Note the necessarily schematic style (e.g., many pathways and regions are omitted, and *Hippocampus* refers to the extended hippocampal formation and its subcortical connections).

Additionally, Brewin (2015), on the basis of the distinction between perceptual and episodic memory (Brewin, 2014), points to recent neuroimaging

evidence suggesting that individuals suffering from flashbacks show increased activation of motor and sensory areas including the mid-occipital cortex, supplementary motor area, precentral gyrus, and the insula but reduced bilateral inferior temporal cortex volume and lower activation of the para-hippocampal gyrus (Osuch et al., 2001; Whalley et al., 2013). Both these areas that showed reduced activity are thought to be responsible for the encoding and consolidation of contextual visual and spatial information. Reductions in brain volume for ventral visual stream areas in patients reporting more flashbacks (Kroes, Whalley, Rugg, & Brewin, 2011) provide further evidence for the suggestion that flashbacks and intrusive memories more generally display patterns of neural activity that distinguishes them from ordinary autobiographical memories.

At a more cognitive level, the distinction between S-reps and C-reps in PTSD is thought to be supported by the existence of a long-term memory system that automatically encodes low-level sensory information and that might at times operate separately from the more language-based episodic long-term memory storage (Brewin, 2014). This is corroborated empirically by evidence emerging, for example, by SenseCam research where individuals appear to be able to remember, in the long-term, low-level, minute details from day to day life without being consciously aware of them (Loveday & Conway, 2011). More specific to intrusive memories, Brewin (2014) highlighted that the number of reported intrusive memories following exposure to an analogue trauma was not correlated with performance on episodic memory tasks across several studies (*e.g.* Sündermann, Hauschildt, & Ehlers, 2013), further hinting at a distinction between perceptual and episodic memory systems.

1.4.3 Cognitive model of PTSD

The cognitive model of PTSD by Ehlers and Clark (2000) also identified disruption in information processing mechanisms as a key variable for the development of intrusive memories and for the maintenance of a sense of current threat. In particular, the model points to data-driven processing as the underlying mechanism for the development of re-experiencing symptoms and the current sense of threat experienced by people with PTSD. Data-driven processing represents a construct that was developed within studies of memory and human vision to indicate a form of information processing relying disproportionately on incoming sensory and perceptual stimuli (Roediger, 1990).

According to the Ehlers and Clark model, individuals engaging in data-driven processing peritraumatically tend to disproportionally process sensory information bottom-up to the detriment of the encoding of conceptual information responsible for situating the sensory details in a specific time and place, giving meaning to the event, and organising the information. The disorganised and fragmented nature of data-driven memories is the reason they are so easily triggered involuntarily and lack self-referential processing, *i.e.* are not integrated within autobiographical memory. This is thought to represent a departure from how normal autobiographical memories tend to be elaborated and incorporated in an autobiographical memory storage. In the case of normal autobiographical memories, the ease of intentional retrieval is strengthened through higher-level meaning-based strategies while cued retrieval via triggers is inhibited (Conway & Pleydell-Pearce, 2000). Ehlers and Clark (2000) suggest that perceptual priming, poor stimulus discrimination, and enhanced associative learning all play a key role in the shaping of intrusive memories by facilitating cue-driven retrieval rather than higher level meaning-based retrieval strategies.

Intrusive memories are hypothesized to result from the failure of individuals to incorporate contextual information (*e.g.* where and when did the event happen and end) within the traumatic memory and to update the memory with more accurate information. Furthermore, because intrusive memories are elicited via bottom-up cue-driven retrieval, individuals might not necessarily be aware of the triggers and of the underlying reasons for their re-experiencing symptom (Ehlers et al., 2004) leading to what Ehlers and Clark describe as "affect without recollection".

Furthermore, drawing on the work by Foa and Rothbaum (1998) and Jones and Barlow (1990), the cognitive model by Ehlers and Clark places particular importance on the role of negative appraisal and interpretation of the traumatic event and of PTSD symptoms (*e.g. "I am going crazy"*, "*I have changed forever"*). Additionally, Ehlers and Clark developed a detailed account of how a number of behavioural and cognitive strategies such as memory suppression, rumination, and avoidance can contribute to the maintenance of the condition (Michael, Halligan, Clark, & Ehlers, 2007).

A schematic visual representation of the cognitive model of PTSD taken from Ehlers and Clark (2000) is shown below in Figure 1.2.

Figure 1.2 *Schematic Visual Representation of the Cognitive Model of PTSD. From Ehlers and Clark (2000)*

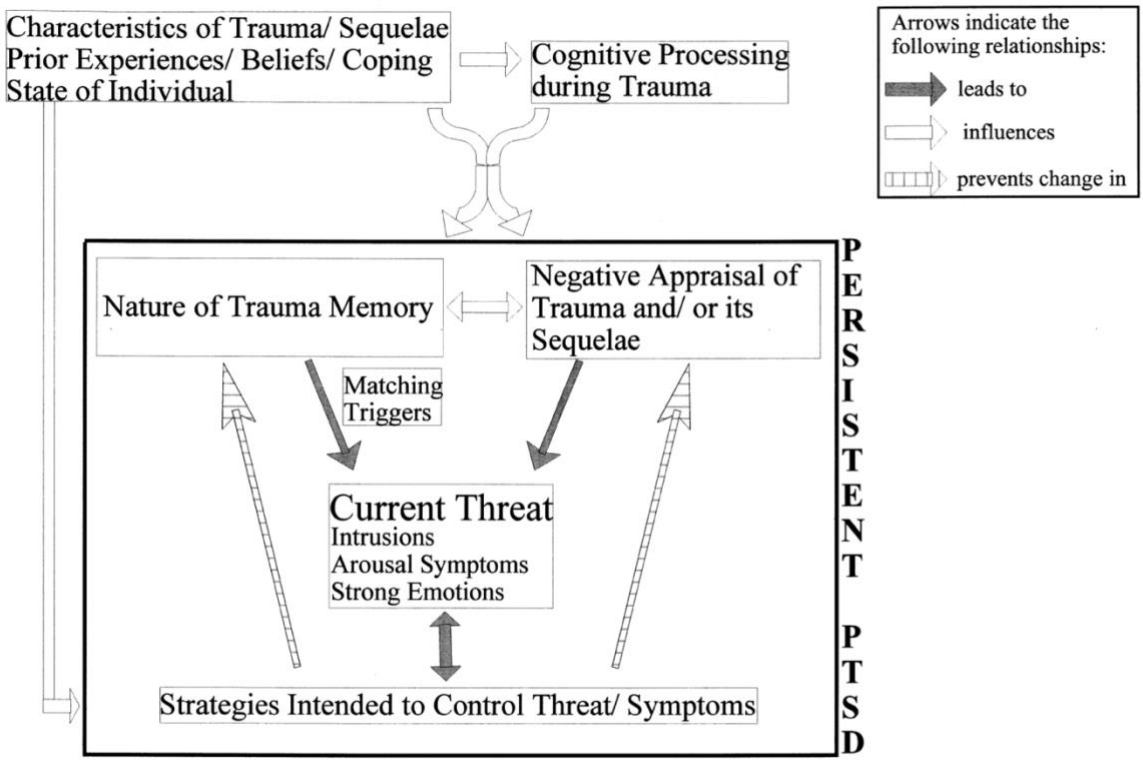


Fig. 1. A cognitive model of PTSD.

While the model by Ehlers and Clark (2000) and the revised dual representation theory by Brewin et al. (2010) share a number of insights on the development and maintenance of intrusive memories and PTSD, they also differ (see Brewin and Holmes, 2003 for a more detailed discussion). Firstly, the model by Ehlers and Clark (2000) places more emphasis on the way the memory is encoded during the peritraumatic phase rather than on how the output of this encoding process is represented in memory. Secondly, according to Ehlers and Clark (2000), data-driven processing at the time of the trauma represents, *per se*, a risk factor for the development of PTSD. On the other hand, according to the revised dual representation theory by Brewin et al. (2010), the detailed processing of the traumatic event would represent a risk factor only if it ended up being over-

represented as a sensory-representation and dissociated from its corresponding contextual representations in memory. Finally, the revised dual representation theory by Brewin et al. (2010) differs from the cognitive model by Ehlers and Clark (2000), and from the emotional processing accounts, as it does not assume that memory disorganisation and fragmentation are in themselves risk factors for PTSD. Conversely, it is the content of such memory representations and their association with high levels of arousal during trauma that represent a risk factor.

1.4.4 Basic memory mechanisms models

The information processing theories of PTSD proposed by Ehlers and Clark (2000) and by Brewin et al. (2010) have been interpreted by some (*e.g.* Rubin, Boals, & Berntsen, 2008) as "special mechanisms theories". According to the critics, these theories imply that the mechanisms through which intrusive memories develop in PTSD are idiosyncratic to the condition or to traumatic events. In contrast, Rubin, Berntsen, and Bohni (2008) propose that the development of intrusive memories in PTSD can be explained more parsimoniously in terms of general reconstructive memory processes at the time of recall in what they define as a "basic mechanisms view". In particular, the basic mechanisms view hypothesizes that symptoms of PTSD can be explained in terms of general research on emotion, autobiographical memory, and personality instead of using special mechanisms for trauma or PTSD (Rubin, Boals, & Berntsen, 2008).

According to the "basic mechanisms view", intrusive memories in PTSD can be explained by three classes of mechanisms that affect autobiographical memories in general, rather than being specific to traumatic memories or PTSD. These three classes of mechanisms are: (i) The emotional intensity of the memory; (ii) When and

how often the memory has been retrieved in the past; and (iii) The centrality of the memory for the person's life story and identity (Rubin, Dennis, & Beckham, 2011). These three mechanisms alone can, according to Rubin et al. 2011, explain the development, maintenance, and phenomenological characteristics of intrusive memories in patients with PTSD.

Importantly, these mechanisms are thought to impact voluntary and involuntary memory in the same way. Memory enhancement associated with stressful/traumatic material is thought to concern both involuntary and voluntary memory rather than reducing voluntary and enhancing involuntary access (Berntsen & Rubin, 2014). Therefore, these theories suggest that involuntary and voluntary memories operate on the same memory systems sharing both encoding and consolidation processes but differing only in memory retrieval mechanisms. As a result of these assumptions, intrusive memories in PTSD are thought not to be qualitatively distinct from other forms of memory but on the contrary they are conceptualised as lying on a continuum with other types of memory (Berntsen, 2009).

These positions have however been criticized for extrapolating findings generated among non-clinical populations into clinical populations (Brewin, 2014), as well as for not being able to explain a range of intrusive memory phenomena unique to PTSD such as flashbacks where the patients completely lose touch with reality or intrusions that are not recognised by the patient as memories, *e.g.* when individuals re-experience emotions and physical sensations rather than specific autobiographical events (Ehlers, 2010).

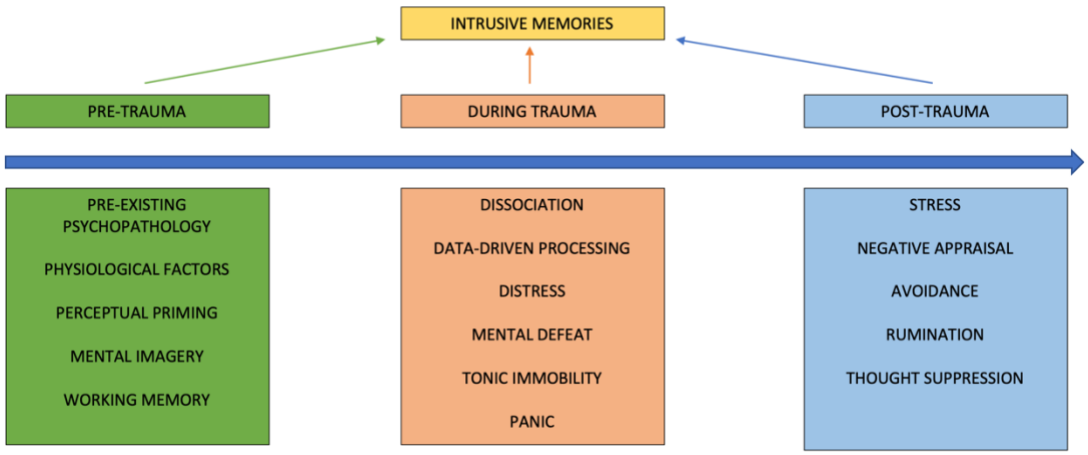
The current thesis will be mainly concerned with the latter three theoretical accounts of memory in PTSD, *i.e.* the revised dual representation theory by Brewin

et al. (2010), the cognitive model by Ehlers and Clark (2000), and the basic memory mechanisms model by Rubin and colleagues. In the current thesis, I will test empirically some claims made by the revised dual representation theory and by the cognitive model of PTSD. In particular, I will test the claims concerning the key role of disruptions in information processing mechanisms at the time of traumatic memory encoding due to peritraumatic reactions in determining the moments that intrude unprompted following trauma. In the next section I will first provide a brief overview of the literature on general risk factors for intrusive memories. I will then provide a more detailed account of the literature on the association between peritraumatic reactions and intrusive memories.

1.5 Risk factors for intrusive memories

A number of risk factors have been identified for the development and maintenance of intrusive memories. These risk factors can have an effect either prior to the traumatic event, during the traumatic event, or after the traumatic event has taken place. Since the current thesis will only focus on risk factors taking place peritraumatically, we will provide only a brief summary account of risk factors for intrusive memories taking place either prior or after the traumatic event and will largely focus on peritraumatic risk factors for intrusive memories of trauma (for a systematic review of risk factors taking place at all three pre-, peri-, and post-traumatic stages see Marks, Franklin, & Zoellner, 2018). A schematic representation of risk factors for intrusive memories is shown below in Figure 1.3.

Figure 1.3 *Schematic Representation of Risk Factors for Intrusive Memories Divided according to Pre-, Peri-, and Post-trauma Risk Factors*



The vast majority of studies focusing on pre-, peri-, and post-traumatic predictors of intrusive memories have relied on the trauma analogue film paradigm. Generally, in this experimental model, healthy participants are exposed to traumatic images and resulting short-lived intrusive memories occurring over the following days are recorded by participants using a diary (James, Lau-Zhu, Clark, Visser, Hagenaars, & Holmes, 2016).

1.5.1 Pre-trauma risk factors for intrusive memories

Several factors taking place before trauma have been identified as important predictors of intrusive memories in experimental studies (Marks et al., 2018). Negative appraisal style pre- and post-trauma (Woud, Postma, Holmes, & Mackintosh, 2013), together with pre-existing psychopathology (Regambal & Alden, 2009), have both been found to be significant predictors, with effect sizes ranging from medium to large, of intrusive memories. Pre-existing biological characteristics

have also been shown to be potential vulnerability factors. These include the FKBP5 risk alleles (Cheung & Bryant, 2015), menstrual cycle position and sex hormones (Ferree, Kamat, & Cahill, 2011; Soni, Curran, & Kamboj, 2013), and noradrenaline levels (Rombold, et al., 2016). Alcohol intake, albeit only low doses, and nicotine intake prior to exposure to analogue trauma (Bisby, King, Brewin, Burgess, & Curran, 2010; Hawkins & Cougle, 2013) have also been identified as possible predictors of intrusive memories.

Several other pre-trauma factors might influence the development of intrusive memories. For example, intrusive memories appear to be more likely in individuals that show a predisposition to engage in perceptual priming, *i.e.* an individual's increased capacity in recognising the perceptual qualities of a memory such as smells, sights, and sounds following exposure to stimuli that share sensory commonalities with such memory (Ehlers, Michael, Chen, Payne, & Shan, 2006, Sündermann et al., 2013). Another potential pre-trauma risk factor for intrusive memories has been identified in high levels of mental imagery capacity, *i.e.* an individual's capacity to mentally imagine vivid and detailed representations in the absence of an external stimulus (Morina, Leibold, & Ehring, 2013, but see Krans, Näring, Speckens, & Becker, 2011 for opposite results). Other pre-trauma cognitive functions that might moderate the risk of intrusive memories are working memory capacity, *i.e.* the amount of information an individual can retain under cognitive control in working memory at any moment in time, and attentional control (Brewin & Smart, 2005; Grueschow, Jelezarova, Westphal, Ehlert, & Kleim, 2020; Hagenaars & Putman, 2011; but see James, Lau-Zhu, Tickle, Horsch, & Holmes, 2016; Meyer et al., 2020 for inconclusive findings).

Overall, prospective analogue studies show that, while pre-existing psychopathology, negative appraisal, and enhanced perceptual priming appear to lead to increased vulnerability to intrusive memories, the evidence for the role of mental imagery and working memory is still inconclusive (Marks et al., 2018).

1.5.2 Post-trauma risk factors for intrusive memories

Factors that take place post-trauma have also been shown to influence the development and, in particular, the maintenance of intrusive memories as memory consolidation, retrieval, and reconsolidation take place in the hours and days following trauma (Parsons & Ressler, 2013). As in the pre-trauma phase, negative appraisal and attentional biases toward trauma related stimuli are also associated with more intrusive memories post-trauma (Kleim et al., 2012; Woud et al., 2013).

Additionally, vantage point, *i.e.* whether participants describe the memory as if they were seeing the scene through their eyes (observer perspective), or as if they were seeing the scene from above or from an outsider's perspective (field perspective), has been proposed as a potential risk factor during memory retrieval (McIsaac & Eich, 2004). However only preliminary, and inconsistent, evidence exists in relation to intrusive memories' development and vantage point (Luo et al., 2013; Williams & Moulds, 2008). Rumination has also been proposed as an additional post-trauma risk factor for intrusive memories (Santa Maria, Reichert, Hummel, & Ehring, 2012) but evidence appears mixed (Ball & Brewin, 2012; Ehring, Szeimies, & Schaffrick, 2009), mostly due to variation in the operationalisation of rumination across studies.

More robust support exists for the relationship between avoidance, in particular thought suppression, and intrusive memories. Evidence from cognitive

psychology indicates that, generally, attempts to avoid a specific thought tend to result in the opposite effect, in what is known as a "rebound effect" (Wenzlaff & Wegner, 2000). Indeed, both individuals with acute stress disorder (ASD) and PTSD show an increase in the frequency of intrusive memories following a 5-minute suppression period (Aikins et al., 2009; Nixon & Rackebrandt, 2016), though there is less evidence for the long-term effects of suppression.

Modulating different variables during memory consolidation has also been shown to affect the frequency and distress of intrusive memories. Individuals who were asked to engage in visuospatial tasks (*e.g.* playing Tetris) following exposure to an analogue trauma showed decreased intrusive memories. The authors explained these results by suggesting that fewer sensory details of the movies could be consolidated in memory while the individual was engaged in a competing visuospatial task (Holmes, James, Kilford, & Deeprose, 2010). Similarly, individuals who provided a verbal description focused on "what" they had seen, *i.e.* taxing the visuospatial system, had fewer intrusive memories compared with individuals who provided a verbal description focusing on "why" what they had seen in the clips might have happened (Luo et al., 2013).

Additionally, biologically disrupting memory consolidation using nitrous oxide, an NMDA receptor-inhibitor, resulted in faster decreased frequency of intrusive memories in the 2 days following exposure to the trauma film in comparison with the placebo group (Das et al., 2016). Growing evidence is also highlighting the role of sleep following trauma in the consolidation of intrusive memories (Kleim, Wysokowsky, Schmid, Seifritz, & Rasch, 2016) with a recent study reporting that both sleeping "too much" and "too little" was associated with more intrusive memories following exposure to real-life traumatic events (Porcheret

et al., 2020). However, findings concerning the specific relationship between sleep and intrusive memory development remain mixed (Porcheret, Holmes, Goodwin, Foster, & Wulff, 2015; Porcheret et al., 2019; Woud et al., 2018).

More recently, studies have attempted to take advantage of the theory of re-consolidation frailty, *i.e.* the idea that a memory becomes more vulnerable to editing and goes through a period of temporal instability while being retrieved (Besnard, Caboche, & Laroche, 2012). A series of behavioural and pharmacological interventions aimed specifically at targeting maladaptive memories during this retrieval phase have been devised, with moderate success (Walsh, Das, Saladin, & Kamboj, 2018).

The most successful results have been achieved through the administration of propranolol, a beta-adrenergic receptor antagonist, to patients 60-90 minutes prior to writing a one-page trauma narrative which they then read to their therapist "as if they were back in the event" (Brunet, Saumier, Liu, Streiner, Tremblay, & Pitman, 2018). After the six weekly sessions, the propranolol group displayed significant improvement in symptoms compared to the control group. The suggested mechanistic explanation is that the propranolol induced a decrease in physiological arousal to trauma reminders allowing for a better contextualisation, destabilisation, and updating of the traumatic memory (Lee, Nader, & Schiller, 2017). Preliminary findings in an uncontrolled study have also shown that 20 inpatients with complex PTSD that played Tetris for 25 minutes immediately after retrieving one consolidated intrusive memory reported an average 64% reduction in that specific memory (Kessler et al., 2018). Similar findings were replicated in a laboratory setting using the trauma analogue film paradigm (Kessler et al., 2020). However,

these results can also be explained in terms of the procedures themselves creating new competing memories, rather than due to reconsolidation taking place.

Decreasing physiological arousal and distress at retrieval therefore seems key in addressing intrusive memories in therapy. Indeed, increased distress and stress at the time of retrieval appears to heighten vulnerability to intrusive memories. In a unique one-year longitudinal study on rescue workers following a plane disaster, being distressed during the retrieval of intrusive memories following the crash predicted more intrusive memories at 6, 9, and 12 months following trauma (Schooler, Dougall, & Baum, 1999). Those findings were replicated experimentally by Cheung, Garber, and Bryant (2015) who reported finding that, among participants who were purposefully stressed by using a cold pressor task while retrieving a distressing memory, subsequent increases in cortisol predicted 29% of the variance in intrusive memories.

Exploiting this window of reconsolidation potential during retrieval, some researchers have attempted to "erase" specific memories, rather than simply incorporating new information into them. In an experiment conducted with rats, administration of a protein synthesis blocker following the reminder of a previously learned association lead to the disappearance of that memory (Nader, Schafe, & LeDoux, 2000). Similar support for the reconsolidation hypothesis in humans was found by administering propranolol or an extinction strategy to participants prior to memory reactivation. This generally led to a decrease in the fear expression associated with the memory, *i.e.* the conditioned emotional reaction, while keeping the declarative aspect of the memory intact (Kindt, Soeter, & Vervliet, 2009; Soeter & Kindt, 2010, but Klucken et al., 2016; Schroyens, Beckers, & Kindt, 2017 failed to replicate these results).

The process of reconsolidation in humans remains a complex, and controversial, phenomenon (Kindt, 2018; Schiller & Phelps, 2011). In particular, as Brewin (2018) highlights, it is problematic to pinpoint any significant change in intrusive memories to the experimental manipulation of re-consolidation as it is very likely that those memories are already on the minds of participants before they are asked to "re-activate" the memory by the researchers. Nonetheless, the focus on reconsolidation and retrieval mechanisms represents an exciting avenue for future work with considerable implications for treatment of intrusive memories.

1.6 Peritraumatic risk factors for intrusive memories

Although pre- and post-trauma factors play an important role in the development and maintenance of intrusive memories, the focus of the current thesis is going to be on the role of phenomena that take place during or immediately after the traumatic event, *i.e.* peritraumatic phenomena. This choice is based on the emphasis placed on memory encoding as a key step in the development of intrusive memories by existing theoretical frameworks of PTSD (Brewin et al. 2010; Ehlers & Clark, 2000), as detailed in the section above on theoretical models. The following sections summarise the most thoroughly studied of these reactions and, when research exists, their relationship with intrusive memories.

As with pre- and post-trauma risk factors, most studies that have assessed the relationship between intrusive memories and peritraumatic phenomena have done so using the analogue trauma paradigm (James et al., 2016). Each peritraumatic reaction will be described in turn (for a comprehensive review of peritraumatic reactions independently from their relationship with intrusive memories see Gorman, Engel-Rebitzer, Ledoux, Bovin, & Marx, 2016).

1.6.1 Peritraumatic psychic dissociation

Dissociation is a complex and heterogeneous phenomenon that encompasses several components and has often been defined inconsistently (Bryant, 2007). It is conceptualised by DSM-5 as a "*disruption of and/or discontinuity of the normal integration of consciousness, memory, identity, emotion, perception, body representation, motor control, and behaviour*" (American Psychiatric Association, 2013: 291). Key indicators of dissociation are depersonalization, derealisation, amnesia, and identity confusion or alteration. Other important aspects of dissociation, defined as "compartmentalisation" by Holmes et al. (2005), include unexplained neurological symptoms, more severe symptoms such as dissociative fugues, and somatoform dissociation (Nijenhuis, van der Hart, Kruger, & Steele, 2004). Due to peritraumatic dissociation generally being described in the literature in psychological terms it will be defined in the current thesis as "psychic peritraumatic dissociation", to distinguish it from the somatic presentations of peritraumatic dissociation that are going to be introduced separately in the section below.

Different conceptualisations of dissociation have been proposed (Allen, 2001; Cardeña, 1994; Holmes et al., 2005; Putnam, 1997; van der Kolk and Fisler, 1995). Many models of dissociation build on classical work from Janet (1887) where dissociation is conceptualised as a mechanism aimed at reducing suffering by *dissociating* traumatic memories from awareness or as a way of compartmentalising distress (Nijenhuis & van der Hart, 2011).

Peritraumatic dissociation simply implies the presence of dissociative features during or immediately after the trauma (Candel & Merckelbach, 2004). Peritraumatic dissociation represents the peritraumatic phenomenon that has

received most attention. A meta-analysis of PTSD risk factors reported that peritraumatic dissociation was the highest predictor of PTSD following trauma (weighted r = .35) (Ozer, Best, Lipsey, & Weiss, 2003). The strong link between peritraumatic dissociation and PTSD was also confirmed in a subsequent meta-analysis (Lensvelt-Mulders et al., 2008, but see van der Hart, van Ochten, van Son, Steele, & Lensvelt-Mulders, 2008 for a critical appraisal of the literature).

Peritraumatic dissociation has been hypothesized to affect information processing at the time of the trauma leading to impaired encoding and subsequent increased chances of developing intrusive memories (Ehlers & Clark, 2000; Holmes, Brewin, & Hennessy, 2004). To assess the impact of dissociation on memory in laboratory conditions, some authors have tried to induce dissociative states experimentally (Brewin, Ma, & Colson, 2013; Brewin & Mersaditabari, 2013). Within trauma film paradigm studies, attempts at inducing dissociation experimentally have included using a visuospatial task (Brewin and Saunders, 2001), a dot-staring task (Holmes et al., 2004), staring into a mirror (Dorahy, Peck, & Huntjens, 2016), and hypnosis (Hagenaars, van Minnen, Holmes, Brewin, & Hoogduin, 2008, Holmes et al., 2004). Other studies have relied on retrospective self-reports of state dissociation (Hagenaars & Krans, 2011; Holmes et al., 2004; Laposa & Rector, 2012; Măirean & Ceobanu, 2017). Finally, some studies have attempted to assess peritraumatic dissociation through decreases in heart rate, as a proxy measure of state dissociation (Chou, La Marca, Steptoe, & Brewin, 2014a; Holmes et al., 2004).

Studies that have attempted to induce dissociative states experimentally have generally failed to find an association between induced-state dissociation and intrusive memories (*e.g.* Holmes et al., 2004). Importantly, it is unclear whether the

methods used are effective in creating a state with any similarity to genuine peritraumatic dissociation. Studies using self-report also report mixed findings. Holmes et al. (2004) have found an association between state dissociation and increased frequency of intrusive memories in two out of three experiments. Similar results were shown by Laposa and Rector (2012) but disappeared when self-referent and data-driven information processing were controlled for.

Măirean and Ceobanu (2017) found a relationship between self-reported state dissociation and intrusive images, but not intrusive thoughts. Finally, one study by Hagenaars and Krans (2011) failed to find any association between self-reported state dissociation and intrusive memories. Studies using decreases in heart rate as a proxy measure for peritraumatic dissociation did find a relationship between decreases in heart rate and increased rate of intrusive memories but no direct analysis of actual peritraumatic dissociation and intrusive memories was conducted, therefore limiting the conclusions of the studies (Chou et al., 2014a). The systematic review by Marks et al. (2018) deems the results concerning peritraumatic dissociation and intrusive memories in analogue paradigm as inconclusive, although a meta-analytic analysis should have been required to fully corroborate this conclusion.

1.6.2 Somatoform dissociation

Somatoform dissociation was a concept introduced by Nijenhuis (2004), on the basis of studies of physical responses to threat in animal models such as "playing dead", to contrast the mind-centred conceptualisations of dissociation (Nijenhuis, Vanderlinden, & Spinhoven, 1998). Nijenhuis operationalised somatoform dissociation as a phenomenon that specifically involved the body and comprised a partial or complete loss of perception, such as paralysis and anaesthesia, as well as

more active involuntary sensory perceptions such as distortions in the visual field or ataxia (Nijenhuis et al., 2004). While the relationship between somatoform dissociation and PTSD has received some attention (Hagenaars, van Minnen, & Hoogduin, 2007), no research has yet investigated the relationship between peritraumatic somatoform dissociation as conceptualised by Nijenhuis and intrusive memories.

1.6.3 Tonic immobility

More recently, trauma researchers have explored the possibility of applying animal models of threat-response to human trauma reactions (Marx, Forsyth, Gallup, Fusé, & Lexington, 2008). One behaviour that has received particular attention has been that of tonic immobility (TI). TI has been conceptualised as the last step within the defence cascade, taking place after freezing, flight, and fight, when escape or resistance have been unsuccessful (Kozlowska, Walker, McLean, & Carrive, 2015). TI is characterised by catatonic-like motionless posture, suppressed vocal behaviour, analgesia, intermittent periods of eye closure, fixed, unfocused stare or gaze, Parkinsonian-like tremors in the extremities, and waxy flexibility, together with sympathetic and parasympathetic reactions (Kozlowska et al., 2015). Tonic immobility has been extensively assessed in rape survivors (Galliano, Noble, Travis, & Puechl, 1993; Kalaf et al., 2017) but recent evidence highlights its presence in a variety of different traumas characterised by situations in which escape or resistance are not possible (Hagenaars, 2016).

The relationship between tonic immobility and intrusive memories following exposure to analogue trauma has been the subject of some research. Non-movement experimental manipulations, used as a proxy reaction of immobility, during an

aversive film resulted in more intrusive memories than a free-to-move control condition (Hagenaars, Brewin, van Minnen, Holmes, & Hoogduin, 2010; Hagenaars, van Minnen, Holmes, Brewin, & Hoogduin, 2008). Non-movement also affected the quality of intrusive images, but not thoughts (Hagenaars et al., 2010). Additionally, spontaneous immobility during analogue trauma has also been found to be associated with more intrusive memories of the aversive film (Hagenaars & Putman, 2011; Kuiling, Klaassen, & Hagenaars, 2019).

1.6.4 Distress

As briefly touched upon in the section on theoretical models of intrusive memories, high arousal during memory encoding is generally thought to lead to enhanced consolidation and result in more vivid and persistent memories (Christianson, 1992). This appears to be the case for intrusive memories as well, although caution should be taken in interpreting results due to the limited number of studies and the differing operationalisations of stress, arousal, and distress.

In one of the few analogue studies assessing peritraumatic phenomena in a clinical sample, Nicholson, Bryant, and Felmingham (2014) found that the interaction between cortisol and salivary alpha amylase (sAA), a marker of stress and noradrenergic activity, explained 34% of the variance of intrusive memories in the group with PTSD but not in the trauma-exposed or no trauma control groups. Indeed, a similar study by Cheung and Bryant (2015) found no significant association between cortisol, sAA, and intrusive memories in a non-clinical sample. Those two studies raise some doubts concerning how appropriate it is to generalise findings on experimentally induced intrusive memories from non-clinical populations to individuals suffering with PTSD.

Other studies focused on emotional arousal during encoding of the analogue memory. Hall and Berntsen (2008) found that higher emotional stress at encoding led to more accessible intrusive, and voluntary, memories. Similarly, Wegerer, Blechert, Kerschbaum, and Wilhelm (2013) also found that higher fear conditionability, measured by assessing skin conductance and fear levels following association of conditioned stimuli (*i.e.* sounds) to unconditioned stimuli (*i.e.* distressing clips), resulted in higher frequency of intrusive memories. Furthermore, Chou, La Marca, Steptoe, & Brewin (2014b) found that higher cortisol levels during exposure to a traumatic film were moderately predictive of more frequent intrusive memories, although this effect was only present among individuals with higher sympathetic activations. Another study found that participants who rated the analogue trauma stimuli as more arousing and aversive reported more intrusive memories following exposure (Rattel et al., 2019).

However, Dunn, Billotti, Murphy, & Dalgleish (2009) found no effect of emotional suppression, regulation, or no regulation instructions on the frequency of intrusive memories. Therefore, the effect of biological factors, in particular stress markers, and emotional arousal on intrusive memories seems a promising avenue of enquiry but results are limited by their number and by substantial variation in the measured variables.

1.6.5 Panic

Another peritraumatic reaction related to psychological distress is individuals experiencing panic attacks during or immediately after a traumatic event. Evidence suggests this can be a common occurrence, with Resnick, Falsetti, Kilpatrick, & Foy (1994) reporting that 90% of rape survivors fulfilled the criteria for a panic attack in

the 72 hours following trauma. The limited amount of literature on the topic suggests a positive relationship between the experience of a peritraumatic panic attack and the development of both acute stress disorder (ASD) (Bryant and Panasetis, 2001; Nixon & Bryant, 2003) and PTSD (Adams and Boscarino, 2011; Bryant, et al., 2011). However, to the authors' knowledge, no research has investigated the relationship between peritraumatic panic attacks and the development of intrusive memories.

1.6.6 Mental defeat

Mental defeat has been conceptualised as an extreme form of helplessness and powerlessness, in which the individual is thought to lose their sense of being a human, might feel as an object, and does not care anymore about whether they are going to live or die (Dunmore, Clark, & Ehlers, 1999; Dunmore, Clark, & Ehlers, 2001; Ehlers & Clark, 2000). Mental defeat has been found to predict PTSD symptoms trajectories in prospective studies up to 6 to 9 months following trauma among assault survivors (Dunmore et al., 2001; Freeman et al., 2013; Kleim, Ehlers, & Glucksman, 2012). However, studies to date have mostly focused mostly on survivors of inter-personal trauma such as assault survivors (Dunmore, Clark, & Ehlers, 1997; Dunmore et al., 1999), survivors of political imprisonment (Ehlers, Maercker, & Boos, 2000), and post-conflict populations (Wilker et al., 2017). Furthermore, to the author's knowledge, no work has explored the relationship between intrusive memories and mental defeat.

1.6.7 Data-driven processing

As introduced in the description of the Ehlers and Clark (2000) cognitive model of PTSD, data-driven processing has been defined as an information

processing style characterised by a disproportionate processing of sensory stimuli. Data-driven processing stands in opposition to conceptual processing which is characterised by a more contextual and chronological pattern of information processing aimed at meaning-making. Data-driven processing has been shown to be a significant predictor of intrusive memories' development in analogue studies (Kindt, van den Hout, Arntz, & Drost, 2008, but see Halligan, Clark, & Ehlers, 2002; Segovia, Strange, & Takarangi, 2016 for inconsistent findings).

It has been proposed that excessive data-processing might be responsible for the sensory predominance and sense of "nowness" that characterise intrusive memories as very little contextual information about time, space, and other conceptual information has been encoded during trauma (Ehlers & Clark, 2000; but see Pearson, Ross, & Webster, 2012; Krans, Pearson, Maier, & Moulds, 2016 for alternative explanations concerning the role of contextual representations). Contextual information has indeed been highlighted as key to the formation of an integrated memory flexible enough to be updated by new information (Garfinkel et al., 2014; Liberzon & Sripada, 2008).

Relevant to the distinction between data-driven and conceptual processing is the experimental work in which either the visuospatial or the verbal systems are taxed with different tasks while participants are exposed to an analogue trauma film (*e.g.* by having participants tap specific sequences on a keyboard or make shapes out of plasticine in order to tax the visuospatial system or counting backwards to tax the verbal system) (Mertens, Lund, & Engelhard, 2020). It has generally been found that engagement in a concurrent visuospatial task while watching the trauma film results in fewer intrusive memories (Bourne, Frasquilho, Roth, & Holmes, 2010; Holmes et al., 2004; Krans, Näring, Holmes & Becker, 2010a; Stuart, Holmes, & Brewin,

2006). It has been suggested that this effect on intrusive memories is due to the visuospatial tasks competing for resources in sensory-perceptual processing therefore diminishing the encoding of bottom-up, sensory-heavy, data-driven information in favour of a more conceptual and contextual processing of the traumatic stimuli.

Additionally, it has also been shown that having participants engage in visuospatial tasks such as playing Tetris immediately after exposure to analogue trauma, sometimes even 30 minutes or several hours following exposure, can decrease the frequency of recorded film-related intrusions (Deeprose, Zhang, DeJong, Dalgleish &, Holmes, 2012, Holmes, James, Kilford, & Deeprose, 2010). These findings have informed a number of interventions that have used concurrent visuo-spatial tasks to prevent the development of intrusive memories during the consolidation phase among various populations (Freedman, Eitan, & Weiniger, 2020; Horsch et al., 2017; Iyadurai et al., 2018; Kessler et al., 2018), in what has been termed a "cognitive vaccine" (Holmes et al., 2010).

However, considering the complexity of many visuospatial tasks, another explanation proposed by Pearson and Sawyer (2011) is that cognitive load in general, rather than task modality, is responsible for the decrease in intrusive memories. Indeed, in terms of the multimodal working memory model (Baddeley, 2010), it is unclear whether these tasks are selectively taxing the visuospatial sketchpad alone or whether the central executive is also engaged. For example, research taxing the visuospatial system through eye-movements has shown that this also involves the central executive as demonstrated by reduced performance on a concurrent reaction time task (van den Hout et al., 2011). Additionally, Isaacs (2004)

reported a reduction in intrusive memories among 26 patients with PTSD asked to perform a demanding counting task while holding their intrusive memories in mind.

Additionally, doubt has been cast on whether taxing the visuospatial system has any effect on data-driven versus conceptual processing, with a study by Logan and O'Kearney (2012) failing to find a relationship. Furthermore, some studies failed to find any relationship between type of concurrent task and intrusive memories development (Brewin & Saunders, 2001; Krans, Langner, Reinecke, & Pearson, 2013; Krans, Näring, Holmes & Becker, 2010b, Pearson & Sawyer, 2011) and one study actually found a decrease in intrusive memories following a verbal enhancement task (Krans, Näring, & Becker, 2009). Marks et al. (2018) hypothesize that such inconsistent findings might be explained by the inconsistent difficulty of different concurrent tasks.

A number of experimental studies operationalised data-driven processing using the Data-Driven Processing Scale (DDPS) (Halligan et al., 2002). This was the measure used in the current study to operationalise data-driven processing quantitatively. The measure taps both into sensory-heavy, bottom-up processing (*i.e.* "*My mind was fully occupied with what I saw, heard, smelled and felt*") and lack of conceptual processing (*i.e.* "*I did not fully understand what was going on*"). Studies using this measure found a strong positive association between scores on the DDPS during exposure to an analogue trauma and higher frequency of intrusive memories (Morina et al., 2013; Laposa & Rector, 2012; Regambal & Alden, 2009; Sündermann et al., 2013). In conclusion, the systematic review on predictors of intrusive memories by Marks et al. (2018) reports emerging evidence on the role of data-driven processing in increasing the risk of intrusive memories, although less evidence exists for the role of conceptual processing.

Having provided a detailed account of the most common peritraumatic reactions and, when available, of their relationship with intrusive memories, in the following section I will highlight a number of limitations in the reviewed literature and how the current thesis will attempt to address these.

1.7 Limitations in current literature

Despite considerable advances in our understanding of peritraumatic reactions and their relationship with intrusive memories, a number of limitations are present in the literature. I will first address the limitations in the peritraumatic literature, followed by a discussion of the limitations in the literature on the relationship between peritraumatic reactions and intrusions. The discussion of limitations will be accompanied by how the current thesis will attempt to address these limitations.

Despite the importance of peritraumatic reactions in predicting the risk of developing PTSD following trauma, a number of issues exist concerning their operationalisation in the quantitative literature and also concerning their conceptualisation more broadly. Various commonly used standardised measures of peritraumatic reactions exists. These include the Peritraumatic Dissociative Experiences Questionnaire (PDEQ) (Marmar, Weiss, & Metzler, 1997), the Tonic Immobility Scale (TIS) (Forsyth, Marx, Fusé, Heidt, & Gallup, 2000), the Tonic Immobility Questionnaire (TIQ) (Taylor, Stapleton, & Asmundson, 2007), the Peritraumatic Distress Inventory (PDI) (Brunet et al., 2001), the Somatoform Dissociation Questionnaire-Peritraumatic (SDQ-P) (Nijenhuis, van Engen, Kusters, & van der Hart, 2001), the Mental Defeat Questionnaire (MDQ) (Dunmore et al., 1999), and the Data-Driven Processing Scale (Halligan et al., 2002). However, these measures often overlap conceptually one with another and it is unclear whether they

effectively operationalise distinct peritraumatic reactions. Additionally, it is not yet clear which of these peritraumatic processes are uniquely associated with PTSD. Finally, most studies have explored the relationship between peritraumatic reactions and PTSD overall, rather than investigating whether peritraumatic reactions are uniquely associated with specific PTSD symptom clusters. In Chapter 2, I will address these limitations by investigating the factor structure of six of the standard peritraumatic measures mentioned above using exploratory factor analysis. I will also explore the relationship between the newly identified peritraumatic factors and overall PTSD, as well as individual PTSD symptom clusters using exploratory structural equation modelling.

Another limitation in the literature concerning peritraumatic reactions pertains to how accurately the peritraumatic literature captures the cognitive, affective, and behavioural reactions experienced by people during trauma. Indeed, the existing work on peritraumatic reactions has largely based the identification of the different peritraumatic reactions on accounts from clinical experience (*e.g.* dissociation), and insights from animal models (*e.g.* tonic immobility), or psychological theory (*e.g.* data-driven processing). Additionally, the vast majority of the literature on peritraumatic reactions has relied on quantitative measurements of these reactions. It therefore remains unclear whether the current literature fully captures the array of reactions experienced at the time of the trauma as well as whether it appropriately characterises the lived experience of such reactions. In Chapter 4, I will address these limitations in the literature by using qualitative methods to investigate spontaneously reported peritraumatic reactions and a largely inductive analytical framework in order to allow new themes to emerge

naturalistically from the data. I will test whether the current conceptualisation of peritraumatic reactions fully captures the complexity of the traumatic experience.

A number of limitations also exist concerning the literature on the relationship between peritraumatic reactions and intrusive memories. The first limitation is methodological and concerns the most common way in which this relationship has been addressed, *i.e.* using the experimental analogue trauma film paradigm. This method, while allowing for robust experimental control and real-time ratings of reactions, is limited by a number of concerns regarding its ecological validity. Firstly, most studies using the analogue film paradigm focus on intrusive memories that, by definition as per ethical requirements, must be short-lived and spontaneously disappear. The vast majority of analogue studies therefore require participants to take note of intrusive memories experienced within the first one or two weeks following exposure (Marks et al., 2018).

However, intrusive memories immediately following exposure to distressing events can be very common, with Mayou et al. (1993) study indicating that 76% of motor vehicle accident survivors reported intrusive memories of the traumatic event in the weeks following the event. Similar findings have been reported following other traumatic events, including disasters (De Soir et al., 2015). Nonetheless, for most people, this symptom will spontaneously disappear with time (Galatzer-Levy et al., 2013). Indeed, it is the persistence in time of intrusive memories and the distress that they generate, rather than their presence in the acute phase, that is believed to characterise intrusive memories in PTSD (American Psychiatric Association, 2013; Marks et al., 2018, Schooler et al., 1999). Importantly, intrusive memories in the acute post-trauma phase do not seem to be strongly predictive of subsequent PTSD (Bryant, 2016; McFarlane, 1988; Shalev, 1992; but see Brewin, Andrews, Rose, &

Kirk, 1999; Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992 for contrasting evidence).

Additionally, when measured, the distress caused by analogue-generated intrusive memories tends to be low (Marks et al., 2018). This raises the question of whether intrusive memories generated through the analogue film paradigm differ from intrusive memories in PTSD simply in quantitative terms, as assumed in the experimental literature, or whether they are a qualitatively different psychological phenomenon in and of themselves (Christie & Choudhary, 2015).

The same issue concerning differences in quantity versus in quality is relevant to peritraumatic reactions studied in a laboratory setting. It is indeed unclear whether reactions such as dissociation or immobility resulting from exposure to distressing movie clips or images resemble the dissociation or immobility experienced by people exposed to real-life trauma. Traumatic events are generally events that happen suddenly and abruptly, generate extreme feelings of fear, horror, and helplessness, and, as per DSM-5 Criterion A definition, imply direct or indirect exposure to “death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence” (American Psychiatric Association, 2013).

Conversely, in analogue experimental studies, participants decide to voluntarily be exposed to past or fictional events that have little to no personal relevance to them in a controlled laboratory setting they can leave whenever they want and after having signed a consent form that generally warns them about potentially distressing content. If we add to this that prior mental health problems and real-life exposure to similar traumas generally constitute exclusion criteria and that nowadays the materials participants are exposed to are very unlikely to be novel or shocking considering the daily exposure to violence and horror through the media, the

translation of findings from analogue studies to trauma-exposed populations appears problematic.

The use of analogue trauma is at times justified through reference to the DSM-5 Criterion A recent addition which indicates that repeated exposure to aversive details of trauma through electronic media, television, and film in the course of professional duties can represent a potentially traumatic event (American Psychiatric Association, 2013; James et al., 2016). However, the participation in analogue trauma studies does not qualify as a "professional duty" and the experience of a police officer repeatedly exposed to real-life gruesome details is likely to be a substantially different experience from that of participants in the trauma analogue film paradigm. Indeed, attempts at experimentally generating peritraumatic reactions such as dissociation in laboratory settings have generally led to mixed results (Marks et al., 2018).

Despite these methodological limitations, the trauma film paradigm has been fundamental in formulating important testable hypotheses concerning the underlying mechanisms behind intrusive memory development and findings from this model have led to the development of promising real-life interventions (Freedman, Eitan, & Weiniger, 2020; Horsch et al., 2017; Iyadurai et al., 2018; Kessler et al., 2018). Additionally, recent advances in the use of virtual reality might provide a solution to some of the limitations in ecological validity mentioned above (Cuperus, Klaassen, Hagenaars, & Engelhard, 2017; Dibbets & Schulte-Ostermann, 2015).

The current thesis addressed the ecological limitations inherent to the trauma analogue film paradigm by investigating the relationship between retrospective reports of peritraumatic reactions experienced during real-life trauma and intrusive memories that had persisted for months and years following trauma. In Chapter 3,

peritraumatic reactions will be operationalised drawing from the Chapter 2 findings concerning the factorial structure of standardised peritraumatic scales. Conversely, in Chapter 5, peritraumatic reactions will be operationalised drawing from the peritraumatic reactions spontaneously reported in the participants' qualitative accounts reported in Chapter 4.

Another important limitation in the literature on the relationship between peritraumatic reactions and intrusive memories is that it relies on global ratings of peritraumatic reactions for the entire traumatic event rather than for the specific moments that are later re-experienced as intrusive memories. However, as mentioned above, phenomenological studies on intrusive memories indicate that intrusive memories are rarely, if ever, representations of the entire traumatic event but rather "snippets" from salient sections of the event (Ehlers et al., 2002; Ehlers et al., 2004). Additionally, experimental studies indicate that the variation in peritraumatic reactions throughout exposure can determine which moments later intrude and which moments do not (Chou et al., 2004a). Therefore, drawing from experimental studies using a similar approach (Hellawell & Brewin, 2002), I developed a study design that differentiated between peritraumatic reactions experienced during traumatic moments that later intruded in memory and moments from the same trauma that did not. This allowed for a "zooming" into the peritraumatic reactions experienced during the specific moments of the trauma that later intruded rather than during the overall trauma. Results from these studies will be presented in Chapter 3 and Chapter 5.

1.8 Earthquakes, peritraumatic reactions, and the 2016-2017 Central Italy earthquakes

1.8.1 The 2016-2017 Central Italy earthquake sequence

On the night of the 24th of August, a 6.0 M_w earthquake struck the regions of Lazio, Marche, Abruzzo, and Umbria in Central Italy. The earthquake led to widespread damage to the hamlets of Amatrice, Arquata del Tronto, and Accumoli. The geographical location of the epicentre is shown below in Figure 1.4. Structural damage from the earthquake caused the death of 303 people, of which the vast majority (238) perished in Amatrice, the hamlet where the research took place. As the pre-earthquake population of Amatrice counted around 2,500 inhabitants (Istituto Nazionale di Statistica, 2016), this number of deaths represents a sizeable proportion of the entire community. Due to the geographical remoteness of the hamlet, the initial response was largely carried out by the inhabitants themselves with very limited technical means as firefighters and the military struggled to access the region due to debris blocking roads and the collapse of bridges.

Three other major earthquake shocks took place in the months following the first earthquake, respectively on the 26th of October (5.9 M_w), the 30th of October (6.5 M_w), and on the 18th of January (5.5 M_w). The October shocks did not lead to any additional direct deaths but contributed to the virtual complete destruction of the hamlets and to widespread additional damage to an extended geographical area. The earthquakes also caused the loss of an invaluable amount of artistic heritage and material culture. The shock on the 18th of January caused a snow avalanche which killed 29 people in the region of Abruzzo. Additionally, a number of smaller aftershocks continued to hit the region up to when the research was taking place (May-July 2018). The official state of emergency ended on the 31st of December 2020. The widespread destruction of the hamlet of Amatrice can be observed below

in Figure 1.5. Additionally, a short clip showing the hamlet before and after the earthquake can be visualised here.

Figure 1.4 *Geographical Location of the Epicentre of the 24th of August 2016 Earthquake*

Figure 1.5 *The Main Hamlet of Amatrice following the 2016-2017 Central Italy Earthquake Sequence*

Besides human loss, the earthquake sequence led to the displacement of approximately 41,000 people in Central Italy and to widespread economic damage equivalent to 22 billion euros (Protezione Civile, 2017). The local economies, largely dependent on tourism and agricultural businesses were deeply affected causing widespread unemployment. Immediately following the earthquakes, the population of Amatrice was given the possibility to either temporarily relocate in hotels on the Adriatic coast or to remain in the area. Many people decided to remain in the affected area by moving into temporary housing structures such as containers and campers waiting for their temporary housing shelters (*i.e. soluzioni abitative di emergenza, SAE*) to be built by the State.

The first temporary housing shelters were ready in March 2017 but due to a number of bureaucratic complexities leading to substantial delays in their construction, parts of the population were still living in campers and containers when research was taking place. As of today, the reconstruction process has progressed at a slow pace and virtually all inhabitants are still living in temporary housing shelters despite four years having passed since the earthquake sequence leading to widespread anger and frustration. Only 3% of the 80,000 damaged houses have been reconsolidated and the number of displaced people remains stable at around 41,600 (Milone, 2020). Reconstructions efforts have been further hampered by the status of the COVID-19 pandemic in Italy.

1.8.2 Earthquakes and psychopathology

Globally, earthquakes are the natural hazard contributing to the highest number of deaths, being responsible for higher levels of mortality than all other types of natural hazards put together (Centre for Research on the Epidemiology of

Disasters, 2015). The Southern Europe region, and Italy in particular, has been identified as an area especially vulnerable to earthquakes (European Commission, 2017). Only in the last decades, several powerful earthquakes struck Italy such as the 2009 L'Aquila earthquake or the 2012 Northern Italy earthquakes, resulting in widespread human and economic loss.

Besides direct loss, earthquakes represent highly stressful events and have been associated with increased levels of post-trauma psychopathology such as post-traumatic stress disorder (PTSD) in the exposed populations. A meta-analysis (N = 76,101) reported that the incidence of probable PTSD following an earthquake is 23.66% (Dai, Chen, Lai, Li, Wang, & Liu, 2016). Findings on the mental health consequences of the 2009 L'Aquila earthquake in Italy confirm these results with reported rates of probable PTSD ranging from 35% to 40% of the exposed population (Dell'Osso et al., 2011a; Stratta, Rossetti, di Michele, & Rossi, 2016). However, besides a few exceptions (Massazza, Joffe, & Brewin, 2019; Maslovaric et al., 2017), the mental health consequences of the recent 2016-2017 Central Italy earthquake sequence have not yet been investigated, possibly due to the rural settings where the disaster took place hindering accessibility.

1.8.3 Peritraumatic reactions during earthquakes

A number of studies have investigated peritraumatic reactions during earthquakes. All focused either on peritraumatic dissociation or distress and found positive associations with overall PTSD with studies being conducted in Iran (Nobakht, Ojagh & Dale, 2019), Japan (Nishi et al., 2012), New Zealand (Kannis-Dymand, Carter, Lane, & Innes, 2019), the US (Marmar, Weiss, Metzler, Ronfeldt, & Foreman, 1996), China (Wei et al., 2013), Haiti (Derivois, Cénat, Joseph, Karray,

& Chahraoui, 2017), and Turkey (Tural et al., 2004). One study following an earthquake in Indonesia however failed to find a significant relationship between peritraumatic distress and PTSD among community volunteers (Thormar et al., 2014). Few studies exist investigating other peritraumatic reactions besides dissociation and distress among earthquake survivors (see Prati, Catufi, and Pietrantoni, 2012 for an exception). No study has investigated the relationship between peritraumatic reactions and intrusive memories among earthquake survivors.

1.8.4 Intrusive memories of earthquakes

Following earthquakes, intrusive memories tend to be common and persistent occurrences among survivors. A study conducted 6-month following the L'Aquila earthquake reported that 58.2% of the sample experienced distressing intrusive symptoms (mean score higher than 1.5 on a scale from 0 to 4 of the Impact of Event Scale-Revised Intrusion subscale) (Roncone et al., 2013). Substantial intrusive symptomatology in the aftermath of the L'Aquila earthquake was also found 15-18 months following the disaster (mean of 17 out of 20 on Davidson Trauma Scale re-experiencing sub-scale) (Cofini, Carbonelli, Cecilia, Binkin, & di Orio, 2015). Similarly, in another study among Chinese adolescents exposed to the 2008 Wenchuan earthquake, 56.3% of the sample was experiencing intrusive thoughts three years following exposure (Tian, Wong, Li, & Jiang, 2014). Similar long-term persistence of intrusive symptomatology was found 2 ½ years following an earthquake in Armenia, with intrusive recollections reported by 92% of surveyed children (Najarian, Goenjian, Pelcovitz, Mandel, & Najarian, 1996), and following the 1999 Istanbul earthquake (Eksi & Braun, 2009).

1.9 Summary, thesis overview, and sample considerations

Having provided an overview of the theoretical underpinnings and empirical findings concerning the relationship between peritraumatic reactions and intrusive memories, I will now present the various empirical chapters of this thesis. In Chapter 2, I will investigate the factorial structure of the six most commonly used peritraumatic reactions standard scales. In Chapter 3, I will build upon findings from Chapter 2 and assess the relationship between newly identified peritraumatic factors and intrusive memories by comparing peritraumatic reactions experienced during moments that intruded versus moments from the same trauma that did not, both among participants with intrusions and participants without. Chapter 4 will mirror the exploratory approach to peritraumatic reactions taken in Chapter 2 and investigate, using qualitative methods, the peritraumatic reactions spontaneously reported by participants during semi-structured interviews. Chapter 5 will mirror Chapter 3 in addressing the relationship between the peritraumatic reactions identified in the qualitative analyses of Chapter 4 and intrusive memories by comparing peritraumatic reactions experienced during moments that intruded versus moments from the same trauma that did not. Finally, in Chapter 6, I will draw some over-arching conclusions from the findings, and indicate possible practical implications as well as future research directions.

The sample used for the analyses in Chapters 3, 4, and 5 is the same (N = 104) and was based on the first wave of data collection. I then decided to expand the sample in order to have sufficient power to conduct factor analytic work on the standard peritraumatic measures. In the weeks immediately following the first wave of data collection I therefore collected data from an additional 204 participants,

amounting to a total of 308 participants. This larger sample forms the basis of the analyses reported in Chapter 2.

2 Chapter 2: The Structure of Peritraumatic Reactions and their Relationship with PTSD among Disaster Survivors

A version of this chapter has been accepted for publication at the *Journal of Abnormal Psychology.*

Massazza, A., Joffe, H., Hyland, P., & Brewin, C. R. (2020). The structure of peritraumatic reactions and their relationship with PTSD among disaster survivors.

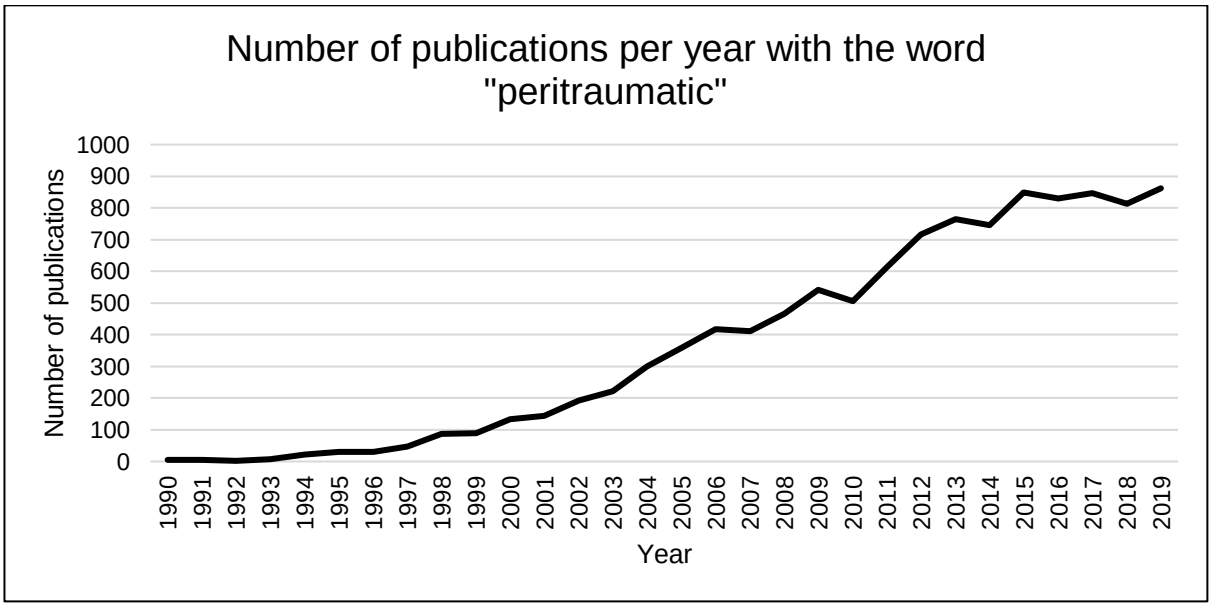
Chapter 1 provided an overview of the theoretical background and evidence concerning memory and PTSD broadly, as well as peritraumatic reactions and intrusive memories specifically. In this first empirical chapter, I will be addressing the topic of peritraumatic reactions and their relationship with overall PTSD as well as specific PTSD symptom clusters.

2.1 Introduction

The systematic study of peritraumatic reactions (*i.e.*, transient feelings, thoughts, and behaviours that take place either during or immediately after exposure to trauma) principally began with the studies by Marmar and colleagues (Marmar, Weiss, Metzler, Ronfeldt, & Foreman, 1996; Marmar et al., 1994) and received further impetus with the inclusion of Criterion A2 (*i.e.,* the specification that traumatic experiences had to be accompanied by intense feelings of fear, helplessness, and horror) in the DSM-IV posttraumatic stress disorder (PTSD) diagnosis (American Psychiatric Association, 1994). Since then peritraumatic phenomena have been found to be strong predictors of the risk of developing PTSD following a traumatic event (Bovin & Marx, 2011), and are of considerable clinical

and theoretical importance. A search on Google Scholar to identify the number of yearly publications using the word “peritraumatic” showed no results before the year 1994 corresponding to Marmar’s first studies on peritraumatic dissociation (Marmar et al., 1994). Since then, as shown in Figure 2.1, the literature on peritraumatic phenomena has been growing steadily, with more than 800 papers being published on the topic each year in the last few years.

Figure 2.1 *Number of Publications per Year on Google Scholar Using the Word "Peritraumatic" from 1990 onwards*



There are a number of peritraumatic scales that measure psychological, physiological, and somatic reactions but many of these contain overlapping items and how the contents of the scales relate to one another is not known. There is an urgent need to understand how many distinct and robust peritraumatic reactions exist and to determine which of these is central in predicting the risk of developing PTSD. As the characteristics of different peritraumatic reactions have been described in depth in Chapter 1, the following sections will only briefly summarise the key peritraumatic phenomena that have been most studied in the literature on PTSD. Current limitations will be outlined followed by our research questions.

2.1.1 Different types of peritraumatic response

Peritraumatic dissociation (psychic). Dissociation is a complex phenomenon that encompasses several components including depersonalisation, derealisation, amnesia, and identity confusion or alteration (Bryant, 2007; Cardeña, 1994; van der

Hart, Nijenhuis, Steele, & Brown, 2004). Peritraumatic dissociation has been defined (Marmar, Metzler, & Otte, 2004) as alterations "*in the sense of self, time, place, and meaning, which confer a sense of unreality to the event as it is occurring*" (p. 146). Meta-analyses on PTSD risk factors have reported that peritraumatic dissociation is a strong predictor of PTSD with a weighted *r* in the range 0.35 – 0.40 (Breh & Seidler, 2007; Lensvelt-Mulders et al., 2008; Ozer, Best, Lipsey, & Weiss, 2003). However, caution has been advised in interpreting such findings due to several methodological differences and shortcomings across heterogeneous studies together with theoretical and conceptual complexities in defining and measuring peritraumatic dissociation (van der Hart, van Ochten, van Son, Steele, & Lensvelt-Mulders, 2008).

Peritraumatic distress. Substantial evidence supports the link between psychological distress at the time of the trauma and the subsequent development of PTSD (Brewin, Andrews, & Rose, 2000; Vance, Kovachy, Dong, & Bui, 2018). Peritraumatic distress now includes emotions such as anger, shame, and guilt (Andrews, Brewin, Rose, & Kirk, 2000), threats to physical safety or thoughts of death (March, 1993), panic (Adams & Boscarino, 2011), and a variety of physiological signs of arousal including shaking, increased heart rate, and loss of bowel and bladder control (Solomon, Laor, & McFarlane, 1996). A meta-analysis on the relationship between peritraumatic distress and PTSD symptoms found a significant weighted $r = 0.55$ (Thomas, Saumier, & Brunet, 2012).

Peritraumatic dissociation (somatoform). Somatoform dissociation is a concept derived from studies of physical responses to threat in animals such as "playing dead" (Nijenhuis, Vanderlinden, & Spinhoven, 1998). It was defined as specifically involving the body and comprising a partial or complete loss of perception, such as paralysis, analgesia, and anaesthesia, as well as more active

involuntary responses such as distortions in the visual field or ataxia (Nijenhuis, van der Hart, Kruger, & Steele, 2004). These physical symptoms cannot be explained by organic conditions or by the direct effect of a substance. The relationship between somatoform dissociation and PTSD has received some attention (Hagenaars, van Minnen, & Hoogduin, 2007), but substantially less than its psychological counterpart. Peritraumatic nausea, a reaction thought to be part of the peritraumatic somatoform dissociation construct, has recently been found to be a prospective predictor of PTSD in three large samples of individuals admitted to emergency departments (Michopoulos et al., 2019).

Tonic immobility. Tonic immobility is the last step within the defence cascade, taking place after freezing, flight, and fight, when escape or resistance has been unsuccessful. It is characterised by catatonic-like motionless posture, suppressed vocal behaviour, analgesia, intermittent periods of eye closure, fixed, unfocused stare or gaze, Parkinsonian-like tremors in the extremities, and waxy flexibility, together with sympathetic and parasympathetic reactions (Kozlowska, Walker, McLean, & Carrive, 2015). Tonic immobility has been extensively assessed in rape survivors (Kalaf et al., 2017) but recent evidence highlights its presence in a variety of different traumas characterised by situations in which escape or resistance is not possible (Hagenaars, 2016). In retrospective studies higher levels of tonic immobility at the time of the trauma were found to be associated with subsequent PTSD (Kalaf et al., 2015; Hagenaars & Hagenaars, 2020).

Data-driven processing. Data-driven processing has been defined as a bottom-up information processing style characterised by a disproportionate processing of sensory/perceptual stimuli (Halligan, Clark, & Ehlers, 2002). The concept was first applied to PTSD by Ehlers and Clark (2000), who proposed that

intrusive memories result from excessive data-driven processing at the time of the trauma, resulting in poorly elaborated memories that are insufficiently integrated with other autobiographic knowledge (see Chapter 1 for a more detailed description of the Ehlers and Clark (2000) model). Data-driven processing has been associated with higher levels of intrusive memories and PTSD (Ehring, Ehlers, & Glucksman, 2008; Halligan et al., 2002; Halligan, Michael, Clark, & Ehlers, 2003).

Mental defeat. Mental defeat is an extreme form of powerlessness in which individuals lose their sense of being human and cease caring about whether they are going to live or die (Dunmore, Clark, & Ehlers, 1999, 2001). Mental defeat has been found to predict PTSD symptom trajectories in prospective studies up to 6 to 9 months following trauma (Dunmore et al., 2001; Freeman et al., 2013; Kleim, Ehlers, & Glucksman, 2012). Studies to date have mostly focused on assault survivors (Dunmore et al., 1999, 2001), survivors of political imprisonment (Ehlers, Maercker, & Boos, 2000), and on post-conflict contexts (Wilker et al., 2017).

2.1.2 Inter-relationship of peritraumatic reactions

There is little consensus concerning how these responses relate to one another. Most attention has been paid to the relationships between peritraumatic distress and peritraumatic dissociation. Correlations between them tend to be in the range of 0.5 – 0.7 (Brunet et al., 2001; Bui et al., 2011; Kannis-Dymand, Carter, Lane, & Innes, 2019). In some cases, the association between peritraumatic dissociation and PTSD has been found to significantly decrease when peritraumatic distress is also included as a predictor (van der Hart et al., 2008). However, other studies have found peritraumatic distress to predict PTSD even after dissociation was entered in the model (Birmes et al., 2005; Bui et al., 2010; Moss et al., 2017). Some

have argued that peritraumatic dissociation is a mediator of the relationship between peritraumatic distress and PTSD (Otis, Marchand, & Courtois, 2012) or that peritraumatic distress is a trigger for peritraumatic dissociation (Fikretoglu et al., 2006).

Tonic immobility and peritraumatic dissociation have also been found to be positively associated (Fusé, Forsyth, Marx, Gallup, & Weaver, 2007; Heidt, Marx, & Forsyth, 2005; Marx, Forsyth, Gallup, Fusé, & Lexington, 2008). In one study (Abrams, Carleton, & Asmundson, 2012) tonic immobility did not predict PTSD severity after peritraumatic dissociation and trait anxiety were controlled for. However, except for Heidt et al. (2005), such studies have generally used sub-optimal measures of dissociation such as the dissociation subscale of the Tonic Immobility Scale (TIS) (Forsyth, Marx, Fusé, Heidt, & Gallup, 2000) rather than a dissociation-specific measure. Importantly, TI and peritraumatic dissociation are thought to be characterised by two distinct, if not opposed, cognitive processing styles with TI being associated with a lack of disruption of higher cognition (Gallup, Boren, Suarez, Wallnau, & Gagliardi, 1980), whereas peritraumatic dissociation is thought to impair these same processes (Zoellner, 2008).

One paper assessed the relationship between somatoform and psychic dissociation and found a strong positive correlation of $r = .62$ (Nijenhuis, van Engen, Kusters, & van der Hart, 2001). In a prospective study, somatoform dissociation and psychic dissociation uniquely predicted PTSD at 6 months, but not when initial PTSD numbing was controlled for (Hagenaars, van Minnen, & Hoogduin, 2007).

To the author's knowledge, only one study assessed the relationship between data-driven processing and peritraumatic dissociation finding a high positive correlation of $r = .72$ in a sample of undergraduate students (Regambal, 2006,

unpublished thesis). To the author's knowledge, no studies have been conducted exploring the relationship between mental defeat with other peritraumatic phenomena and no study has included all six peritraumatic reactions in the same design.

Indeed, a significant problem with this literature is that few studies have included more than one or two measures of peritraumatic responding. The high correlations typically obtained between them may reflect overlap in items belonging to different scales. Moreover, individual measures are often composed of a number of factors, some of which overlap conceptually with other measures (Hagenaars, 2016). For example in the Tonic Immobility Scale (Forsyth et al., 2000) items 9 "*Rate the extent to which you felt detached from yourself"* and 10 *"Rate the extent to which you felt detached from what was going on around you*", theoretically belong more to dissociation than tonic immobility.

It is, therefore, unknown how many separate constructs are needed to account for the variety in peritraumatic responding, and which of these constructs are most strongly associated with PTSD. It is also possible that peritraumatic responding is associated with specific symptom clusters, such as intrusions or alterations in arousal and reactivity, rather than with PTSD generally.

2.1.3 Research questions

In this study, I first assessed the relationship between standard peritraumatic measures and PTSD in a sample of survivors exposed to the same earthquake. I then addressed the latent structure of the different types of peritraumatic responses. All items from representative scales measuring each of the six peritraumatic reactions reviewed above were entered into an exploratory factor analysis (EFA). Following

this, I used exploratory structural equation modelling or ESEM (Asparouhov & Muthen, 2009) to assess how the different latent factors underlying peritraumatic responding were associated both with PTSD and the four constituent symptom clusters (Intrusion, Avoidance, Negative Alterations in Cognition and Mood, and Alterations in Arousal and Reactivity) described in DSM-5 (American Psychiatric Association, 2013).

2.2 Methods

2.2.1 Participants and recruitment

All participants were survivors of the 2016-2017 Central Italy earthquakes. On the 24th of August 2016 a 6.0 M_w earthquake struck Central Italy, destroying the majority of buildings in Amatrice, Accumoli, and Arquata del Tronto. The vast majority of the deaths, 238 out of 303, were registered in Amatrice (pre-earthquake population 2,500), the hamlet where the research took place. Further powerful shocks struck Central Italy during this period, the last major shock taking place on the 18th January 2017 and aftershocks kept hitting the region as research was taking place. For more details on the 2016-2017 Central Italy earthquake sequence see Chapter 1.

A purposive sample of 341 participants was identified building on a previous study conducted in the area by the authors (Massazza, Joffe, & Brewin, 2019) and with the aid of the health centre and the local municipality. Participants were contacted individually by telephone or face-to-face to generate a sample that was approximately representative of the population as a whole in terms of age and gender as per 2016 census data (Istituto Nazionale di Statistica, 2016). Of the 341 individuals contacted, 308 agreed to participate (90% response rate).

2.2.2 Measures

All measures were answered in respect of the earthquakes to which participants had been exposed.

Mental Defeat Questionnaire (MDQ) (Dunmore et al., 1999). The MDQ is an 11-item self-report questionnaire that asks participants to retrospectively rate the extent to which they experienced mental defeat (*e.g.* helplessness, de-humanisation) during the trauma from 0 "*not at all/never"* to 4 *"very strongly"* (example item *"I felt destroyed as a person"*). Scores can range from 0 – 44 with higher scores indicating more mental defeat. Cronbach's α in this sample was 0.89.

Somatoform Dissociation Questionnaire-Peritraumatic (SDQ-P) (Nijenhuis et al., 2001). The SDQ-P is an 11-item self-report questionnaire which asks participants to retrospectively rate the extent to which they experienced somatoform dissociation reactions (*e.g.* distortions in body perception or unusual bodily experiences) during the trauma from 1 "*not at all"* to 5 "*extremely"* (example item *"It felt as if my body, or parts of it, disappeared"*). It is a measure largely based on the Somatoform Dissociation Questionniare-20 (Nijenhuis, Spinhoven, Van Dyck, Van der Hart, & Vanderlinden, 1996). Participants specify whether the reaction might have been due a physical cause (*e.g.* medical condition, being physically restrained). Scores can range from 11 – 55 with higher scores indicating more somatoform dissociation. Cronbach's α in this sample was 0.83.

Peritraumatic Dissociative Experiences Questionnaire (PDEQ) (Marmar, Weiss, & Metzler, 1997). The PDEQ is a 10-item self-report questionnaire which asks participants to retrospectively rate the extent to which they experienced a series of dissociative reactions (*e.g.* derealisation, depersonalisation, distortions in sense of

time *etc.*) during the trauma from 1 "*not at all true*" to 5 *"extremely true"*. Example item: *"What was happening seemed unreal to me, like I was in a dream, or watching a movie or play"*. Scores can range from 10 – 50 with higher scores indicating more dissociation. Cronbach's α in this sample was 0.89.

Tonic Immobility Scale (TIS) (Forsyth, Marx, Fusé, Heidt, & Gallup, 2000). The TIS is a 10-item self-report questionnaire which asks participants to retrospectively rate the extent to which they experienced tonic immobility (*e.g.* paralysis, suppressed vocal behaviour *etc.*) during the trauma from 0 "*not at all*" to 6 *"extremely".* Example item "*Rate the degree to which you froze or felt paralyzed during your most recent experience"*. Scores can range from 0 – 60 with higher scores indicating more immobility. Cronbach's α in this sample was 0.87.

Peritraumatic Distress Inventory (PDI) (Brunet et al., 2001). The PDI is a 13-item self-report questionnaire which asks participants to retrospectively rate the extent to which they experienced distress (*e.g.* negative emotions or perceptions of life threat) during the trauma from 1 *"not at all true*" to 5 *"extremely true"* (example item: *"I thought I might die"*). Scores can range from 13 – 65 with higher scores indicating more distress. Cronbach's α in this sample was 0.82.

Data-Driven Processing Scale (DDPS) (Halligan et al., 2002). The DDPS is an 8-item self-report questionnaire that asks participants to retrospectively rate the extent to which they experienced data-driven processing (*e.g.* disproportionate perceptual processing) during the trauma from 0 "*not at all*" to 4 "*very strongly"* (example item: "*I was overwhelmed by sensations and couldn't put everything together*"). Scores can range from 0 – 32 with higher scores indicating more data-driven processing. Cronbach's α in this sample was 0.91.

A summary table of the different peritraumatic measures with example items is shown below in Table 2.1. All measures are reported in full in Appendix C.

Table 2.1 *Outline of Different Peritraumatic Reactions with Corresponding Measures and Example Items from the Measure Used in Current Study*

Peritraumatic phenomenon	Measure	Example items
Mental defeat	Mental Defeat Questionnaire (MDQ) (Dunmore et al., 1999)	*"I lost any willpower", "I felt destroyed as a person"*
Somatoform dissociation	Somatoform Dissociation Questionnaire-Peritraumatic (SDQ-P) (Nijenhuis et al., 2001)	"*It felt as if my body, or parts of it, disappeared"*
Psychological dissociation	Peritraumatic Dissociative Experiences Questionnaire (PDEQ) (Marmar, Weiss, & Metzler, 1997)	"*What was happening seemed unreal to me, like I was in a dream, or watching a movie or play"*
Tonic immobility	Tonic Immobility Scale (TIS) (Forsyth et al., 2000)	"*Rate the degree to which you froze or felt paralyzed during your most recent experience"*
Distress	Peritraumatic Distress Inventory (PDI) (Brunet et al., 2001)	"*I felt helpless", "I thought I might die"*
Data-driven processing	Data-Driven Processing Scale (DDPS) (Halligan et al., 2002)	"*I was overwhelmed by sensations and couldn't put everything together*"

Participants also completed the PTSD Checklist for DSM-5 (PCL-5), a 20-item self-report measure assessing the 20 symptoms of PTSD (Weathers et al., 2013). The rating scale ranges from 0 ('*not at all'*) to 4 ('*extremely*') focusing on how bothered the individual was by the symptoms in the last month. The PCL-5 has been shown to have high total internal reliability (α = .90) and acceptable to good internal reliability for the subscales Intrusion, Avoidance, Negative Alterations in Cognition and Mood, and Alterations in Arousal and Reactivity (α range = .57 – .78)

(Sveen, Bondjers, & Willebrand, 2016). Internal reliability in the current study was high with Cronbach's α = .94.

Finally, participants answered a series of demographic questions investigating traumatic exposure, gender, age, level of education, religious affiliation, and residency.

2.2.3 Procedure

All questionnaires went through a thorough back-translation procedure. As the only measure without an official English translation, the SDQ-P was first translated from Dutch into English with the aid of a native-speaking expert in peritraumatic reactions. Then all measures were first translated from English to Italian by me. The Italian translations were then given to a second translator fluent in both Italian and English who translated the measures back into English blind to the original versions. The original English version and the back-translated English version were then compared, and discrepancies resolved. All Italian translated measures are reported in Appendix D.

Data collection took place for three months in May, June, and July 2018. This was 20 months following the earthquake in August 2016 and 15 months following the last major earthquake in January 2017. The UCL Research Ethics Committee approved this research with the project ID: 10517/001. The approval form is reported in Appendix A. The project was also approved by the national health service centre of Rieti and by the local municipality, Comune di Amatrice (see Appendix B). Prior to taking part, participants read an information sheet and provided written informed consent (see Appendix F).

2.2.4 Data analysis

The analytical approach for this study involved several steps. First, descriptive statistics were calculated for all demographic and earthquake exposure variables, peritraumatic reactions, and PTSD scores.

Second, correlations were calculated between the different peritraumatic standard measures. Additionally, multiple regression was conducted with the six peritraumatic standard measures as independent variables and total PCL-5 scores as dependent variable.

Third, EFA analysis was performed to examine the latent structure of the 63 indicators of peritraumatic experiences. Models with one to seven factors were estimated, and because the peritraumatic experience indicators are ordered categorical in nature, the Weighted Least Squares Mean- and Variance-adjusted (WLSMV) estimator was used (Flora & Curran, 2004). The models were estimated using Geomin rotation meaning the extracted factors were free to correlate. There was minimal missing data (n = 1) and this was managed using the default pairwise deletion method.

Assessment of model fit followed standard guidelines (Hu & Bentler, 1999) where acceptable fit is indicated by a non-significant chi-square test (χ^2), Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) values $\geq$ .90, and Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) values $\leq$ .08. The χ^2 test produces inflated Type 1 errors, therefore model fit and model comparisons should not rely solely on this index (Tanaka, 1987). In an EFA context, overall model fit improves with increasing numbers of extracted factors, therefore, determining the optimal factorial solution was made on the basis of four criteria. Statistically, I inspected the change in the TLI

value (ΔTLI) for each model compared to the model with one less factor extracted. The ΔTLI value is superior to the more commonly used ΔCFI value because the TLI contains a penalty for increasing model complexity. Chen and colleagues (Chen, Curran, Bollen, Kirby, & Paxton, 2008) recommend than changes $\geq$ .010 reflect significant improvement in model fit. Additionally, all models were estimated using the Maximum Likelihood estimator to generate BIC values which can be used to compare nested and non-nested models. The model with the lowest BIC value should be favoured, and a change of ten points represents strong evidence in favour of the model with the lower BIC value (Raftery, 1995). In addition to these considerations, model selection was guided by inspection of the model parameters and the interpretability of the extracted factors.

Finally, an ESEM analysis was performed to assess the bivariate and multivariate associations between the extracted peritraumatic experience factors and PTSD. As with the EFA models, ESEM models with one to seven peritraumatic experience factors were estimated. In the ESEM model, the peritraumatic experience factors were modelled as the predictor variables and PTSD was modelled as the criterion variable. A second-order model of PTSD was estimated where the correlations between the first-order factors of Intrusions, Avoidance, NACM, and Arousal were explained by a higher-order PTSD factor. A confirmatory factor analysis indicated that this model fit the data well ($\chi^2(166) = 461.94$, $p < .001$; CFI = .96; TLI = .96; RMSEA (90% CI) = .08 (.07, .08); SRMR = .05). In a planned post-hoc analysis, the best fitting ESEM model was re-estimated with only the first-order PTSD factors included in the model in order to determine how the peritraumatic experience factors were associated with the four PTSD symptoms clusters. The four-factor model of PTSD also produced acceptable model fit ($\chi^2(164) = 445.62$, $p <$

.001; CFI = .97; TLI = .96; RMSEA (90% CI) = .08 (.07, .08); SRMR = .05). The ESEM models used the same estimator and method of rotation as the EFA models, and assessments of overall and relative model followed the same criteria described for the EFA component. All analyses were performed using Mplus version 8.2 (Muthén & Muthén, 2017).

An ESEM was deemed superior to testing the factor scores in a regression model for a number of reasons. Most importantly, the ESEM model allowed us to incorporate the EFA model and the regression model into an omnibus structural equation model. In a traditional structural equation model, the measurement model should be based on a confirmatory factor analysis (CFA), which according to an independent cluster model of CFA (IMC CFA) posits that all items should have zero loadings on all factors other than the one they are designed to measure (Tomarken & Waller, 2005). However, as many psychological constructs are unlikely to meet these requirements, this often leads to error being included in the model, *e.g.*, by over-inflating the correlations between factors which, in turn, can lead to biased estimates in the structural component of the model (Marsh et al., 2010).

The IMC CFA assumptions were particularly unlikely to be met in the current case, due to the high correlations between peritraumatic measures shown in previous work. Additionally, no previous theory concerning the structure of peritraumatic reactions existed, therefore defying the purpose of conducting a confirmatory test on the peritraumatic measures. ESEM was developed in order to partially address these limitations, as EFA models do not require all cross-loadings to be constrained to zero. As a result, using an ESEM model allowed us to rely on the advantages given by SEM models but without the overly restrictive requirements

of CFAs (see Marsh, Morin, Parker, & Kaur, 2014 for a comprehensive overview of the rationale behind ESEM and its use in clinical psychology to date).

Finally, while the factor score could have been saved to represent the latent variable of interest and added into a regression-based model, the factor score is only an estimate of the true latent variable score, and depending on the data, it may not be an accurate representation of the latent variable. Conversely, using the ESEM approach rather than factor scores in a regression-based model ensures that the most accurate structural parameters are produced (Marsh et al., 2014)."

2.3 Results

2.3.1 Descriptive statistics

The majority of participants were from Amatrice (n = 274), with a minority from other adjoining municipalities hit by the earthquakes (n = 34). All identified as Caucasian. Most participants (78%, n = 243) had lost their house due to the earthquakes, with 35% (n = 109) losing a family member, 44% losing close friends (n = 138), and everybody losing acquaintances. Additional information on demographic status and degree of earthquake exposure are reported below in Table 2.2.

Table 2.2 *Information on Demographic Variables and Earthquake Exposure*

Variables	Percentage of total sample or mean
Gender and age	
Male	41% (*M* age = 48.37, *SD* = 17.35, range = 18-80)
Female	59% (*M* age = 47.16, *SD* = 16.01, range = 18-81)
Religion	
Catholic	84%
Other	16%
Education	
Secondary school diploma	52%
Middle school diploma	25%
University degree	14%
Primary school diploma	9%
Earthquake exposure	
Exposed to 24th of August earthquake	96%
Exposed to all four main earthquakes (between August 2016 and January 2017)	67%
Subjective earthquake intensity	*M* = 9.1 (*SD* = 1.74)
Exposed to gruesome scenes such as corpses or body parts	37%
Heard voices of people asking for help from under debris	42%
Witnessed somebody dying in front of them	16%
Injured to the point of receiving medical support	15%

Note. Earthquake intensity was measured on an 11-point scale (0 = '*not intense at all*', 10 = '*extremely intense*')

The mean and standard deviation of scores on the six peritraumatic measures were as follows: Mental Defeat Questionnaire (*M* = 10.53, *SD* = 9.88); Somatoform Dissociation Questionnaire- Peritraumatic (*M* = 20.24, *SD* = 8.75); Peritraumatic

Dissociative Experiences Questionnaire (*M* = 24.71, *SD* = 10.11); Tonic Immobility Scale (*M* = 23.78, *SD* = 15.23); Peritraumatic Distress Inventory (*M* = 36.63, *SD* = 10.01); Data-Driven Processing Scale (*M* = 16.18, *SD* = 9.13). The mean score on the PCL-5 was 24.82 (*SD* = 18.19), and 92 participants (29%) exceeded the suggested clinical cut off score of 33 (Bovin et al., 2016).

2.3.2 Relationship between standard measures

Pearson bivariate correlations were calculated between the different standard peritraumatic measures. The correlation matrix is reported below in Table 2.3.

Table 2.3 *Pearson Bivariate Correlations between the Standard Peritraumatic Measures*

Measure	1	2	3	4	5	6
1. MDQ	-					
2. SDQ-P	.52***	-				
3. PDEQ	.59***	.60***	-			
4. TIS	.56***	.65***	.63***	-		
5. PDI	.64***	.55***	.59***	.69***	-	
6. DDPS	.53***	.51***	.73***	.62***	.56***	-

*Note. *p < .05, **p < .01, ***p < .001.* MDQ = Mental Defeat Questionnaire; SDQ-P = Somatic Dissociation Questionnaire – Peritraumatic; PDEQ = Peritraumatic Dissociative Experiences Questionnaire; TIS = Tonic Immobility Scale; PDI = Peritraumatic Distress Inventory; DDPS = Data-Driven Processing Scale.

2.3.3 Relationship between standard measures and PTSD

A multiple linear regression was conducted with the six standard peritraumatic scales as independent variables and the total PCL-5 score as dependent variable. Results are shown below in Table 2.4. The MDQ, SDQ-P, and PDI were positively associated with total PCL-5 scores.

Table 2.4 *Multiple Regression Analysis for Standard Peritraumatic Measures Predicting Total PCL-5 Scores*

	B	95% CI	*β*	*t*	*p*
MDQ	4.78	[2.41-7.15]	.23	3.96***	<.001
SDQ-P	3.95	[1.28-6.61]	.17	2.91**	.003
PDEQ	2.28	[-0.19-4.76]	.12	1.81	.071
TIS	-0.89	[-2.51-0.72]	-.07	-1.09	.276
PDI	6.22	[3.18-9.26]	.26	4.03***	<.001
DDPS	1.79	[-0.27-3.86]	.11	1.70	.088

Note. Adjusted R^2 = .46 (p < .001). CI = confidence interval for *B*. *p < .05, **p < .01, ***p < .001. MDQ = Mental Defeat Questionnaire; SDQ-P = Somatic Dissociation Questionnaire – Peritraumatic; PDEQ = Peritraumatic Dissociative Experiences Questionnaire; TIS = Tonic Immobility Scale; PDI = Peritraumatic Distress Inventory; DDPS = Data-Driven Processing Scale.

2.3.4 Factor structure

The EFA model fit results are presented in Table 2.5. The χ^2 values declined for models with additional factors extracted, and the DIFFTEST analysis indicated significant (ps < .001) improvement for all models with one additional factor extracted. Inspection of the model fit values indicated that the models with one and two factors extracted did not produce satisfactory fit, whereas models with three or more factors had satisfactory fit. The ΔTLI values were ambiguous in terms of the optimal factorial solution. The ΔTLI supported the five-factor model over the four-factor model but the ΔTLI from five- to six-factors was at the threshold for improved model fit. Inspection of the BIC results however provided unambiguous support for the model with five factors. The five-factor model had a BIC value 144 points lower than the four-factor model strongly supporting its statistical superiority. Based on these results, the five-factor model was deemed to be the optimal solution. The pattern of Geomin rotated factor loadings for the five peritraumatic experience factors in the EFA model are shown in Table 2.6.

Table 2.5 *EFA and ESEM Model Fit Results*

	χ^2	df	CFI	TLI	RMSEA	90% CI	SRMR	ΔTLI K-1 factor	BIC
EFA Models									
One factor	5160	1890	.835	.829	.075	.073, .078	.107	--	63950
Two factors	4185	1828	.881	.873	.065	.062, .067	.092	.044	63366
Three factors	3561	1767	.909	.900	.058	.055, .060	.081	.027	63041
Four factors	3032	1707	.933	.923	.050	.047, .053	.068	.023	62799
Five factors	**2621**	**1648**	**.951**	**.942**	**.044**	**.041, .047**	**.058**	**.019**	**62655**
Six factors	2364	1590	.961	.952	.040	.036, .043	.053	.010	62671
Seven factors	2171	1533	.986	.959	.037	.033, .040	.048	.007	62684
ESEM Models									
One factor	6328	3315	.876	.873	.054	.052, .056	.088	--	81880
Two factors	5420	3252	.911	.907	.047	.044, .049	.079	.034	81292
Three factors	4851	3190	.932	.927	.041	.039, .043	.070	.020	80972
Four factors	4420	3129	.947	.942	.037	.034, .039	.063	.015	80736
Five factors	**4112**	**3069**	**.957**	**.952**	**.033**	**.031, .036**	**.058**	**.010**	**80591**
Six factors	3918	3010	.963	.958	.031	.028, .034	.055	.006	80614
Seven factors	3774	2952	.966	.961	.030	.027, .033	.053	.003	80633

Note. χ^2 = chi-square test; df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Residual; ΔTLI K-1 factor = Change in TLI value between model and model with one less factor; BIC = Bayesian Information Criterion (estimated via the ML estimator). All χ^2 results are statistically significant ($p < .001$). Best fitting models are in bold.

The model fit results for the seven ESEM models with PTSD as the criterion variable are also reported in Table 2.5. All models with the exception of the one-factor model had acceptable fit. As with the EFA results, the ΔTLI results were ambiguous in identifying the optimal solution. The ΔTLI value from four- to five-factors was at the threshold for considering improvement in model fit. However, the BIC value was lowest for the five-factor ESEM model; the five-factor model had a BIC value 157 points lower than the four-factor model strongly supporting its statistical superiority. Based on these results, and consistency with the EFA results, the five-factor ESEM model was deemed to be the optimal solution.

The pattern of Geomin rotated factor loadings for the five peritraumatic experience factors in the ESEM model are shown in Table 2.7.

Table 2.6 *Standardised Factor Loadings for the Five-Factor EFA Solution*

	Mental defeat (F1)	Somatoform dissociation (F2)	Cognitive overload (F3)	Immobility (F4)	Distress (F5)
MDQ-1 "I lost any will-power"	.50		.19	.21	
MDQ-2 "I didn't care what happened to me anymore"	.64				
MDQ-3 "I felt completely defeated"	.74				
MDQ-4 "I no longer felt like a human being"	.62	.24			
MDQ-5 "In my mind, I gave up"	.76				
MDQ-6 "I felt destroyed as a person"	.63		.18		.16
MDQ-7 "I wanted to die"	.74				
MDQ-8 "I lost any inner resistance"	.60		.18		
MDQ-9 "I felt like an object"	.69				
MDQ-10 "I felt completely at the mercy of other people or the situation"	.62				
MDQ-11 "I felt completely humiliated and lost any sense of inner dignity"	.76	.21			
SDQ-P-1 "It felt as if my body, or parts of it, was paralysed"	.16	.28		.70	
SDQ-P-2 "My visual field was smaller than usual (it felt as if I was looking through a tunnel or could just see a section of an area)"		.59	.17		

SDQ-P-3 "It felt as if my body, or parts of it, disappeared"	.29	.62			
SDQ-P-4 "I felt temporarily paralysed or stiff"		.34		.67	
SDQ-P-5 "It felt as if my body, or parts of it, were numb"		.60			
SDQ-P-6 "My sense of taste diminished or was absent"		.58			.19
SDQ-P-7 "I crouched and automatically did not move, it was involuntary and not because I was physically restrained"		.35		.32	
SDQ-P-8 “I felt like I had to vomit”		.36			.45
SDQ-P-9 "I made goal-directed movements that I did not control myself (*e.g.* trying to grab something)”		.59			
SDQ-P-10 "I did not physically manage to eat and drink, although food and drinks were available and not forbidden”		.74			.53
SDQ-P-11 "I completely lost my appetite and thirst while I was hungry or thirsty before"		.74			.56
PDEQ-1 “I had moments of losing track of what was going on. I "blanked out" or "spaced out" or in some way felt that I was not part of what was going on”		.25	.61		
PDEQ-2 “I found that I was on "automatic pilot". I ended up doing things that I later realized I hadn't actively decided to do”		.39	.45		
PDEQ-3 “My sense of time changed. Things seemed to be happening in slow motion”	.21	.31	.40	-.15	

PDEQ-4 “What was happening seemed unreal to me, like I was in a dream, or watching a movie or play”	.13	.17	.64		
PDEQ-5 “I felt as though I were a spectator watching what was happening to me, as if I were floating above the scene or observing it as an outsider”	.14	.24	.61		-.12
PDEQ-6 "There were moments when my sense of body seemed distorted or changed. I felt disconnected from my own body, or it was unusually large or small"	.28	.45	.23		
PDEQ-7 "I felt as though things that were actually happening to others were happening to me- like I was in danger when I really wasn't"	.33	.34	.27		
PDEQ-8 "I was surprised to find afterwards that a lot of things happened at the time that I was not aware of, especially things I ordinarily would have noticed"		.19	.46		
PDEQ-9 "I felt confused; that is, there were moments when I had difficulty making sense of what was happening"		.16	.57		.19
PDEQ-10 "I felt disoriented; that is, there were moments when I felt uncertain about where I was or what time it was"		.27	.51		
TIS-1 "Rate the degree to which you froze or felt paralysed during your most recent experience"			.18	.82	
TIS-2 "Rate the degree to which you were unable to move even though not restrained"			.11	.90	
TIS-3 "Rate the degree to which your body was trembling/shaking during the event"		.25		.38	.46
TIS-4 "Rate the degree to which you were unable to call out or scream during the event"		.18	.13	.52	.17

TIS-5 “Rate the degree to which you felt numb or no pain during the event”		.32			.21
TIS-6 “Rate the extent to which you felt cold during the event”		.26	.27		.33
TIS-7 "Rate the extent to which you felt feelings of fear/panic during the event"			.20	.41	.55
TIS-8 "Rate the extent to which you feared for your life or felt as though you were going to die"				.50	.66
TIS-9 "Rate the extent to which you felt detached from yourself during the event"		.42	.31	.26	
TIS-10 “Rate the extent to which you felt detached from what was going on around you”		.36	.48	.16	-.18
PDI-1 "I felt helpless"	.17		.33		.43
PDI-2 "I felt sadness and grief"	.34		.18		.45
PDI-3 "I felt frustrated or angry"	.51				.38
PDI-4 "I felt afraid for my own safety"				.37	.58
PDI-5 "I felt guilty"	.44	.19			.21
PDI-6 "I felt ashamed of my emotional reactions"	.50	.26			
PDI-7 "I felt worried about the safety of others"					.48
PDI-8 "I had the feeling I was about to lose control of my emotions"	.35		.16	.19	.18
PDI-9 "I had difficulty controlling my bowel and bladder"	.39	.33			
PDI-10 "I was horrified by what I saw"			.20		.30
PDI-11 "I had physical reactions like sweating, shaking, and my heart pounding"		.22	.20		.41
PDI-12 “I felt I might pass out”		.27	.18	.29	.31

PDI-13 "I thought I might die"	.14			.41	.61
DDPS-1 "I couldn't really take it all in"	-.17		.83		.09
DDPS-2 "I did not fully understand what was going on"	-.19		.94		
DDPS-3 "It was just like a stream of unconnected impressions following each other"			.80		.14
DDPS-4 "I could not think clearly"			.87		
DDPS-5 "I was overwhelmed by sensations and couldn't put everything together"		-.09	.88		
DDPS-6 "I was confused and could not fully make sense of what was happening"			.88	.11	
DDPS-7 "My mind was fully occupied with what I saw, heard, smelled and felt"	.21		.45		.27
DDPS-8 "My mind was full of impressions and my reactions to them"			.48		.28

Note. Only statistically significant ($p < .001$) factor loadings are reported. MDQ = Mental Defeat Questionnaire; SDQ-P = Somatic Dissociation Questionnaire – Peritraumatic; PDEQ = Peritraumatic Dissociative Experiences Questionnaire; TIS = Tonic Immobility Scale; PDI = Peritraumatic Distress Inventory; DDPS = Data-Driven Processing Scale.

Table 2.7 *Standardised Factor Loadings for the Five-Factor ESEM Solution*

	Mental defeat (F1)	Somatoform dissociation (F2)	Cognitive overload (F3)	Immobility (F4)	Distress (F5)
MDQ-1 "I lost any will-power"	.51				
MDQ-2 "I didn't care what happened to me anymore"	.62				
MDQ-3 "I felt completely defeated"	.72				
MDQ-4 "I no longer felt like a human being"	.59				
MDQ-5 "In my mind, I gave up"	.77				
MDQ-6 "I felt destroyed as a person"	.63				
MDQ-7 "I wanted to die"	.73				
MDQ-8 "I lost any inner resistance"	.59				
MDQ-9 "I felt like an object"	.68				
MDQ-10 "I felt completely at the mercy of other people or the situation"	.61				
MDQ-11 "I felt completely humiliated and lost any sense of inner dignity"	.73				
SDQ-P-1 "It felt as if my body, or parts of it, was paralysed"		.26		.71	
SDQ-P-2 "My visual field was smaller than usual (it felt as if I was looking through a tunnel or could just see a section of an area)"		.59			

SDQ-P-3 "It felt as if my body, or parts of it, disappeared"	.64			
SDQ-P-4 "I felt temporarily paralysed or stiff"	.33		.68	
SDQ-P-5 "It felt as if my body, or parts of it, were numb"	.61			
SDQ-P-6 "My sense of taste diminished or was absent"	.57			
SDQ-P-7 "I crouched and automatically did not move, it was involuntary and not because I was physically restrained"	.35			
SDQ-P-8 “I felt like I had to vomit”	.37			.46
SDQ-P-9 "I made goal-directed movements that I did not control myself (*e.g.* trying to grab something)”	.62			
SDQ-P-10 "I did not physically manage to eat and drink, although food and drinks were available and not forbidden”	.73			.52
SDQ-P-11 "I completely lost my appetite and thirst while I was hungry or thirsty before"	.75			.56
PDEQ-1 “I had moments of losing track of what was going on. I "blanked out" or "spaced out" or in some way felt that I was not part of what was going on”	.25	.61		
PDEQ-2 “I found that I was on "automatic pilot". I ended up doing things that I later realized I hadn't actively decided to do”	.41	.44		
PDEQ-3 “My sense of time changed. Things seemed to be happening in slow motion”	.31	.41		

PDEQ-4 “What was happening seemed unreal to me, like I was in a dream, or watching a movie or play”			.67		
PDEQ-5 “I felt as though I were a spectator watching what was happening to me, as if I were floating above the scene or observing it as an outsider”			.63		
PDEQ-6 "There were moments when my sense of body seemed distorted or changed. I felt disconnected from my own body, or it was unusually large or small"		.45	.23		
PDEQ-7 "I felt as though things that were actually happening to others were happening to me- like I was in danger when I really wasn't"	.32	.37	.26		
PDEQ-8 "I was surprised to find afterwards that a lot of things happened at the time that I was not aware of, especially things I ordinarily would have noticed"			.45		
PDEQ-9 "I felt confused; that is, there were moments when I had difficulty making sense of what was happening"			.57		.19
PDEQ-10 "I felt disoriented; that is, there were moments when I felt uncertain about where I was or what time it was"		.29	.51		
TIS-1 "Rate the degree to which you froze or felt paralysed during your most recent experience"				.81	
TIS-2 "Rate the degree to which you were unable to move even though not restrained"				.87	
TIS-3 "Rate the degree to which your body was trembling/shaking during the event"		.23		.44	.45
TIS-4 "Rate the degree to which you were unable to call out or scream during the event"				.55	

TIS-5 “Rate the degree to which you felt numb or no pain during the event”		.32			
TIS-6 “Rate the extent to which you felt cold during the event”			.29		.29
TIS-7 "Rate the extent to which you felt feelings of fear/panic during the event"				.46	.53
TIS-8 "Rate the extent to which you feared for your life or felt as though you were going to die"				.55	.66
TIS-9 "Rate the extent to which you felt detached from yourself during the event"		.42	.31	.28	
TIS-10 “Rate the extent to which you felt detached from what was going on around you”		.33	.49		
PDI-1 "I felt helpless"			.37		.40
PDI-2 "I felt sadness and grief"					.46
PDI-3 "I felt frustrated or angry"	.45				.41
PDI-4 "I felt afraid for my own safety"				.39	.58
PDI-5 "I felt guilty"	.40				
PDI-6 "I felt ashamed of my emotional reactions"	.47				
PDI-7 "I felt worried about the safety of others"					.51
PDI-8 "I had the feeling I was about to lose control of my emotions"	.36				.21
PDI-9 "I had difficulty controlling my bowel and bladder"	.38	.37			
PDI-10 "I was horrified by what I saw"					.30
PDI-11 "I had physical reactions like sweating, shaking, and my heart pounding"		.24		.26	.43
PDI-12 “I felt I might pass out”		.30		.29	.34

PDI-13 "I thought I might die"		.44	.62
DDPS-1 "I couldn't really take it all in"	.83		
DDPS-2 "I did not fully understand what was going on"	.94		
DDPS-3 "It was just like a stream of unconnected impressions following each other"	.81		
DDPS-4 "I could not think clearly"	.86		
DDPS-5 "I was overwhelmed by sensations and couldn't put everything together"	.87		
DDPS-6 "I was confused and could not fully make sense of what was happening"	.88		
DDPS-7 "My mind was fully occupied with what I saw, heard, smelled and felt"	.44		.30
DDPS-8 "My mind was full of impressions and my reactions to them"	.46		.32

Note. Only statistically significant ($p < .001$) factor loadings are reported. MDQ = Mental Defeat Questionnaire; SDQ-P = Somatic Dissociation Questionnaire – Peritraumatic; PDEQ = Peritraumatic Dissociative Experiences Questionnaire; TIS = Tonic Immobility Scale; PDI = Peritraumatic Distress Inventory; DDPS = Data-Driven Processing Scale

The 11 items from the Mental Defeat Questionnaire loaded strongly and significantly onto the first factor, with weaker loadings for several other items reflecting lack of control or negative emotional reactions. The factor was labelled 'Mental Defeat'.

The strongest loadings on the second factor consisted of items from the Somatoform Peritraumatic Dissociation Questionnaire, and all of the items from this scale loaded significantly. Most of the items from other scales loading strongly onto this factor were concerned with physical reactions, changes in bodily states, or changes in the person's sense of their body. This factor was labelled 'Somatoform Dissociation'.

The strongest loadings on the third factor consisted of items from the Data-Driven Processing Scale, particularly those indicating the person felt cognitively overwhelmed or unable to process what was going on. All eight items from the DDPS loaded significantly onto this factor. There were also notably strong factor loadings for items from other scales reflecting alterations in cognitive state such as detachment, disorientation, and confusion. This factor was labelled 'Cognitive Overload'.

Seven out of ten items from the Tonic Immobility Scale loaded significantly on the fourth factor, with the strongest loading items reflecting an inability to move or respond in other ways. Items from other scales loading on this factor similarly reflected the freezing and tonic immobility responses as well as emotional states, predominantly fear for one's own safety and survival. The factor was labelled 'Immobility'.

Finally, ten out of 13 items from the Peritraumatic Distress Inventory loaded significantly onto the fifth factor. Items reflecting fear for one's own safety and

survival that loaded highly on the fourth factor also loaded highly on this factor. What distinguished this factor were items from the PDI and other scales reflecting other emotional reactions, such as horror, sadness, and fear for others. This factor was labelled ‘Distress’.

The correlations between the peritraumatic factors from the EFA are reported in Table 2.8. The five factors were largely independent of one another with correlations ranging from .06 to .49.

Table 2.8 *Correlations Between the Five Peritraumatic Factors Extracted from the EFA Model*

	1	2	3	4	5
1. Mental Defeat	-				
2. Somatoform Dissociation	.30*	-			
3. Cognitive Overload	.49*	.40*	-		
4. Immobility	.40*	.33*	.42*	-	
5. Distress	.28*	.06	.26*	.21	-

Note. *$p < .05$

2.3.5 Prediction of PTSD

Table 2.9 reports the bivariate associations between the five peritraumatic factors from the ESEM model and the higher-order PTSD factor. Each peritraumatic experience factor was positively and significantly correlated with PTSD, and the *r* values ranged in strength from .38 (Immobility) to .63 (Mental Defeat). The standardised regression coefficients for the effect of the five peritraumatic experience factors on PTSD are presented in Table 2.10. The five factors explained 57.8% of variance in PTSD ($p < .001$), and all factors with the exception of Immobility significantly predicted PTSD. The strongest effect was for Mental Defeat ($\beta = .36$, $p < .001$).

Table 2.9 *Bivariate Correlations Between Each ESEM Peritraumatic Experience Factor and PTSD and the Four PTSD Symptom Clusters*

	1	2	3	4	5	6	7	8	9	10
1. Mental Defeat	-									
2. Somatoform Dissociation	.36***	-								
3. Cognitive Overload	.48***	.43***	-							
4. Immobility	.38***	.28***	.42***	-						
5. Distress	.32***	.09	.27***	.17**	-					
6. PTSD	.63***	.50***	.54***	.38***	.44***	-				
7. Intrusion	.53***	.58***	.52***	.59***	-.04	--	-			
8. Avoidance	.41***	.46***	.37***	.37***	.06	--	.73***	-		
9. Negative alterations in cognition and mood	.63***	.52***	.48***	.40***	-.02	--	.78***	.70***	-	
10. Alterations in arousal and reactivity	.56***	.52***	.46***	.44***	-.05	--	.83***	.68***	.90***	-

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 2.10 *Standardised Regression Coefficients of the Effects of Each Peritraumatic Experience Factor on PTSD and its Components Derived from the ESEM Analyses*

	PTSD	Intrusions	Avoidance	NACM	Arousal
Mental Defeat	.36***	.22**	.19*	.43***	.34***
Somatoform Dissociation	.26***	.30***	.27**	.27***	.29***
Cognitive Overload	.17*	.16*	.10	.16*	.14*
Immobility	.06	.31***	.14*	.04	.11
Distress	.24***	.08	-.01	.10*	.11*

Note. NACM = Negative alterations in cognition and mood.
* $p < .05$, ** $p < .01$, ***, $p < .001$.

In the planned post-hoc analysis, the five-factor ESEM model was re-estimated with the higher-order PTSD variable removed from the model in order to estimate the effects for each peritraumatic experience factor on the four PTSD symptom clusters. This model fitted the data well (χ^2 (3052) = 4044.67, $p < .001$; CFI = .96; TLI = .96; RMSEA (90% CI) = .03 (.03, .04); SRMR = .06), and explained a significant (*p*s < .001) amount of variance in each PTSD symptom cluster: Intrusions (55.6%), Avoidance (29.1%), Negative Alterations in Cognition and Mood (50.0%), and Alterations in Arousal and Reactivity (45.9%). The bivariate associations between the peritraumatic experience factors and the four PTSD symptoms clusters are reported in Table 2.9.

The standardised regression coefficients are presented in Table 2.10. Mental Defeat and Somatoform Dissociation significantly predicted all four PTSD symptom clusters. Cognitive Overload significantly predicted all PTSD symptom clusters except Avoidance, while Immobility significantly predicted Intrusion and Avoidance. Distress significantly predicted Negative Alterations in Cognition and Mood and Alterations in Arousal and Reactivity.

2.4 Discussion

This is the first study to assess the overall structure of common peritraumatic reactions and their association with PTSD in a large sample of individuals exposed to the same trauma. Five distinct factors emerged that overlap with but are partly independent of existing scales: Mental Defeat, Somatoform Dissociation, Cognitive Overload, Immobility, and Distress.

Two aspects of these results are particularly noteworthy. The first is the identification of the Cognitive Overload factor that although strongly related to existing well-recognised constructs does not correspond exactly to any one of them. This factor is primarily constituted from items measuring psychic dissociation on the Peritraumatic Dissociative Experiences Questionnaire and items from the Data-Driven Processing Scale. The overriding theme of the items from these two separate scales was a sense of disorientation and confusion, combined with an inability to apprehend and cognitively process events in the normal way. Whereas data-driven processing is a theoretical construct designed to account for how traumatic events may lead to PTSD, cognitive overload is a description of people's experience.

The second aspect concerns the experience of extreme fear. Fear of dying or perceived threat to life is a well-established risk factor for PTSD (Ozer et al., 2003). Our data suggested that it can occur separately in the context of physiological reactions such as freezing and immobility and, along with other negative emotions such as sadness, horror, and concern for others, in the context of general emotional distress.

Our results are consistent with other studies that found a multi-factorial structure to individual peritraumatic measures. For example studies reported a two-

factor solution for the PDEQ contrasting “altered awareness” and “derealisation” (Brooks et al., 2009; Carvalho, Cunha, Pinto-Gouveia, & da Motta, 2018; Sijbrandij et al., 2012). The effect of our expanded item pool was to suggest that PDEQ items tended to load either on a factor indicating disrupted information-processing or on a factor indicating alterations to the sense of the body. Our analyses also provide support for the three-factor structure of tonic immobility, where physical immobility, fear, and dissociation factors have been distinguished (Abrams, Carleton, Taylor, & Asmundson, 2009; Fusé, Forsyth, Marx, Gallup, & Weaver, 2007; Hagenaars, 2016). In our ESEM analysis some TIS items loaded on the Immobility factor, other items reflecting fear loaded on both the Immobility and Distress factors, and items reflecting dissociation loaded on the Somatoform Dissociation and Cognitive Overload factors.

Factor analyses of the PDI have generally resulted in inconsistent findings with some studies suggesting a bi-factorial solution (Brunet et al., 2001; Rybojad, Aftyka, & Samardakiewicz, 2018) and others a four-factor solution (Simeon, Greenberg, Knutelska, Schmeidler, & Hollander, 2003). Our ESEM results confirm the likely heterogeneity of the PDI as there were some high loading items on each of the five factors. However, the majority of items were split between the Distress factor and the Mental Defeat factor, the latter reflecting guilt, shame, and loss of control. The life-threat items could be distinguished from the distress items by their loadings on both our Immobility and Distress factors.

In the current sample, Mental Defeat was the factor most highly associated with overall PTSD and its four subscales. This finding confirms the association between mental defeat and PTSD (Wilker et al., 2017) and suggests that, despite

having been developed in the context of interpersonal violence, the construct might be relevant to other types of traumas as well.

Somatoform Dissociation was generally the second most significant predictor of PTSD scores, and the highest predictor for the Avoidance subscale. This highlights the relevance of the construct which is attracting growing interest although it has to date received less attention than psychic aspects of dissociation which here were part of the Cognitive Overload factor. Of note, the PDI item measuring helplessness loaded strongly on the Cognitive Overload factor, echoing a specific association between helplessness and out-of-body-experiences previously noted by Reynolds and Brewin (1999). The Cognitive Overload and Distress factors also uniquely predicted overall PTSD scores confirming the importance of cognitive changes in how information is apprehended and processed during trauma (Brewin, Gregory, Lipton, & Burgess, 2010; Ehlers & Clark, 2000) as well as of the variety of negative emotions involving the self and others that may occur (Vance et al., 2018).

Although Immobility had a significant zero-order association with PTSD, it did not uniquely predict overall PTSD scores once the other factors were controlled. This may have occurred because the items measuring fear of death, panic, *etc*., which are strong predictors of PTSD risk, were shared with the Distress factor. This would suggest that immobility and freezing responses only predict PTSD to the extent that they index fear. Other studies have similarly found that tonic immobility did not uniquely predict PTSD (Hansen, Armour, Wittmann, Elklit, & Shevlin, 2014; Kunst, Winkel, & Bogaerts, 2011). As suggested by Hansen et al. (2014) this might be due to the link between tonic immobility and PTSD being explained by the self-blame and guilt associated with not fighting back, variables not measured in the current study, or due to TI's pathogenic potential being context-dependent on the

type of trauma (Hansen and Elklit, 2014). Anecdotally, many participants in our study reported uncertainty over whether their immobility reaction was "psychological" or caused by the earthquake tremors physically hindering their movements. This could have made the measurement of freezing and immobility less accurate in the current sample.

Immobility did, however, uniquely predict Intrusion and Avoidance. Previous research has shown that high levels of fear, as captured in the Immobility factor, are associated with more intrusions in PTSD (Reynolds & Brewin, 1999). The role of immobility and freezing in predicting intrusive memories has also been studied in the trauma film paradigm. Increased intrusions are associated with spontaneous reports of immobility while watching (Kuiling, Klaassen, & Hagenaars, 2019) and with reductions in heart rate, a possible indicator of immobility (Chou, La Marca, Steptoe, & Brewin, 2014a; Holmes, Brewin, & Hennessy, 2004).

In contrast, the Distress factor uniquely predicted Negative Alterations in Cognition and Mood and Alterations in Arousal and Reactivity but not Intrusion or Avoidance. This echoes previous findings that PTSD symptoms from these clusters are part of a non-specific dysphoric element to the disorder that is distinct from intrusion and avoidance (Zelazny & Simms, 2015). Although fear loads on the Distress factor, its influence on intrusions may be counteracted by the numerous other emotions such as anger, sadness, and concern for others.

The finding that associations between peritraumatic factors and PTSD scores varied in relation to the PCL-5 subscales is an important one. This suggests that peritraumatic reactions, both overall and in terms of specific reactions, might be particularly important for certain PTSD symptoms (*e.g.* re-experiencing) and less for others (*e.g.* avoidance) and might shed light on possible distinct aetiological

pathways for different PTSD symptom clusters. Besides few exceptions (Adams et al., 2009), these associations have yet received little attention. The association between specific peritraumatic reactions and intrusions will be addressed in depth in Chapters 3 and 5.

The results using the factor scores largely confirmed the findings from the peritraumatic standard measurements. As for the Mental Defeat factor score, the MDQ was also a strong predictor of PTSD, in particular for the NACM sub-scale. The SDQ-P was also a significant predictor of PTSD and all of its subscales and the strongest predictor for the Avoidance subscale, as with the Somatoform Dissociation factor score. Some discrepancies were identified between the Distress factor score and the PDI as, for example, the PDI was the strongest predictor of the PCL-5 Intrusion sub-scale whereas the Distress factor score was not significantly associated with the Intrusion sub-scale. This could be due to the items from the PDI measuring shame, guilt, and loss of control loading more on the Mental Defeat factor than on the Distress factor. Some discrepancies were also identified between the results using the Immobility factor score and the TIS. Overall, while the findings using the peritraumatic factor scores largely support the results using the complete standard measures, they do allow for a clearer interpretation of the results by ensuring that each peritraumatic reaction is composed only of the items that uniquely characterise it.

Another important finding concerns the high level of correlation between the standard peritraumatic measures. These correlations were in the moderate to high range (r = 51-73). Therefore, if one participant scored highly on one peritraumatic measure, it was likely they would have also had experienced an elevated score on all other peritraumatic measures. This supports previous research that found significant

correlations between PDEQ and PDI (Bui et al., 2011) and between PDEQ and TIS (Marx et al., 2008), but expands this finding to several other peritraumatic constructs. This points to the possibility of peritraumatic reactions being underpinned by a latent and stable variable tying all of these constructs together. Personality factors such as neuroticism have indeed been linked to higher rates of peritraumatic reactions, for example dissociation (Jaycox, Marshall, & Orlando, 2003). Another hypothesis is that the high correlations are due to the substantial degree of conceptual overlap shared between the measures themselves rather than because of correlations between the actual reactions. Importantly, correlation coefficients between the peritraumatic factors were lower (r = .06-.49) than the correlation coefficient between the peritraumatic standard measures (r = 51-73) possibly indicating that the factorial conceptualisation of the constructs was able to remove some of the overlap existing between the standard measures.

One of the limitations of the current research lies in the retrospective nature of peritraumatic reports. The existing evidence for the consistency of such reports over time is mixed. In one study (Ouimette, Read, & Brown, 2005), change in consistency of peritraumatic distress depended on the type of trauma experienced, with moderate changes in survivors of physical abuse (28%) but relatively little change in disaster survivors (7%). Another study did however find high fluctuations in reports of emotional and dissociative intensity over a 12-week period in both individuals with chronic and acute PTSD (Zoellner, Sacks, & Foa, 2001). The most recent study by David, Akerib, Gaston, and Brunet (2010) found moderate consistency in reports of peritraumatic distress and dissociation among individuals without PTSD and those who recovered (r ranging from .45 to .80), but poor consistency among individuals with PTSD. In practice, detailed accounts of

peritraumatic responding following real-life trauma will always be retrospective, but could be accomplished sooner after the traumatic event and be followed up prospectively.

Other limitations include the use of purposive sampling (as discussed in Massazza, Joffe, and Brewin, 2019). One of the recommended strategies for achieving a random sample in disaster settings is that of using probability household sampling (Kessler, Keane, Ursano, Mokdad, & Zaslavsky, 2008). However, as the vast majority of participants' houses had been destroyed or made inhabitable by the earthquake, most participants were living in temporary, undocumented housing such as containers. These temporary shelters were not officially recorded by the municipality in a land registry therefore making randomisation impossible. The rural and remote setting further complicated the recruitment process. Participants were scattered across 69 different hamlets in the Apennines with roads often made inaccessible by debris and certain areas accessible only by foot.

The reliance on a purposive sampling might have led to a number of possible biases. Anecdotally, people who had been very heavily affected by the earthquake, *e.g.,* had lost all family members, sometimes had left the area and had relocated in a different place. Our current sampling technique might have therefore missed this group of highly exposed individuals.

Another limitation is that we were not able to collect data on individuals who refused to participate. Therefore, we are unable to assess whether any systematic bias in the peritraumatic data was introduced into the study design. For example, people who had experienced reactions for which they felt ashamed (*e.g.,* inability to move resulting in not being able to help others) might have been less likely to participate in the study, therefore skewing the reporting of certain reactions.

Similarly, individuals with higher levels of psychopathology or exposure might have also been less likely to participate.

Nonetheless, at the time of data collection in 2018, 2,484 people lived in the town of Amatrice meaning that approximately 11% of the total population participated in the current study therefore reducing the possibility of systematic bias (Istituto Nazionale di Statistica, 2020). Additionally, the age and gender distribution of the current sample broadly reflects the official demographic structure of Amatrice (Istituto Nazionale di Statistica, 2020). Finally, it is unclear how sampling bias could affect the observed relationships between different peritraumatic responses or their relative ability to predict PTSD.

Also, while the response rate was very high, the current sample size may have resulted in the ESEM model being underpowered given the number of observed indicators. There is no clear rule of thumb concerning sample size requirements for EFA/CFA/SEM (Wolf, Harrington, Clark, & Miller, 2013). A substantial number of differing recommendations exist, including requirements concerning the minimum ratio of sample size to number of variables and minimum sample size in absolute terms (Mundfrom, Shaw, & Ke, 2005). For example, Comrey and Lee (1992) consider a sample size of 50 to be very poor for factor analysis, 100 to be poor, 200 to be fair, 300 to be good, 500 to be very good, and 1,000 to be excellent. The current sample would therefore be considered “good”. However, according to Kline (1994), the ratio of number of participants to number of variables is a better way to determine appropriate sample size. Nonetheless, substantial variability in the recommended ratio impedes clear-cut recommendations. For example, Cattell (1978) suggests a ratio of three to six times the number of participants per number of variables, Everitt (1975) argues for a ratio of at least 10 to 1, and Hair, Anderson,

Tatham and Black (1995) of 20 to 1. Additionally, a number of other parameters, such as the number of factors and the size of the communalities, are further likely to impact whether a sample size is appropriate or not.

Overall, considering the high number of variables in our model, it is possible that our analysis was under-powered, and this could have led to an underestimation of the strength of the association between certain factors and PTSD. Future work should attempt replication in a larger sample.

Additionally, the reliance on quantitative measure means that certain meaningful reactions not included in the standard questionnaires might have been missed out. This limitation will be directly addressed in Chapter 4. Additionally, the conclusions are limited by the possible lack of generalisability to other types of trauma (van der Hart et al., 2008).

Finally, another limitation is that the six different questionnaires often had subtle differences in the way questions were framed. For example, the TIS always asked participants to "Rate the degree…" of one's reaction whereas the PDEQ always framed questions in first person, *e.g.*, "I had moments of losing track of what was going on". Similarly, response scales were also worded differently in certain questionnaires with the DDPS asking participants to report how much each reaction "applied to me" while the PDEQ asked participants to report on how truly that reaction applied to them.

Furthermore, certain questionnaires had a slightly different structure one from another. For example, the SDQ-P asked participants to specify whether they thought they were experiencing that reaction due to a physical cause (*e.g.*, not being able to move because stuck under debris). This was the only questionnaire that asked participants to specify this. Graphical differences in the original versions of the

questionnaires were addressed by formatting all questionnaires using the same font and font size as well as the same colouring in the translated Italian versions (as shown in Appendix 8.4).

These methodological features of the different measures could have had a number of consequences on our EFA. For example, the fact that items from the same scale tended to load together could be partially explained by these methods effects (e.g., item ordering, shared wording, similar response formats). However, this limitation was impossible to avoid given the absence of a dedicated multifactor measure of peritraumatic response. Current findings can aid in the development of such a measure and in addressing the aforementioned limitation.

In the next chapter I will build on the findings from this chapter to address the relationship between peritraumatic reactions and intrusive memories. In particular, by drawing on the psychometrically informed framework for peritraumatic reactions identified in this chapter, I will investigate whether moments of the trauma that are later experienced as intrusive memories are characterised by differing levels of peritraumatic reactions than moments from the same trauma that do not intrude.

3 Chapter 3: Intrusive Memories Following Disaster: Relationship with Peritraumatic Reactions and Phenomenology

A version of this chapter has been submitted to the *Journal of Abnormal Psychology.*

Massazza, A., Joffe, H., & Brewin, C. R. (2020). Intrusive memories following disaster: Relationship with peritraumatic reactions and later affect.

Chapter 2 provided a description for the development of a psychometrically validated framework of peritraumatic reactions based on the six most widely used standard peritraumatic measurements. Building on this new model of peritraumatic reactions, in this chapter I will investigate whether moments of a trauma later experienced as intrusive memories are characterised by different levels of peritraumatic reactions when compared to moments from the same trauma that do not intrude later, both among participants with intrusive memories and among participants without.

3.1 Introduction

As discussed in Chapter 1, intrusive memories are highly sensory-based and emotional involuntary memories triggered by external or internal reminders of a distressing event (Ehlers, Hackmann, & Michael, 2004). They are a hallmark symptom of posttraumatic stress disorder (PTSD). According to prominent cognitive theories of PTSD, intrusive memories are the result of disruptions in information processing produced by various peritraumatic responses that occur during traumatic memory encoding (Ehlers & Clark, 2000; Brewin, Dalgleish, & Joseph, 1996; Brewin, Gregory, Lipton, & Burgess, 2010). These theories also suggest that the

recall of intrusive memories is accompanied by emotions that resemble those experienced during the traumatic event contributing to distress, attempts at suppressing the memory, and to a perception that the event is being re-experienced. In this chapter, I test these theory-driven claims by comparing reported peritraumatic responses during moments that are or are not experienced as intrusive memories as well as the phenomenology of such memories at recall.

3.1.1 Intrusive memories and peritraumatic reactions

As discussed in depth in Chapter 1, according to the revised dual representation theory of PTSD (Brewin et al., 2010), intrusive memories are the result of a disrupted relationship between two types of memory, sensory representations and contextual representations. Similarly, the cognitive model of PTSD (Ehlers & Clark, 2000) hypothesizes that re-experiencing symptoms and the sense of current threat experienced by people with PTSD result from individuals engaging disproportionately in bottom-up sensory and affective information processing, *i.e.* data-driven processing, to the detriment of encoding conceptual information at the time of the trauma. In contrast, the mnemonic model of PTSD (Rubin, Berntsen, & Bohni, 2008) considers that the characteristics of intrusive memories can be more parsimoniously explained in terms of general reconstructive memory processes at the time of recall.

As discussed in depth in Chapter 1 and Chapter 2, the behavioural, cognitive, and affective phenomena taking place during traumatic memory encoding have been collectively termed peritraumatic reactions (Gorman et al., 2016). They include peritraumatic dissociation, both in its psychic (Candel & Merckelbach, 2004) and somatoform presentations (Nijenhuis, van Engen, Kusters, & van der Hart, 2001),

peritraumatic distress (Brunet et al., 2001), tonic immobility (Marx, Forsyth, Gallup, Fusé, & Lexington, 2008), mental defeat (Dunmore, Clark, & Ehlers, 2001), and data-driven processing (Halligan, Clark, & Ehlers, 2002). However, as highlighted in the previous chapter, many existing measures of these concepts demonstrate some conceptual overlap and not all correspond to distinct peritraumatic processes. In our previous chapter, aimed at identifying the factor structure of the most commonly administered peritraumatic scales, I identified five psychometrically distinct factors which were labelled Mental Defeat, Somatoform Dissociation, Cognitive Overload, Immobility, and Distress (Massazza, Joffe, Hyland, & Brewin, under review).

The relationship between intrusive memories and peritraumatic reactions has primarily been investigated using the trauma film paradigm (James, Lau-Zhu, Clark, Visser, Hagenaars, & Holmes, 2016). As discussed in detail in Chapter 1, results from studies using this approach have been mixed (Marks et al., 2018). Some studies found a positive relationship between higher levels of self-reported peritraumatic reactions during exposure to analogue trauma and later intrusive memories (Holmes, Brewin, & Hennessy, 2004; Hall & Berntsen, 2008; Morina, Leibold, & Ehring, 2013; Kuiling, Klaassen, & Hagenaars, 2019).

A few naturalistic studies focused on the ability of peritraumatic responses to predict later PTSD symptom clusters, but in these analyses intrusive memories were not distinguished from other forms of re-experiencing such as nightmares and arousal on reminders (Massazza et al., under review; Simeon, Greenberg, Knutelska, Schmeidler, & Hollander, 2003; van der Velden et al., 2006; but see Evans, Mezey, Ehlers, and Clark, 2007 for an exception). Another limitation in the literature is that studies have generally measured peritraumatic reactions experienced during the *whole* traumatic event, even though intrusive memories generally represent only

fractions of the entire trauma (Holmes, Grey, & Young, 2005; Brewin, 2016). It remains unclear why only certain moments of a trauma are encoded as intrusive memories while other moments from the same trauma are encoded as normal autobiographical memories. The cognitive models of intrusive memory development would suggest that fluctuations in peritraumatic reactions during the same traumatic event might be responsible for the differential encoding of memories determining which moments will later intrude and which will not (Chou, La Marca, Steptoe, & Brewin, 2014a).

3.1.2 Phenomenology of intrusive memories

Cognitive models of intrusive memory development also suggest that the disruptions in memory encoding experienced during the peritraumatic phase are responsible for the highly sensorial and affective nature of intrusive memories. Intrusive memories tend to be characterised by high levels of sensorial, in particular visual (Hiskey, Luckie, Davies, & Brewin, 2008), detail and indeed are more likely to be experienced as images than thoughts (Hackmann, Ehlers, Speckens, & Clark, 2004). For example, in a study among sexual abuse survivors, 97% of participants described how their intrusive recollections contained visual detail, whereas only 26% reported that they included thoughts (Ehlers et al, 2002). These visual representations have been found to resemble either “film clips” or “snapshots” of smaller sections of the traumatic event (Michael, Ehlers, Halligan, & Clark, 2005). For example, Ehlers and Steil (1995) report that in a study among sexual abuse survivors, 51% of participants reported their intrusive memory to resemble a “film clip” and 46% as resembling a “single picture”.

Additionally, concerning the visual structure of intrusive memories, another variable that is attracting growing attention is the vantage point through which the memory is experienced at recall, *i.e.* whether the person experiences the visual memory as if from a first person perspective (egocentric or field vantage point) or from a third person perspective (allocentric or observer vantage point) (Nigro & Neisser, 1983). It has been suggested that recall from an allocentric perspective would be associated with fewer intrusive memories as it would reduce the emotional impact of that memory (Berntsen & Rubin, 2006; McIsaac & Eich, 2002; Mooren, Krans, Näring, & van Minnen, 2018). Indeed, patients with PTSD who experienced intrusive memories from an egocentric perspective reported higher distress than those that experienced them from an allocentric perspective (McIsaac & Eich, 2004). Additionally, asking participants to purposefully take an allocentric point of view while recalling a distressing memory was associated with a reduced physiological reaction at recall (Wisco et al., 2015). However, results are mixed as recalling a traumatic memory from an allocentric perspective has also been found to be associated with higher levels of avoidance and overall PTSD symptoms (Kenny et al. 2009).

In addition to their visual phenomenology, intrusive memories are also posited to be accompanied by strong emotions that were experienced at the time of the trauma (Brewin et al., 1996; Kvavilashvili, 2014) This contributes to the feeling of re-experiencing (Bryant, O'Donnell, Creamer, McFarlane, & Silove, 2011) and to the maintenance of a sense of current threat (Ehlers & Clark, 2000) as well as to attempts at avoiding and suppressing the memory.

As mentioned in Chapter 1, emotions such as fear, helplessness, and horror that are often felt during a traumatic event were described as 'primary emotions' by

Brewin et al. (1996) to distinguish them from emotions such as anger, guilt, and sadness that are more likely to arise from later appraisals when the person reflects on the traumatic events and their causes. To date only one study has tested the prediction that involuntary memories, compared to ordinary autobiographical memories, should be accompanied by different sorts of emotion. Hellawell and Brewin (2004) found, as predicted, that involuntary memories of the trauma were more likely to be accompanied by primary emotions and less likely to be accompanied by secondary emotions. More detailed study of the nature of the specific emotions involved is now required.

3.1.3 Research questions

I therefore investigated whether specific moments of a traumatic event that corresponded to an intrusive memory would be characterised by different levels of peritraumatic reactions when compared to moments from the same trauma experienced as normal autobiographical memories. I also investigated whether intrusive memories at recall would be characterised by different phenomenological characteristics in comparison with normal autobiographical memories such as different levels of emotions, degree of re-experiencing, and visual characteristics.

In response to the concern that retrospective reports of peritraumatic responses could be influenced by current levels of symptoms (Candel & Merckelbach, 2004; Rubin et al., 2008), I adopted two strategies. The first was to compare intrusive and non-intrusive distressing memories of the same severe traumatic event in the same individuals so that symptom levels would be constant. The second was to compare, while controlling for symptom levels, the same intrusive memories with the most distressing memories reported by a separate sample of individuals exposed to the

same event who did not develop intrusive memories. The hypothesises were that moments experienced as intrusive memories would be characterised by higher levels of peritraumatic reactions in comparison with moments that did not later intrude and that, at recall, intrusive memories would be accompanied by an excess of primary relative to secondary emotions.

3.2 Methods

3.2.1 Participants and recruitment

Participants in the current study represented a smaller subset of the 308 participants studied in Chapter 2. As described in section 1.9, these 104 participants were recruited first and the additional 204 participants who took part in the ESEM study in Chapter 2 were recruited in the following weeks. As in Chapter 2, all 104 participants were survivors of the 2016-2017 Central Italy earthquakes. The 104 participants were selected for interview building on a previous study conducted by the authors (Massazza, Joffe, & Brewin, 2019) through the help of the local health services and the local municipality. All participants who had participated in the previous study were re-invited to participate in the current study by receiving an invitation letter prior to the beginning of the study (Italian invitation letter reported in Appendix H). These participants had previously been identified with the support of the local municipality and health services due to the lack of reliable means through which a random sample could be generated at the time in which data collection took place (*e.g.*, lack of reliable land registry which would have permitted household randomization).

New participants were also identified, always through the support of the local health services and the municipality. They were contacted face to face or via mobile

phone, and invited to participate in the study. The support from the local health services and the municipality was essential as they had insider knowledge concerning the presence and whereabouts of individuals living in the rural region who would have not been identifiable otherwise.

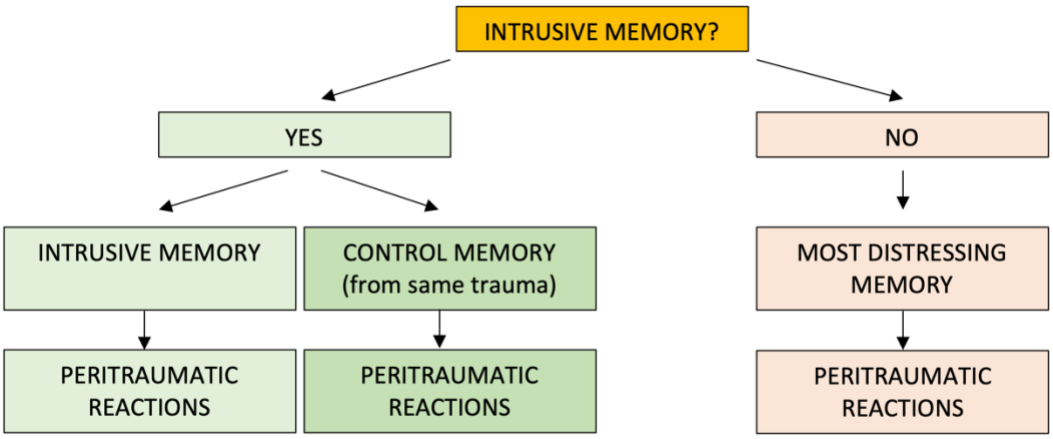
The purposive sampling strategy was aimed at reproducing the approximate demographic distribution of the population of Amatrice as a whole in terms of age and gender as per 2016 census (Istituto Nazionale di Statistica, 2016). The distribution of the sample in terms of gender and age was regularly reviewed as the study was being conducted in order to iteratively inform the recruitment of subsequent participants so to achieve a sample representative of the population.

3.2.2 Study design

A novel design was developed to assess different peritraumatic reactions in moments experienced as intrusive memories versus moments from the same trauma experienced as normal autobiographical memories. Participants were asked to identify an intrusive memory of the earthquake events and then asked to go back in time to the specific moments that were experienced as intrusive and to complete a number of items capturing their peritraumatic reactions during these specific moments. They were then asked to identify a control memory, *i.e.* a memory from the earthquake events that was just as distressing but that never intruded. They then completed the same peritraumatic items but in relation to these other specific moments. If a participant never experienced an intrusive memory, they were asked to identify the most distressing memory of the earthquake and to complete the peritraumatic items in relation to these moments. Additionally, a number of

phenomenological questions were asked in relation to the content and structure of each type of memory. The overall design is represented visually in Figure 3.1 below.

Figure 3.1 *Schematic Representation of Study Design*



3.2.3 Measures

A selection of conceptually representative items taken from standard peritraumatic questionnaires was administered in respect of each identified memory, consisting of five items from the Mental Defeat Questionnaire (MDQ) (Dunmore et al., 2001), three items from the Somatoform Peritraumatic Dissociation Questionnaire (SDQ-P) (Nijenhuis et al., 2001), eight items from the Peritraumatic Dissociative Experiences Questionnaire (PDEQ) (Marmar, Weiss and Metzler, 1997), six items from the Tonic Immobility Scale (TIS) (Forsyth, Marx, Fusé, Heidt & Gallup, 2000), seven items from the Peritraumatic Distress Inventory (PDI) (Brunet et al. 2001), and four items from the Data-Driven Processing Scale (DDPS) (Halligan et al., 2002) for a total of 33 peritraumatic questions. Details of the scales and of translation procedures are reported in the previous chapter. The shortened peritraumatic questionnaire can be found in Appendix C (section 8.3.7). As the selection of items to be included in the shortened questionnaire took place before data collection and before results from the EFA could inform it, they were selected based on how closely they characterized the theoretical construct they were supposed to capture.

Based on our previous analysis of the structure of these scales as applied to the whole trauma presented in Chapter 2, the three highest-loading of the available items were selected to capture each of the five peritraumatic factors, *i.e.* Mental Defeat, Somatoform Dissociation, Cognitive Overload, Immobility, and Distress. These items, their factor loadings from the original exploratory factor analysis, and the coefficient alphas corresponding to each abbreviated 3-item scale in the current sample, are given in Table 3.1. Peritraumatic factor sub-scores were calculated by summing together the scores from each of the three items and then standardising the

results. I decided to standardise the sum scores rather than each item as, with the sole exception of the TIS-3 item in the Distress factor, all items belonging to the same factor were rated on similar Likert scales, *i.e.*, Mental Defeat on a 5-point Likert scale, Somatoform Dissociation on a 5-point Likert scale, Cognitive Overload on a 5-point Likert scale, and Immobility on a 7-point Likert scale. As the main purpose of the standardization was to have measures that could be validly compared across different memory types, it was therefore sufficient to apply it to the summed scores.

Table 3.1 *Internal Reliability of Items Measuring the Five Peritraumatic Factors (Factor Loadings in Brackets)*

Peritraumatic factor	**Items from standard measures**	**Cronbach alpha range for the three memory types**
Mental Defeat	MDQ-5 "In my mind, I gave up" (.76) MDQ-7 "I wanted to die" (.74) MDQ-3 "I felt completely defeated" (.74)	α = .30 - .52
Somatoform Dissociation	SDQ-P-3 "It felt as is my body, or parts of it, disappeared" (.62) SDQ-P-2 "My visual field was smaller than usual (it felt as if I was looking through a tunnel or could just see a section of an area" (.59) PDEQ-6 "There were moments when my sense of body seemed distorted or changed. I felt disconnected from my own body, or it was unusually large or small" (.45)	α = .51 - .64
Cognitive Overload	DDPS-5 "I was overwhelmed by sensations and couldn't put everything together" (.88) DDPS-1 "I couldn't really take it all in" (.83) DDPS-3 "It was just like a stream of unconnected impressions following each other" (.80)	α = .70 - .81
Immobility	TIS-2 "Rate the degree to which you were unable to move even though not restrained" (.90) TIS-1 "Rate the degree to which you froze or felt paralysed during your most recent experience" (.82) TIS-4 "Rate the degree to which you were unable to call out or scream during the event" (.52)	α = .62 - .85
Distress	PDI-13 "I thought I might die" (.61) PDI-7 "I felt worried about the safety of others" (.48) TIS-3 "Rate the degree to which your body was trembling/shaking during the event" (.46)	α = .29 - .49

Note. Factor loadings are from previous Chapter 2 EFA loadings (Massazza, Joffe, Hyland, & Brewin, under review).

Additionally, participants were asked a number of questions relating to the phenomenological characteristics of their memories. Participants were asked to report whether they experienced their memory as an image, an emotion, a thought, or as a physical sensation. Participants could select more than one option and were also given the opportunity to specify if they had experienced the memory in a different modality. If a participant reported experiencing the memory as an image, they were also asked to specify whether they experienced the memory as "*a series of unconnected images*", "*a brief film*", as "*a single image*" or to specify if they experienced the memory in another visual modality. Additionally, participants were asked to report whether they experienced the memory "*as if you were seeing the scene with your eyes, as you see the world normally*" or "*as if you were seeing the scene from the outside, for example as if from the perspective of a third person or from a high viewpoint*" to capture the memory vantage point. Participants were also asked to indicate whether the content of their memory had changed over time.

Participants were then asked to report how vividly they experienced the memory, how much they felt like they were re-living the experience once more in the present when they experienced the memory, how distressing they found the memory, and how accurately the memory captured what had actually happened in reality (*i.e.* fidelity) on a scale from 0 "*not at all*" to 10 "*extremely"*. Participants also rated how predominant each of the five senses was in the memory from 0 "*not predominant at all*" to 10 "*very predominant*". In order to diminish the number of tests in the analysis a composite sensory score was calculated by summing together the scores on each of the five senses. Participants were also asked to rate how much they experienced ten negative emotions during recall of the different types of

memory on a scale from 0 ("*not at all*") to 10 ("*extremely*"). The 10 emotions were: anxiety, anger, sadness, guilt, shame, helplessness, numbness, fear, horror, and disgust. Finally, participants were asked if the felt that the content and/or structure of their memory had changed through time and, if yes, how. The complete questionnaire is reported in Appendix C (8.3.7).

Participants also completed the PTSD Checklist for DSM-5 (PCL-5), a 20-item questionnaire investigating how much the individual was bothered by symptoms in the last month from 0 "*not at all*" to 4 "*extremely"*. The PCL-5 has been shown to have high total internal reliability (α = .90) and acceptable to good internal reliability for its subscales (α range = .57 – .78) (Sveen, Bondjers, & Willebrand, 2016). Internal reliability in the current study was high with Cronbach's α = .91.

As in Chapter 2, participants also completed a number of questions aimed at quantifying their trauma exposure. Participants reported on whether they had remained stuck under debris (*Yes/No*), whether they had witnessed gruesome scenes such as corpses or body parts (*Yes/No*), whether they had heard the voices of people from under the debris (*Yes/No*), whether they had witnessed someone dying (*Yes/No*), and whether they had to receive urgent medical attention (*e.g.*, brought to emergency medical centre or to hospital by helicopter) as a result of a wound (*Yes/No*).

Finally, participants completed a series of demographic questions on gender, age, and education level.

3.2.4 Procedure

To investigate the presence of intrusive memories of the earthquake I began by reading out to the participant a description of what an intrusive memory is (adapted from Hackmann, Ehlers, Clark, and Speckens, 2004, and Evans et al., 2007) and asking whether they had persistently experienced this type of memory in the months following the earthquakes. A complete script of the interview procedure can be found in Appendix F.

The standard prompt was the following: "*People who have gone through a distressing event can remember the event in different ways. Some people have memories of part of the earthquake that pop into their mind when they do not want them to. These are usually from particular moments from before, during or after the event that somehow "got stuck" in memory and keep coming back. These memories consist of part of what actually happened at the time and we will call them intrusive memories. Do you sometimes get or have got in the past such unwanted recollections of the earthquake?".* If they reported having experienced more than one intrusive memory, they were asked to select the one they found most distressing and to state if they were still experiencing the intrusion at the time when the interview was conducted. They then completed the questions concerning the phenomenological characteristics of the memory. Following identification and description of the memory they were asked to complete the 33-items peritraumatic questionnaire and asked to answer each item only in relation to the *specific moments* corresponding to that intrusive memory rather than for the trauma as a whole.

Participants with intrusions were then asked to identify another memory of the earthquakes that was just as distressing as the intrusive memory they had previously identified but that had never spontaneously intruded. The standardised prompt was the following: "*I would now like you to identity another memory*

concerning the earthquake events that is just as distressing as the unwanted recollection you have just described but that never spontaneously popped into your mind without you wanting it. This should be a memory that you sometimes might consciously and voluntarily think about. It's important that you try and identify a memory that is just as distressing and upsetting as the unwanted recollections you have just described but that does not pop into your mind involuntarily". Following the completion of the phenomenological questions in relation to this control memory, participants then completed the same 33 peritraumatic items in relation to the specific moments corresponding to this non-intrusive control memory. Participants that had never experienced intrusive memories were asked to identify the most distressing memory they had of the earthquake events, respond to the phenomenological questions in relation to this memory, and to complete the peritraumatic items in relation to these specific moments.

3.2.5 Data analysis

Descriptive statistics were calculated across the entire sample. I investigated differences in PTSD symptoms, age, gender, education, and trauma exposure between participants with and without intrusions using independent samples t-tests and chi-squared tests of independence. Next, I ensured that all events took place during the peritraumatic timeframe, *i.e.* either during the earthquakes or during key distressing events such as corpse recognition in the days immediately after the earthquake shock. Events that did not take place during this peritraumatic timeframe (*e.g.*, distressing events during life in the tents), corresponding to 11 non-intrusive control memories from the within-subjects analysis and 1 control memory from the between-subjects analysis, were removed. One participant with intrusive memories

reported they could not identify a control memory and was also removed from the analysis. All trauma memories were however retained for the analyses investigating differences in phenomenological characteristics of the memories, as this prediction did not depend on the specific timeframe of events.

In order to test for differences in peritraumatic reactions across memory types I conducted three different MANOVAs. In the first repeated-measures MANOVA moments experienced as intrusive memories were compared with non-intrusive moments among the same participants. Two between-subjects MANCOVAs compared intrusive and control memories (in the group reporting intrusions) with most-distressing memories reported by those who did not experience intrusions, controlling for level of PTSD and age. Individual one-way ANOVAs and ANCOVAs were then conducted for each peritraumatic reaction.

In order to test for phenomenological differences between memory types I used chi-square tests of independence or McNemar's test if the variable was categorical and t-tests or ANCOVAs if the variable was continuous. When participants reported experiencing the memory in a modality that was not covered in the standard options, I summarise the results narratively. Finally, in order to test for differences in emotions experienced at recall between intrusive memories and non-intrusive control memories among the same participants I conducted paired-sample t tests. I used ANCOVAs to compare intrusive and control memories (in the group reporting intrusions) with the most distressing moments reported by those who did not experience intrusions, controlling for levels of PTSD and age.

Presence of outliers was assessed through visual examination of box plots and none were identified. Due to the skewed distributions of the PCL scores, the value was square root transformed and achieved normal distribution.

The composite peritraumatic factor scores were also explored to assess univariate normality. Problematic deviations were defined as variables that displayed skewness greater than ± 2 and kurtosis greater than ± 2 (Byrne, 2010; George & Mallery, 2010; Hair et al., 2010, Kline, 2011). Q-Q plots and box plots were also inspected. Most of the 15 factor scores displayed a distribution that approximated normality. Two exceptions were the composite score for somatoform dissociation and tonic immobility during the worst moments of the trauma. These scores had a positive skew as a number of participants denied experiencing any of these reactions. Parametric analyses were nevertheless applied as the skew was theoretically predictable and owing to the need to control for age and PCL-5 score. A third variable that deviated from normality with the same positive skew was the composite score for the somatoform dissociation factor during the control moments. Once again parametric analysis was applied owing to the limited spread of scores and the theoretically predictable distribution.

Similarly, for the 30 variables that assessed affect at recall, the vast majority had a distribution that lay within the acceptable limits for skewness and kurtosis (± 2). Q-Q plots and box plots were also inspected. Ratings for shame across the three memory types displayed a positive skew due to the fact that most participants reported a score of 0. In contrast, ratings for sadness for intrusive memories and for most distressing memories displayed a negative skew due to the large number of participants that endorsed experiencing these reactions at recall. Parametric analyses are nevertheless reported as group differences for all these variables were negligible. Ratings for helplessness for intrusive memories also displayed a negative skew. Parametric analyses are reported for consistency, although they may underestimate the size of any group difference owing to ceiling effects.

3.3 Results

3.3.1 Demographic details

Forty-five percent of the sample were men (mean age = 44.23, range = 19-72) and 55% were women (mean age = 43.04, range = 18-74). Seventy-four percent of the sample identified as Catholic with the remaining 26% identifying with other religious or spiritual groups. Fifty-one percent had completed secondary school, 26% had completed middle school, 21% held a university degree, and 2% had completed only primary school. In terms of trauma exposure, 4% of participants (n = 4) reported having been stuck under debris, 54% (n = 56) reported having witnessed gruesome scenes, 55% (n = 57) reported having heard the voices of people from under the debris, 17% (n = 18) reported having witnessed the death of someone, and 16% (n = 17) reported having been wounded to the point of requiring urgent medical attention.

The mean PCL-5 score was 20.98 (SD = 15.03). Fifty-one participants (49%) reported having experienced intrusive memories following the earthquakes. Of these participants, 44 (86%) were still experiencing these intrusive memories at the time the interview was conducted. Participants with intrusions reported significantly higher PCL-5 scores (M = 28.01, SD = 16.09) in comparison with participants without intrusions (M = 14.21, SD = 10.17), $t(102) = -5.25$, $p < .001$, $d = 1.02$. Participants with intrusions were younger (M = 37.94, SD = 16.09) than those without intrusions (M = 49.00, SD = 15.23), $t(102) = 3.60$, $p < .001$, $d = 0.69$. The presence of intrusive memories was independent of gender ($\chi^2(1) = .04$, $p = .829$, $\varphi = .03$) and of education level ($\chi^2(2) = 1.19$, $p = .550$, Cramer's V = .12).

The findings were inconsistent concerning differences in traumatic exposure between the two groups. Participants with intrusions were more likely to report having been stuck under debris (7.8% of participants with intrusions) than participants without intrusions (0%) ($\chi^2(1) = 4.32$, $p = .038$, $\varphi = .204$). However, the results are difficult to interpret due to the very small number of participants who reported being stuck under debris, *i.e.,* 4 participants. Participants with intrusions were also more likely to report having been wounded to the point of needing urgent medical attention (27.5%) than participants without intrusions (5.7%) ($\chi^2(1) = 9.02$, $p = .003$, $\varphi = .295$). However, no significant differences between participants with intrusions and participants without intrusions were found in their degree of exposure to gruesome scenes ($\chi^2(1) = 0.36$, $p = .545$, $\varphi = .059$), to hearing the voices of people from under debris ($\chi^2(1) = 1.44$, $p = .230$, $\varphi = .118$), and to witnessing the death of others ($\chi^2(1) = 2.70$, $p = .100$, $\varphi = .161$). As a result of the lack of consistent findings concerning traumatic exposure and intrusion presence, as well as the inevitably imprecise measure available, trauma exposure was not further included in the analyses as a covariate.

The contents of the described memory according to memory type are presented below in Table 3.2.

Table 3.2 *Content of Memory According to Memory Type with Percentage of Times Mentioned in Brackets*

Intrusive memory (*n* = 50)	Control memories (*n* = 39)	Most distressing memory (*n* = 52)
Earthquake shock 24th of August (32%)	Collapsing buildings (13%)	Earthquake shock 24th of August (33%)
Seeing corpses in the debris (18%)	Earthquake shock 30th of October (13%)	Collapsing buildings (17%)
Collapsing buildings (16%)	State funerals (13%)	Seeing corpses in the debris (15%)
Rescue of individuals out from debris (16%)	Rescue of individuals out from debris (10%)	Rescue of individuals out from debris (13%)
Witnessing people in distress, suffering (14%)	Realisation of death of people (10%)	Realisation of death of people (12%)
Getting out of collapsing buildings (12%)	Recognition and management of corpses (10%)	Recognition and management of corpses (10%)
Realisation of death of people (8%)	Earthquake shock 24th of August (8%)	Earthquake shock on the 18th of January (6%)
Finding out/being told of death of people (8%)	Seeing corpses in the debris (8%)	Witnessing people in distress, suffering (4%)
Being stuck under debris (6%)	Witnessing people in distress, suffering (8%)	Finding out/being told of death of people (4%)
Recognition and management of corpses (2%)	Finding out/being told of death of people (5%)	Earthquake shock on the 30th of October (2%)
Earthquake shock on the 30th of October (2%)	Helping people out of dangerous situations (5%)	Getting out of collapsing buildings (2%)
	Earthquake shock on the 18th of January (3%)	Being stuck under debris (2%)
	Getting out of collapsing buildings (3%)	
	Period in hospital for injures suffered (3%)	
	Moment in which participant felt ashamed (3%)	

Note. One memory could contain more than one content theme. Memories that did not correspond to moments belonging to the peritraumatic timeframe were removed from the peritraumatic analyses and are not shown in this table.

3.3.2 Peritraumatic reactions and memory type

For the within-subjects analysis the repeated-measures MANOVA was significant, Wilks' $\Lambda = .54$, $F(5, 34) = 5.69$, $p < .001$, $\eta^2_p = .45$. Separate univariate repeated-measures ANOVAs were then conducted for each peritraumatic factor sub-score and results are shown in Table 3.3. Intrusive memories were characterised by higher levels of peritraumatic somatoform dissociation, cognitive overload, immobility, and distress, but not by more mental defeat.

Table 3.3 *Peritraumatic Reactions During Moments Experienced as Intrusive Memories and Control Memories (Same Participants)*

Peritraumatic factors	Intrusive memories		Non-intrusive control memories				
	M	*SD*	*M*	*SD*	*F*(1, 38)	*p*	Partial η^2
Mental defeat	5.00	3.85	4.10	3.51	2.49	.122	.06
Somatoform dissociation	3.64	3.46	2.07	3.17	6.27*	.017	.14
Cognitive overload	9.64	4.44	7.53	4.12	8.60**	.006	.18
Immobility	6.25	4.81	3.38	3.58	10.92**	.002	.22
Distress	9.10	3.34	6.58	3.46	16.08***	.000	.29

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

The between-subjects MANCOVA between moments corresponding to intrusive memories and moments corresponding to most-distressing non-intrusive memories, controlling for PCL-5 scores and age, was also significant, Wilks' $\Lambda = .70$, $F(5, 95) = 7.78$, $p < .001$, $\eta^2_p = .29$. The individual ANCOVAs are shown below in Table 3.4. Once again intrusive memories were characterised by higher scores on all peritraumatic factors except for mental defeat.

Table 3.4 *Peritraumatic Reactions During Moments Encoded as Intrusive Memories and Control Memories (Different Participants)*

Peritraumatic factors	Intrusive memories		Non-intrusive control memories				
	M	*SD*	*M*	*SD*	*F*(1, 99)	*p*	Partial η^2
Mental defeat	5.35	3.88	2.81	2.78	2.64	.107	.02
Somatoform dissociation	3.35	3.54	0.73	1.95	13.61***	.000	.12
Cognitive overload	9.39	4.45	4.88	4.27	15.28***	.000	.13
Immobility	5.96	4.88	2.10	3.96	16.46***	.000	.14
Distress	9.51	3.64	6.56	3.43	11.78***	.000	.10

Note. Analyses controlled for age and transformed PCL-5 scores.
* $p < .05$, ** $p < .01$, *** $p < .001$

The between-subjects MANCOVA comparing distressing control memories among participants with intrusions and most-distressing memories among participants without intrusions was not significant after controlling for transformed PCL-5 scores and age, Wilk's $\Lambda = .92$, $F(5,83) = 1.40$, $p = .230$, $\eta^2_p = .07$.

3.3.3 Phenomenological characteristic and memory type

I first tested for differences in whether different memory types were experienced as images, emotions, thoughts, or physical sensations. Within-subjects differences in overall phenomenological characteristics between intrusive memories and non-intrusive control memories were tested using the McNemar's test and are reported in Table 3.5. Conversely, between-subjects differences in overall phenomenology between intrusive memories and most distressing memories as well as between non-intrusive control memories and most distressing memories were tested using chi-square tests of independence and results are shown in Table 3.6 and Table 3.7.

Intrusive memories were significantly more likely to be experienced as images and emotions in comparison with both non-intrusive control memories and most-distressing memories and marginally less likely to be experienced as thoughts than non-intrusive control memories. No significant differences were found between control non-intrusive memories among participants with intrusions and most distressing memories among participants without intrusions. Participants were also given the opportunity to specify whether they experienced the memory in a different way. One participant reported experiencing their intrusive memory as a sound and another participant also described experiencing their most distressing memory as a sound.

Table 3.5 *McNemar's Tests of Within-Subjects Differences in Overall Phenomenological Characteristics between Intrusive and Non-Intrusive Control Memories*

	Intrusive memory	Control non-intrusive memory	*p*
Image	92.2%	64.0%	.003
Emotion	80.4%	58.0%	.013
Thought	47.1%	59.2%	.049
Physical sensation	37.3%	32.0%	.804

Table 3.6 *Chi-square Test of Between-Subjects Differences in Overall Phenomenological Characteristics between Intrusive and Most Distressing Memories*

	Intrusive memory	Most distressing memory	χ^2 (1)	*p*
Image	92.2%	75.5%	5.29*	.021
Emotion	80.4%	47.2%	12.37***	.000
Thought	47.1%	54.7%	0.61	.435
Physical sensation	37.3%	20.8%	3.44	.063

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 3.7 *Chi-square Test of Between-Subjects Differences in Overall Phenomenological Characteristics between Non-Intrusive Control Memories and Most Distressing Memories*

	Control non-intrusive memory	Most distressing memory	χ^2 (1)	*p*
Image	64.0%	75.5%	1.60	.205
Emotion	58.0%	47.2%	1.21	.271
Thought	59.2%	54.7%	0.91	.338
Physical sensation	32.0%	20.8%	1.68	.195

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

If a participant reported experiencing their memory as an image, they were asked some follow-up questions concerning the visual characteristics of the memory. Within-subjects differences were tested using the McNemar's test and between-subjects differences using chi-square tests of independence. Results are reported below in Table 3.8, Table 3.9, and Table 3.10. No statistically significant differences were found although more participants reported experiencing intrusive memories as a series of unconnected images and less as a brief film in comparison with the non-intrusive memories. More participants also reported experiencing intrusive memories from an allocentric perspective, but this difference did not reach significance. Participants were also given the opportunity to specify whether they experienced the memories in a different visual modality. One participant reported experiencing their intrusive memory as a series of connected images, two as fragments of a movie, and two as a continuous long movie. Concerning most distressing memories, one participant reported experiencing this as a series of connected images, and two participants as short disconnected movies. Finally, one participant reported experiencing their non-intrusive control memory as a long continuous movie.

Table 3.8 *McNemar's Test of Within-Subjects Differences in Visual Phenomenology between Intrusive and Non-Intrusive Control Memories*

	Intrusive memory	Control non-intrusive memory	*p*
Series of unconnected immages	40.4%	26.0%	.332
Brief film	55.3%	64.7%	.607
Single image	8.5%	5.9%	.625
Egocentric	82.4%	88.0%	.549
Allocentric	27.5%	16.0%	.210

Table 3.9 *Chi-square Test of Between-Subjecst Differences in Visual Phenomenology between Intrusive and Most Distressing Memory*

	Intrusive memory	Most distressing memory	χ^2 (1)	*p*
Series of unconnected images	40.4%	23.1%	2.92	.087
Brief film	55.3%	69.2%	1.74	.187
Single image	8.5%	7.7%	.019	.890
Egocentric	82.4%	83.0%	.008	.928
Allocentric	27.5%	22.6%	.321	.571

Table 3.10 *Chi-square Test of Between-Subjects Differences in Visual Phenomenology between Control Non-Intrusive Memory and Most Distressing Memory*

	Control non-intrusive memory	Most distressing memory	χ^2 (1)	*p*
Series of unconnected images	26.0%	23.1%	0.11	.737
Brief film	64.7%	69.2%	0.16	.681
Single image	5.9%	7.7%	0.09	.760
Egocentric	88.0%	83.0%	0.51	.474
Allocentric	16.0%	22.6%	0.72	.394

I then tested for differences in the phenomenological experience of the memory at recall. Within-subject differences were tested using paired-sample t-tests whereas between-subject differences were tested using individual one-way ANCOVAs controlling for transformed PCL-5 scores and age. Results are reported below in Table 3.11, Table 3.12, and Table 3.13. Intrusive memories were experienced as significantly more distressing and with a more intense sense of reliving in comparison with both control non-intrusive memories and most distressing memories. Additionally, participants reported trying to suppress intrusive memories significantly more than non-intrusive control-memories or most distressing memories. Interestingly, the control non-intrusive memories among participants with intrusions were also experienced with a more marked sense of re-living and underwent more attempts at suppression when compared to the most distressing memories of participants without intrusions.

Table 3.11 *Paired-Sample T-Tests of Differences in Phenomenological Characteristics Between Intrusive and Non-Intrusive Control Memories at Recall*

	Intrusive memory		Control non-intrusive memory			
	M	*SD*	*M*	*SD*	*t* (49)	*p*
Distress	8.42	1.78	6.56	3.48	4.11***	.000
Re-experiencing	8.02	1.86	6.84	2.75	2.90**	.005
Fidelity	8.68	2.08	8.18	2.15	1.22	.225
Suppressing	5.76	3.42	4.82	3.58	2.07*	.043
Vividness	8.50	1.69	8.00	2.01	1.57	.121
Sensory	28.98	10.55	25.78	9.60	1.94	.057

Note. The variable "sensory" was calculated by aggregating values on all five sensory items (*i.e.* sight, smell, hearing, taste, and touch).
* $p < .05$, ** $p < .01$, *** $p < .001$

Table 3.12 *One-Way Between-Subjects ANCOVAs Testing for Differences in Phenomenological Characteristics Between Intrusive and Most Distressing Memory at Recall*

	Intrusive memory		Most distressing memory				
	M	*SD*	*M*	*SD*	*F*(103)	*p*	Partial η^2
Distress	8.45	1.78	6.16	3.13	11.19**	.001	.10
Re-experiencing	8.05	1.86	4.26	2.87	39.12***	.000	.28
Fidelity	8.70	2.07	8.88	1.55	0.00	.938	.00
Suppressing	5.70	3.40	2.26	3.53	14.53***	.000	.12
Vividness	8.52	1.68	8.00	1.91	2.56	.112	.02
Sensory	29.00	10.44	25.94	8.59	2.74	.100	.02

Note. Analyses conducted controlling for transformed PCL-5 score and age.
The variable "sensory" was calculated by aggregating values on all five sensory items (*i.e.* sight, smell, hearing, taste, and touch).
* $p < .05$, ** $p < .01$, *** $p < .001$

Table 3.13 *One-Way Between-Subjects ANCOVAs Testing for Differences in Phenomenological Characteristics Between Non-Intrusive Control Memory and Most Distressing Memory at Recall*

	Non-intrusive control memory		Most distressing memory				
	M	*SD*	*M*	*SD*	*F(102)*	*p*	Partial η^2
Distress	6.56	3.48	6.16	3.13	0.01	.891	.00
Re-experiencing	6.84	2.75	4.26	2.87	13.24***	.000	.11
Fidelity	8.18	2.15	8.88	1.55	1.29	.258	.01
Suppressing	4.82	3.58	2.26	3.53	7.55**	.007	.07
Vividness	8.00	2.01	8.00	1.91	0.18	.671	.00
Sensory	25.78	9.60	25.94	8.59	0.00	.949	.00

Note. Analyses conducted controlling for transformed PCL-5 score and age.
The variable "sensory" was calculated by aggregating values on all five sensory items (*i.e.* sight, smell, hearing, taste, and touch).
* $p < .05$, ** $p < .01$, *** $p < .001$

Finally, participants were asked to report whether they believed their memory had changed through time or not. While the vast majority of participants did not report any changes in the memory through time, more participants reported changes in intrusive memories (17.6%) than in control non-intrusive memories (8.0%) and most distressing memories (11.3%). However, these differences were not statistically significant neither within-subjects ($p = .344$) or between-subjects (χ^2 (1) = .843, p = .359). Participants were asked to specify how their memory had changed through time. In relation to intrusive memories, 4 participants reported that new details were gradually emerging in the memory as time passed, while other 4 reported the opposite trend of the memory losing vividness, sensorial charge, level of detail, or being partially forgotten and becoming "more blurred" (*verbatim*). One participant described how the visual structure of the intrusive memory had changed from a series of unconnected images to a brief movie, while another participant reported having substituted the content of the intrusive memory during psychotherapy with a

less distressing image. Concerning non-intrusive control memories, one participant reported a weakening of the memory whereas 3 participants reported the opposite trend of an increasing amount of detail emerging with time. Finally, concerning most distressing non-intrusive memories, 5 participants reported their memory weakening in terms of emotional and vividness or becoming "lighter" (*verbatim*).

3.3.4 Emotions at recall and memory type

Differences in emotions experienced at recall of intrusive memories and non-intrusive control memories among participants with intrusions are reported in Table 3.14. Intrusive memories at recall were characterised by higher levels of anxiety, fear, and helplessness.

Table 3.14 *Emotions Experienced at Recall of Intrusive Memory Versus Control Non-Intrusive Memory*

	Intrusive memories		Non-intrusive control memories			
	M	*SD*	*M*	*SD*	*t*(49)	*p*
Anxiety	7.38	2.76	4.94	3.92	4.51***	.000
Anger	6.52	3.78	6.46	3.62	0.10	.915
Sadness	8.52	2.36	8.34	2.61	0.39	.696
Guilt	4.42	4.01	3.46	3.85	1.50	.140
Shame	0.86	2.25	0.94	2.53	-0.21	.832
Helplessness	8.48	2.71	7.30	3.47	2.37*	.022
Numbness	2.78	3.77	2.20	3.33	1.08	.282
Fear	6.46	3.36	4.72	3.89	2.62*	.011
Horror	4.28	4.26	4.00	4.05	0.47	.638
Disgust	1.68	3.13	2.62	3.82	-1.65	.105

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

One-way between-subjects ANCOVAs were conducted to test for differences in emotions experienced at recall of intrusive memories and most-distressing memories, controlling for age and PTSD symptoms. Results are shown in Table 3.15. Intrusive memories were again characterised by higher levels of anxiety and fear at recall, but no differences in levels of helplessness were found in this comparison.

Table 3.15 *Emotions Experienced at Recall of Intrusive Memories Versus Most Distressing Memories*

	Intrusive memories		Most distressing memories				
	M	*SD*	*M*	*SD*	*F*(1, 103)	*p*	Partial η^2
Anxiety	7.43	2.76	4.30	3.79	12.64**	.001	.11
Anger	6.58	3.77	5.52	4.02	1.17	.280	.01
Sadness	8.54	2.35	8.67	2.19	0.01	.902	.00
Guilt	4.33	4.01	2.01	3.28	2.67	.105	.02
Shame	0.84	2.23	0.58	1.76	0.00	.956	.00
Helplessness	8.50	2.69	7.45	3.53	1.16	.284	.01
Numbness	2.72	3.75	1.39	2.68	1.85	.176	.01
Fear	6.52	3.36	4.49	3.96	4.33*	.040	.04
Horror	4.39	4.29	3.67	4.08	0.67	.414	.00
Disgust	1.84	3.31	2.33	3.48	0.22	.633	.00

Note. Analyses controlled for age and transformed PCL-5 scores.
* $p < .05$, ** $p < .01$, *** $p < .001$

Finally, one-way between-subjects ANCOVAs were conducted to test for differences in emotions experienced at recall of non-intrusive control memories (among participants with intrusions) and most distressing memories, controlling for age and PTSD symptoms. No significant difference in emotions at recall was found between the two memory types, largest $F(1, 102) = 1.02$, $p = .314$.

3.4 Discussion

This is the first study to test the predictions from cognitive theories of intrusive memory development and phenomenology (Brewin et al., 1996, 2010; Ehlers & Clark, 2000) using a novel naturalistic design and a psychometrically validated model of peritraumatic reactions. As hypothesized, moments experienced as

intrusive memories were associated with higher levels of all peritraumatic reactions except for mental defeat, when compared to moments from the same trauma experienced as distressing, but non-intrusive, by the same participants. Additionally, moments experienced as intrusive memories were also characterised by higher scores on all peritraumatic reactions except for mental defeat in comparison with the moments experienced as most distressing memories among participants without intrusions controlling for PTSD symptoms. These findings support the importance of peritraumatic encoding for intrusive memories, and answer the valid concerns raised that retrospective reports of these reactions could be biased by current mood state (Candel & Merckelbach, 2004; Rubin et al., 2008).

In addition, confirming findings from Ehlers et al. (2002) and Hackmann et al. (2004), intrusive memories were most commonly experienced as images (92.2%) and least commonly as thoughts (47.1%). Furthermore, intrusive memories were more likely to be experienced as images and emotions and less likely to be experienced as thoughts when compared to normal autobiographical memories from the same trauma. I also provide support for the preliminary findings concerning the visual characteristic of intrusive memories. In particular, as shown in studies by Michael et al. (2005) and as mentioned in Ehlers and Steil (1995), experiencing intrusive memories as brief "movie scenes" was the most common visual modality (55.3% of participants with intrusive memories in the current sample experienced their intrusive memory as a "brief film").

Interestingly, intrusive memories were more likely (40.4% of participants with intrusion) to be experienced as a "series of disconnected images" than non-intrusive control memories (26%) or most distressing memories (23.1%), although this difference did not reach significance. This trend however could be seen as

indicating that intrusive memories are characterised by a higher degree of "fragmentation" as the sensory elements from the wider scene encoded by the perceptual memory system are not bounded as effectively (Brewin, 2015; van der Kolk & Fisler, 1995, but see Clark, Holmes, Woolrich, & Mackway, 2016 for opposing neuroscientific evidence).

No significant differences in vantage point were found between the different memory types, although an allocentric perspective was more common in intrusive memories (27.5%), than in non-intrusive control memories (22.6%) and most distressing memories (16%). This trend is somewhat at odds with recent evidence indicating a significant association between higher allocentric spatial memory performance and lower intrusive memory severity and frequency (Bisby, King, Brewin, Burgess, & Curran, 2010; Sierk et al., 2019). The trend is also at odds with the assumption that recall from an allocentric perspective would be associated with fewer intrusive memories as it would reduce the emotional impact of that memory (Berntsen & Rubin, 2006; McIsaac & Eich, 2002; Mooren, Krans, Näring, & van Minnen, 2018).

The higher prevalence of allocentric perspective in intrusive memories among the current sample could however be explained by a higher degree of peritraumatic dissociation-like reactions such as derealisation and depersonalisation among participants with intrusions. Indeed, although not reported in the Results, overall PDEQ scores were significantly higher among participants with intrusions (M = 27.09, SD = 8.22) than among participants without intrusions (M = 18.67, SD = 7.16), $F(1,102) = 32.50$, $p < .000$, $\eta^2_p = .24$. Additionally, as will be discussed in Chapter 4, peritraumatic derealisation was among the most commonly reported peritraumatic reactions. Indeed, individuals that tend to engage in dissociation have

been found to be more likely to retrieve intrusive memories from an allocentric perspective (Williams & Moulds, 2007). Future studies might investigate more systematically possible relationship between peritraumatic dissociation at encoding and vantage point.

In line with theoretical models of intrusive memories, in the current sample intrusive memories were associated with higher levels of distress, feeling like one was re-experiencing the event in the here and now, and attempts at suppression than normal autobiographical memories from the same traumatic event (Ehlers & Clark, 2000). Interestingly, the control non-intrusive memories of participants with intrusions were also characterised by a more marked sense of re-living and by stronger attempts at suppression when compared to the most distressing memories of participants without intrusions, although the memory types were perceived as equally distressing. This could indicate that participants with intrusions might have a general tendency towards experiencing memories with a stronger sense of reliving, possibly due to some underlying trait such as enhanced mental imagery contributing to re-experiencing (Pearson, Naselaris, Holmes, & Kosslyn, 2015).

Finally, replicating Hellawell and Brewin (2004), recall of intrusive memories was associated with higher levels of "primary" traumatic emotions such as fear, anxiety, and helplessness in comparison with normal autobiographical memories in the within-subject analyses. Fear and anxiety were also higher in the comparison between individuals with and without intrusions. Unlike in the earlier study, there were no differences in levels of "secondary" emotions such as anger, sadness, or shame that might emerge during the appraisal phase of the trauma rather than during the traumatic event itself. This may be due to the extended nature of the exposure provided by the series of earthquakes which, in comparison to briefer

traumatic events, may have permitted a greater degree of appraisal to occur while the events were unfolding. The results concerning primary emotions nevertheless strengthen earlier reports suggesting a specific link between fear and intrusive memories (Reynolds & Brewin, 1999). The finding that intrusive memories, relative to non-intrusive memories, are characterised by those emotions that predominate during the trauma itself is also consistent with the predictions of dual representation theory of PTSD (Brewin et al., 1996, 2010). In contrast, there is less basis in the mnemonic theory (Rubin et al., 2008) for this pattern of results.

The key strength of the current design was the focus on peritraumatic reactions during *specific moments* of the trauma that were later experienced as different types of memory, rather than on reactions occurring during the trauma as a whole. Our results suggest that variation within the same individual in levels of peritraumatic reactions could be a meaningful determinant of intrusive memory development. This confirms, in a naturalistic setting, results from the experimental literature showing that momentary decreased heart rate, used as a proxy measure of dissociation, was associated with the specific moments of a trauma film that later intruded (Chou et al., 2014; Holmes et al., 2004).

In many circumstances the notion of a "traumatic event" may therefore be better understood as a collection of micro-events associated with different peritraumatic features (Ehlers, 2010), as supported by qualitative work conducted with this sample and presented in the next chapter (Massazza, Brewin, & Joffe, 2020). These observations raise questions about the precision of peritraumatic measures that require respondents to summarise their response over an extended period of time. They also support the argument of Marks et al. (2018) that one of the main limitations of the trauma film paradigm is that by using a rapid-fire series of

distressing film clips, researchers might be artificially truncating the peritraumatic variation which characterises the chronology of a real-life trauma (*e.g.* Bourne, Frasquilho, Roth, & Holmes, 2010 using clips only from the aftermath of a road-traffic accident).

A second strength of the current design is the use of a psychometrically validated model of peritraumatic reactions which distinguished five distinct dimensions and that was presented in detail in the previous chapter. Participants reported higher levels of peritraumatic distress, immobility, cognitive overload, and somatoform dissociation in moments experienced as intrusive memories compared to moments that did not intrude. These findings support the hypothesis that intrusive memory might correspond to "hotspot" moments of peak emotional distress (Holmes et al., 2005). Additionally, they provide support in a naturalistic setting to experimental findings concerning the associations between peritraumatic arousal (Hall and Berntsen, 2008), cognitive load (Nixon, Nehmy, & Seymour, 2007), immobility (Kuiling et al., 2019), data-driven processing (Morina et al., 2013), and somatoform dissociation (Hagenaars, van Minnen, Holmes, Brewin, & Hoogduin, 2008) with intrusive memories.

Interestingly, mental defeat did not appear to differ significantly between the moments experienced as different memory types. However, in the structural equation modelling analysis presented in Chapter 2, the mental defeat factor was the one most highly associated with overall PCL-5 scores as well as with its subscales. This may indicate that mental defeat contributes to overall PTSD via different pathways than memory encoding. For example, it might affect a more global appraisal of how one reacted during the overall event, leading to feelings of guilt or shame for feeling

helpless or failing to react (Ehlers & Clark, 2000). Alternatively, the restricted number of items measuring the factor could explain the non-significant findings.

A third strength in the current design is that the time-lag between trauma and data collection allowed us to investigate many intrusive memories that persisted 15-20 months after trauma. In contrast to experimental studies, where intrusions rarely last more than a few days, these long-lasting intrusions are what clinicians are likely to encounter in therapy since many patients will access treatment for post-trauma psychopathology months, if not years, following exposure (Maguen, Madden, Cohen, Bertenthal, & Seal, 2012).

As in Chapter 2, the main limitation of the current study is the retrospective nature of the description of peritraumatic reactions. Findings concerning the accuracy and consistency of retrospective recall of peritraumatic reactions are mixed (Ouimette, Read, & Brown, 2005; David, Akerib, Gaston, & Brunet, 2010). While peritraumatic ratings are by nature retrospective, future studies might collect data closer to exposure. The retrospective assessment of intrusive memories could also be improved by either investigating intrusive memories triggered *in vivo* in laboratory settings (Lau-Zhu, Holmes, & Porcheret, 2018) or using ecological momentary assessment methods (Kleim, Graham, Bryant, & Ehlers, 2013). Additionally, the cross-sectional nature of the study hinders precise causal inference concerning the relationship between peritraumatic reactions and intrusions with possible reverse causality and third variable issues. However, these alternative explanations are less likely given the combination of within-subjects and between-subjects findings. Future longitudinal designs will be necessary to expand upon and confirm the current results.

Future studies might also investigate more systematically covariates that have the potential of influencing and explaining the relationship between peritraumatic reactions and intrusive memories. For example, in the current sample the relationship between traumatic exposure and the presence of intrusive memories was inconclusive with no differences found between participants with intrusions and participants without on most exposure items. However, participants with intrusions were more likely (27.5%) to report being injured to the point of needing urgent medical attention in comparison with participants without intrusions (5.7%).

One possible explanation is that a proportion of the wounded participants might have suffered from traumatic brain injury which in turn could have disrupted normal memory encoding processes resulting in higher chances of developing intrusive memories. Indeed, traumatic brain injury has been shown to affect the risk of developing PTSD overall (Bryant, 2011), possibly through its impact on memory reconsolidation of the event (Vasterling, Jacob, & Rasmusson, 2018). Future studies could investigate the association between intrusive memories and injury during trauma, and traumatic brain injury specifically, more systematically.

Another possible covariate of interest could be alcohol. Anecdotally, the earthquake on the 24th of August took place during the night soon after a village festival. As a result, a small number of participants, especially young male participants, reported being under the effect of alcohol during the peritraumatic phase. However, no retrospective measure of alcohol intake was taken during this study and as a result no substantial inference can be made concerning the relationship between alcohol intake in the peritraumatic phase and intrusive memories. Nonetheless, especially in light of recent evidence on the association between traumatic events under the influence of alcohol and intrusive memories

(Jaffe, Blayney, Bedard-Gilligan, & Kaysen, 2019; McFarlane et al., 2009), more systematic research could explore this linkage.

Furthermore, as described in the limitations of Chapter 2, the purposive nature of the sample constitutes another possible limitation as certain people, *e.g.*, survivors who had relocated elsewhere following the earthquakes or who were unknown to the municipality and health services, might have been systematically omitted from the sampling framework leading to a study group not representative of the population of Amatrice as a whole.

Additionally, the lack of information concerning the participants who refused to participate is a further limitation inherent to this sampling technique. Participants who had experienced certain peritraumatic reactions, that were more severely exposed, or had higher levels of psychopathology could have been less likely to take part in the study. However, this cannot be confirmed due to the lack of data. Importantly, the substantial proportion of the total population surveyed as well as the attempt made at recruiting a sample representative of the population as a whole in terms of key demographic characteristics should have safeguarded against major biases being introduced into the sample.

Furthermore, a number of statistical limitations are also present. Firstly, some of the composite peritraumatic factor scores had low Cronbach's alpha levels. This is especially true for the Distress factor. This might be due to the fact that Cronbach alpha becomes relatively unstable with very few items (i.e., three in this case) (Rammstedt & Beierlein, 2014). An alternative explanation is that the low value is due to the heterogeneous nature of the items included in the construct. For example, the Distress factor included three quite distinct items measuring fear of death, concern for the safety of others, and trembling/shaking. This is because the

shortened peritraumatic questionnaire used for the specific moments of the trauma aimed to capture the heterogeneity of peritraumatic reactions, and choices had to be made over inclusion of items that were very similar in nature (e.g., only included PDI-13 "*I thought I might die*" and not PDI-4 "*I felt afraid for my own safety*"). A downside of this approach is that the shortened peritraumatic questionnaire did not included certain items from the complete measure that had higher loadings on the factor than the ones included in the factor sub-score (e.g., in the case of Distress, PDI-4 "*I felt afraid for my own safety*", factor loading: .58 or TIS-7 "*Rate the extent to which you felt feelings of fear/panic during the event",* factor loading: .55). The inclusion of these higher-loading items might have led to higher Cronbach's alphas if included.

Another possible statistical limitation is that multiple tests had to be conducted in the current analysis, which could have led to alpha inflation issues. However, for the core hypothesis-driven analysis investigating the association between peritraumatic reactions and intrusive memories, the strength of the associations indicates that even if a correction was applied, the pattern of results would remain consistent. Nonetheless, the remaining analyses should be treated as exploratory in nature and in need of more systematic replication.

Finally, there is the potential risk for order effects in the administration of the tasks. Although a number of precautions were taken to avoid this possibility (e.g., randomization of the order in which the complete peritraumatic measures were administered), this remains a possibility. For example, the ratings of peritraumatic reactions of the control memories among participants with intrusions might have been influenced by having completed the same peritraumatic items for the intrusive memory moments very shortly before. Future studies might avoid this possible

carry-over effect by randomizing whether participants are first asked about their intrusive memory or their control memory or by having a longer pause between the rating of the two different memories.

This represents the first study to test in a sample exposed to the same real-life trauma predictions made from theoretical models of intrusive memory development and phenomenology (Brewin et al., 1996; Ehlers & Clark, 2000). Our findings support these predictions and add to numerous findings that suggest intrusive trauma memories are underpinned by different processes than ordinary autobiographical memory (Bisby & Burgess, 2017; Chou, La Marca, Steptoe, & Brewin, 2018; Kleim, Ehring, & Ehlers, 2012; Kroes, Whalley, Rugg, & Brewin, 2011; Sierk et al., 2019; Whalley et al., 2013). Improvements in the treatment of PTSD, and psychiatric disorders in general, will follow from a better understanding of the mechanisms behind the development and phenomenological characteristics of specific symptoms (Holmes, Craske & Graybiel, 2014). The current work contributes to this endeavor by using a novel, theory-driven, naturalistic design, shedding more light on one of the hallmark symptoms of PTSD.

However, another limitation of the current study is that it is based on a conceptualisation of peritraumatic reactions that has largely been developed within the quantitative literature. The identification of peritraumatic reactions in psychotraumatology has mostly relied on clinical experience (*e.g.* dissociation), as well as on insights from animal models (*e.g.* tonic immobility) and theory (*e.g.* data-driven processing). It is unclear how accurately and comprehensively the current conceptualisation captures the full array of possible peritraumatic reactions experienced by survivors during trauma. The next chapter will address this limitation by using qualitative methods and a largely inductive framework to explore

spontaneously reported peritraumatic reactions reported by participants during interviews.

4 Chapter 4: Thoughts, Feelings, and Behaviours during Disaster: A Large Qualitative Study on Peritraumatic Reactions

A version of this chapter has been published at *Qualitative Health Research*

Massazza, A., Brewin, C. R., & Joffe, H. (2020). Feelings, thoughts, and behaviors during disaster. *Qualitative Health Research, 31,* doi: 10.1177/1049732320968791

In Chapter 2 and 3 I relied on a conceptualisation of peritraumatic reactions largely based on the quantitative literature. There is a need to investigate qualitatively whether the current conceptualisation of peritraumatic reactions captures fully and accurately the lived experience of individuals exposed to trauma.

4.1 Introduction

The field of trauma and post-traumatic stress disorder (PTSD) has highlighted the thoughts, feelings, and behaviours people experience during or immediately after exposure to traumatic events (Bovin & Marx, 2011). These phenomena have been collectively named "peritraumatic reactions". From Janet's studies on dissociation in hysteria onwards (Janet, 1887), peritraumatic reactions have occupied a central role in defining the experience of trauma and post-trauma psychopathology (van der Kolk & Fisler, 1995). The most influential theories on the development of PTSD suggest that what happens at the time of the traumatic event and its consequences for the encoding of traumatic memories is key to understanding the condition (Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000).

As mentioned in previous chapters, a large volume of literature has been devoted to understanding the link between peritraumatic reactions and post-trauma

psychopathology (Gorman, Engel-Rebitzer, Ledoux, Bovin, & Marx, 2016). Meta-analytic studies of risk factors for PTSD prior, during, and following the traumatic event have identified peritraumatic reactions as some of the most important risk factors for PTSD development (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003). As described more fully in previous chapters, the reactions that have received the most attention are peritraumatic dissociation, both in its psychic (Candel & Merckelbach, 2004; Nobakht, Ojagh, & Dale, 2019) and somatoform (Nijenhuis, 2004) presentations, distress (Brunet et al., 2001; Kannis-Dymand, Carter, Lane, & Innes, 2019), tonic immobility (Marx, Forsyth, Gallup, Fusé, & Lexington, 2008; Hagenaars & Hagenaars, 2020), panic attacks (Nixon & Bryant, 2003), data-driven processing (Halligan, Clark, & Ehlers, 2002), and mental defeat (Dunmore, Clark, & Ehlers, 2001). While these reactions are believed to be somewhat phenomenologically distinct from one another as highlighted in Chapter 2, they tend to be associated with higher levels of post-trauma psychopathology, most commonly PTSD (Vance, Kovachy, Dong, & Bui, 2018), but also depression (Bunnel, Davidson, Anton, Crookes, & Ruggiero, 2018).

The existing work on peritraumatic phenomena has largely based the identification of different peritraumatic reactions on accounts from clinical experience (*e.g.* dissociation), and insights from animal models (*e.g.* tonic immobility) or psychological theory (*e.g.* data-driven processing). While these are reasonable methods to determine the presence of such reactions, inductive, systematic qualitative work is needed to provide a naturalistic and scientifically accurate account of the lived experience of peritraumatic reactions among trauma survivors (Tatano Beck, 2011).

Additionally, the current approach to studying peritraumatic reactions is largely based on the use of standard questionnaires such as the Peritraumatic Dissociative Experiences Questionnaire (Marmar et al., 1994) and the Peritraumatic Distress Inventory (Brunet et al., 2001). This deductive method is inevitably bound to confirm the presence of these reactions by enquiring specifically about them, possibly missing important, clinically relevant experiences. Indeed, when more inductive qualitative approaches have been used to explore survivors' recollections of reactions during traumatic events, the findings have suggested a more nuanced and complex range of experiences than the ones identified in the peritraumatic literature.

In the largest qualitative study to use interviews to investigate spontaneously reported reactions during traumatic events, 125 survivors of various disasters across different European countries were asked to recall in a free narrative their own reactions (Grimm, Hulse, Preiss, & Schmidt, 2014). Across the entire sample, the most frequently reported emotions and cognitions were fear, panic (as in amplification of "fear" rather than mass panic or panic attacks), and perceptions of high risk. Conversely, the most frequently reported behaviours were extending support to others and attempting to save lives. Qualitative studies among survivors of various emergencies also provide evidence for survivors spontaneously comforting and supporting or cooperating with each other during traumatic events (Wilson, d'Ardenne, Scott, Fine, & Priebe, 2012; Drury, 2018). Furthermore, approximately half of the sample reported that they reacted in a calm and rational manner while the other half reported acting on an instinctual and automatic level. A minority described not reacting at all due to resignation. Other reactions that were

identified included detachment, relief, emotion regulation, nervousness, dissociation, seeking information, and preparing for evacuation.

However the study was limited by a considerable time-lag between the events and the retrospective accounts, *i.e.* an average of four years, by the lack of homogeneity between the different traumatic events among participants, and by the fact that most interviews were conducted in focus groups, which are not ideal settings for openly discussing some peritraumatic reactions (*e.g.* guilt, shame) due to social desirability bias.

Qualitative studies examining peritraumatic reactions specifically during earthquakes have also confirmed a more diverse range of reactions than the ones identified in the psychotraumatology literature. A mixed-methods study among 100 individuals exposed to 1997 Umbria-Marche earthquakes in Italy identified fleeing (38% of total sample), short-term freezing (22%) and seeking shelter (12%) as the most common behavioural reactions followed by having no reaction (10%), seeking information (7%), and reaching and protecting significant others (7%) (Prati, Catufi, & Pietrnatoni, 2012). Fear (38%) was the most common emotional response with only 8 participants reporting feelings of panic. Prosocial behaviour was frequently reported (25%). Another study on the 2011 Christchurch earthquake in New Zealand (N = 61) also identified a variety of peritraumatic cognitions including worry and concern (21% of total sample), perception of current threat (21%), safety-seeking (16%), confusion and shock or feeling overwhelmed (14%), observing and explaining (12%), appealing to external forces (4%), self-soothing (4%), searching for more information (3%), and excitement (2%) (Kannis-Dymand, Dorahy, Crake, Gibbon, & Luckey, 2015).

In another smaller qualitative study among teachers (N = 20) during the 2011 Christchurch earthquake, teachers reported that confirming the whereabout and ensuring the safety of children were their behavioural priorities. Their reported emotions were fear/fright and anxiety, but also relief (O'Toole, 2017a). Other reactions mentioned by the teachers included stress, sadness and grief, pride, compassion, empathy, and love for their students. Importantly, when experiencing fear and anxiety, many teachers engaged in various emotional regulation techniques such as self-talk, deep-breathing, and problem-focused coping in order to give an impression of calm while prioritising the wellbeing of the children (O'Toole, 2017b). These emotional reduction and disengagement mechanisms have received some attention in the first-responders literature (Levy-Gigi, Bonanno, Shapiro, Richter-Levin, Kéri, & Sheppes, 2016; Hammock, Dreyer, Riaz, Clouston, McGlone, & Luft, 2019), but have not been addressed in peritraumatic work. In general, while a large amount of literature exists on peritraumatic reactions, very little research has been conducted on how people manage and cope with peritraumatic reactions in the acute phase of a trauma (see Toussaint et al., 2017 for an exception).

The current focus of the psychotraumatology literature on a small sub-set of negative peritraumatic reactions therefore appears incomplete when compared to the more nuanced and complex picture provided by experiential accounts of disaster survivors. The current study will attempt to address these limitations and provide a naturalistic account of the lived experience of peritraumatic reactions by taking a more inductive qualitative approach and asking participants to spontaneously report on feelings, thoughts, and behaviours experienced during key distressing moments of the same traumatic event.

4.2 Methods

4.2.1 Participants and recruitment

The participants in the current study are the same participants that were described in Chapter 3, and a subset of the participants of Chapter 2. All participants were survivors of the 2016-2017 Central Italy earthquakes. A purposive sampling strategy was used in order to identify a sample that reflected the demographic distribution of the population as a whole in terms of gender and age as per 2016 census data (Istituto Nazionale di Statistica, 2016). The recruitment process was aided by the local health centre and municipality. Participants were contacted either by phone or approached face to face. The recruitment was aided by the trusting relationship the authors had built with the population during previous research, which has been highlighted as an important basis of access in rural areas (Hamilton, 2019).

4.2.2 Procedure

Semi-structured interviews were conducted in Italian with 104 survivors. As described in Chapter 3 (section 3.2.2, 3.2.4, and Figure 3.1), participants received a description of the characteristics of intrusive memories and asked whether they had experienced such a memory. If they did, they were then asked to "*describe in as much detail as they could what they felt, thought and did in these moments*" (see Appendix F for the complete interview schedule). They were then asked to identify a control distressing memory from the same trauma and also describe in as much detail as they could their thoughts, feelings, and behaviours in those specific moments. If they had not experienced an intrusive memory, they were simply asked to identify their most distressing memory of the trauma and to describe the peritraumatic

reactions experienced in these moments. The qualitative descriptions of peritraumatic reactions preceded the completion of the shortened (33 items) peritraumatic questionnaire (described in Chapter 3) in order not to prime participants with peritraumatic reactions from the standard questionnaires. The interviewer did not use an interview guide or inject any external content related to pre-identified peritraumatic reactions in order to allow the participant's narrative to form freely and naturalistically. Interviews lasted an average of 1h and were tape-recorded.

4.2.3 Data analysis

As in Chapter 2, I explored peritraumatic reactions in themselves rather than in relation to intrusive memories. Indeed, the main aim of the current piece was to investigate the lived experience of peritraumatic reactions independently from their association with memory type or PTSD status. Therefore, in the current chapter I aggregated together all descriptions of peritraumatic reactions from the three different types of memories. The objective of the current chapter was to assess how peritraumatic reactions were described by participants, independently from whether they were described as taking place during a moment that was then experienced as an intrusive memory or not.

All 104 interviews were transcribed *verbatim* in Italian. I followed the methodological framework for thematic analysis as described by Joffe (2012). While transcribing, recurring peritraumatic reactions were noted down to create a preliminary thematic framework. The various codes corresponding to different peritraumatic reactions were then clustered into thematically related groups of codes in order to facilitate the analysis. The complete coding framework is reported in

Appendix G. The assignment of codes to particular groups/clusters followed from discussions among the authors and from inspection of code co-occurrence tables in order to assess which codes spontaneously appeared most in association with other codes (Contreras, 2011).

Following the methodological framework described by Fereday and Muir-Cochrane (2006), I used a hybrid approach encompassing a largely inductive analytic framework with the inclusion of some theory-driven constructs (*e.g.* dissociation, mental defeat, cognitive overload). This was justified by the fact that while I was interested in letting new themes emerge spontaneously from the participants' narratives, I also wanted to explore whether and how commonly researched peritraumatic reactions would have been reported by participants when unprompted. However, I tried to remain as close as possible to the specific wording used by participants whenever appropriate (*e.g.* only coding for "panic" when participant specifically spoke of "panic").

In order to assess the reliability of the coding frame, the authors explained the framework to a second coder who was naïve to the field of peritraumatic reactions and blindly coded approximately 5% of the entire dataset (O'Connor & Joffe, 2020). A substantial inter-coder reliability rate was achieved between coders, with an average Kappa of .73. Discrepancies were discussed and resolved. Following discussion among the authors the thematic framework was finalised. As in Chapter 2, distressing moments were accepted only if they had happened between the moment of the earthquake shock on the 24th of August and the State funerals that took place on the 30th of August or during the earthquake shocks of the 30th of October and 18th of January as per definition of peritraumatic, *i.e.* occurring during or immediately after the traumatic event (Gorman et al., 2016). All sections

corresponding to the peritraumatic time frame were then thematically analysed in order to explore the most frequent themes in depth.

Our thematic analysis was largely grounded in a phenomenological epistemological framework whereby I set out to analyse and report on the experiences, meanings, and reality as discussed by the participants themselves in order to represent the lived experiences of these reactions. Despite my knowledge of peritraumatic reactions, I attempted to approach the data without preconceived assumptions and remain as close as possible to the specific wording used by participants. The substantial inter-coder reliability rate achieved with a second coder naïve to the field of peritraumatic reactions is reassuring in this respect. The analysis was conducted using ATLAS.ti (version 7).

4.3 Results

4.3.1 Participants demographics

Demographic information on the current sample are provided in section 3.3.1 of Chapter 3.

4.3.2 Description of distressing moments

Participants identified various key distressing moments during the semi-structured interviews. The most commonly reported events are presented in Table 4.1. Unlike in Chapter 3, the content is not presented according to memory type as, as mentioned above, peritraumatic reactions were analysed in the current chapter independently from their association with a specific memory type. As in Chapter 3, a number of key distressing moments, and their corresponding peritraumatic reactions, were excluded from the thematic analysis as they took place outside of the

peritraumatic timeframe. These included the period of life in the tents (*n* = 6), returning back home or in Amatrice for the first time weeks after the event (*n* = 3), being told by a family member one had been selfish during the emergency (*n* = 1), the dishonesty of politicians (*n* = 1), and the moments of the 2009 L'Aquila earthquake (*n* = 1).

Table 4.1 *Content of Key Distressing Moments Identified by Participants, in order of Prevalence*

Content	N. of times mentioned
Earthquake shock on the 24th of August	32
Seeing corpses or body parts in the debris	20
Collapsing buildings and material devastation	16
Rescue of individuals out from debris	12
Recognition and management of corpses	11
Moments of realisation of death of people	10
Finding out/being told of death of people	8
State funerals and/or private funerals	6
Earthquake shock on the 30th of October	6
Witnessing people in distress	4
Getting out of collapsing buildings	4
Being stuck under debris	4
Earthquake shock on the 18th of January	4

Note. Distressing moments mentioned less than 4 times are not included in this table.

4.3.3 Description of peritraumatic reactions

A total of 85 different peritraumatic reactions were identified in the interviews (see Table 4.2). Each code was assigned to one of 7 groups of codes: emotional distress; action, hyper-focus, and emotion regulation; cognitive overload; dissociation; mental defeat and loss of control; immobility and somatic reactions; and positive affect. Some codes could have belonged to various groups and were therefore placed in the group to which they most aligned according to how they were discussed by participants. Most participants (81%) also described the reactions of other people around them during interviews.

"*In those moments there are so many different emotions, and they vary from person to person, there was maybe who panicked, so for example there was this person that lived in the apartment below mine and she arrived at the door and she couldn't manage to get out, she kept say "I cannot get out, oh my God", she was stuck there, or my cousin that couldn't understand what was going on, but, in that moment, I had become so cold, as if what was happening was normal*"

[Female, 23]

Additionally, more than half of participants (53%) mentioned struggling to describe certain reactions in their own words and 25% of participant described their reactions as "strange".

"*There is always a point while I tell my story when it's like a dead end, like a tunnel without an exit, I mean you arrive at a point where you can't manage to describe or to get the person you are speaking with to understand what it felt like, it's like a dead end, because there isn't a similar human experience you can refer to* […], *there are no words to describe it, you cannot find something to compare it with, that's why I haven't even tried to describe it to so many people, I haven't even ever spoken about it with my wife*"

[Male, 52]

Finally, 19% of participants reported experiencing several different, at times contradictory, reactions at the same time.

"*The joy of seeing a person that comes out* [of the debris] *alive, when those kind of things happen there is so much sadness but when you see someone alive everyone is happy, but then I saw other people that were comforting a young woman that was waiting for her children to be taken out dead, it's not nice, I mean, on one side there is the happiness but then you turn around and see the faces of people, it's a mix of things, it is not easy to explain because unless you go through certain things it is not easy to explain it with words, it doesn't really make it justice, and anyway it's all a jumble of feelings, of thoughts…"*

[Female, 46]

"In that moment it is a soup [lit. minestrone] *of feelings that I cannot even try and describe because it's so complicated, usually one experiences one feeling at a time, but not then, you are happy, then you are sad, there you felt everything, desperation, then fear, then determination, then hope that alternated continuously, all together"*

[Male, 23]

Each participant reported experiencing a mean of 21 different reactions at the time of the traumatic event (range = 6-43) indicating considerable fluctuations between different types of peritraumatic reactions. Each group of peritraumatic codes will be presented separately, with individual peritraumatic codes presented in order starting from the most often reported within that group of codes. Due to the volume of peritraumatic reactions identified, only those spontaneously reported by at least 25% of the sample are described qualitatively below, but all are mentioned in

Table 4.2. Each group of peritraumatic codes will be presented separately, in order of prevalence.

Certain reactions did not belong to any specific group such as appealing to God or religious coping (18% of total sample), over-identification with other people (15%), avoiding distressing scenes (14%), being in physical pain (7%), feeling a sense of injustice (5%), and smoking tobacco (5%). Therefore, when these reactions are reported in a certain section (*e.g.* "appealing to God" in the "emotional distress" section) it does not imply that they were not also associated with other peritraumatic groups.

Table 4.2 *Descriptive Information on Codes under Each Code Group in order of Prevalence*

1. Emotional distress	**2. Action, hyper-focus, and emotion regulation**	**3. Cognitive overload**
Fear for others (78%)	Gaining awareness (78%)	Confusion (63%)
Fear for self (70%)	Goal-oriented actions (72%)	Not knowing what to do (46%)
Uncertainty (63%)	Trying to be useful/ Helping others (64%)	Overwhelmed/shocked (45%)
Sadness, emotional pain (43%)	Staying calm (38%)	Not realising extent of damage (30%)
Anger (35%)	Urge to act/ Being reactive (34%)	Feeling lost (24%)
Urge to flee (34%)	Maintaining clarity of thoughts/ self-control (32%)	Having no thoughts, thought vacuum (22%)
Anxiety about future (32%)	Calming others/ Providing emotional support (31%)	Racing thoughts (14%)
Catastrophic thinking (30%)	Being strong/courageous (25%)	Geographical disorientation (11%)
Anxiety (29%)	Instinctual behaviours (25%)	Disorganised thoughts (10%)
Thought of death (26%)	Concentrated/ Focused (21%)	
Crying (22%)	Feeling prepared (21%)	
Guilt/ shame (20%)	Taking leadership/ Taking initiative (20%)	
Feeling trapped (19%)	Detachment (18%)	
Panic (17%)	Being strong for other people (17%)	
Screaming (16%)	Heightened physical capacities (17%)	
Desperation (13%)	Sense of duty (11%)	
Why questions (13%)	Trying to shield other people from horror (10%)	
Guilt for having survived (4%)	Earthquake survival strategy (9%)	
4. Dissociation	**5. Mental defeat and loss of control**	**6. Immobility and somatic reactions**
Distortions in sense of reality (51%)	Helplessness (60%)	Physical immobility (37%)
Unbelievability (43%)	Feeling defeated (30%)	Feeling cold (15%)
Numbness (26%)	Feeling useless/ insignificant/ defenceless (26%)	Unusual body experiences (15%)

Distortions in sense of time (21%)	Feeling vulnerable/lonely (16%)	Not feeling pain (*i.e.* anaesthesia) (11%)
Distortions in sense of self (20%)	Exhaustion (15%)	Loss of appetite and thirst (10%)
Feeling of void (13%)	Lack of control (14%)	Fainting (9%)
Feeling like on automatic pilot (11%)	Loss of emotional control/ Feeling "crazy" (14%)	Difficulty breathing (8%)
Feeling like a spectator (9%)	Feeling like something else has control of body (3%)	Shaking (7%)
Failing to notice obvious things (5%)		Fear-related bodily sensations (4%)
		Feeling like throwing up/ Throwing up (3%)
		Loss of control over bowel or bladder (2%)
7. Positive affect		
Hope (29%)		
Joy (24%)		
Social connectedness (21%)		
Sense of invincibility/exaltation (10%)		
Emotional liberation (5%)		
Awe (2%)		

Note. The number in brackets corresponds to the percentage of the total sample that reported experiencing the reaction. Importantly, these numbers do not necessarily indicate the actual prevalence of the reaction but simply how prevalent the reaction was in the spontaneous reports of participants. Each peritraumatic group is presented in order of prevalence, calculated by summing together the percentages of each code within each code group.

4.3.3.1 Emotional distress

The majority of participants reported experiencing various negative peritraumatic emotions. These ranged from primary traumatic emotions such as fear, anxiety, and shock to more complex affective reactions such as guilt, anger, and sadness. Most participants mentioned fear as the predominant emotion experienced during the earthquakes. However, fear for the safety of others was reported by more participants (78% of total sample) than fear for one's own safety (70% of total sample). Indeed, fear was often experienced in relation to significant others, especially family members not physically present at the scene. The first actions and thoughts of participants were often social in nature with participants either calling by phone, or actively going to search for, significant others. Even when in extreme danger or distress, the thoughts of some participants were directed towards others. One participant that had remained stuck under debris described how:

> "*I remember that I was there in the middle of all this debris and I thought, now I will die, and my family will die in another place, and I will die here on my own, I thought of my nephews, I thought of the people in my family, the people that I love that maybe where dying far away from me* [cries]"
>
> [Female, 60]

> *"I thought that my parents together with my daughter were dying, because I was completely unable to understand that the earthquake was also happening where I was, despite part of the house was collapsing I projected this earthquake to where my daughter was living"*
>
> [Female, 44]

Following fear for others, fear for one's own safety was the most commonly reported emotion. Fear was often described as an overwhelming emotion, experienced in a "pure"[1] form, absorbing all other cognitive and emotional resources by completely occupying one's mental space. Fear was described as an emotion that could "make you lose your mind" by interfering with rationality and decision-making abilities. Participants described how their brains, used as a symbol for rationality, were emptied, zeroed, or blocked by fear. Participants variously described fear as clinging to them, taking control of them, or possessing them.

> "*My first emotion was fear, an incredibly strong fear, a terrible fear, maybe the worst fear that I have ever experienced in my life, so much fear, terror, I was terrified, you know like when you go and watch an horror movie that you are not used to watching and you are scared even of small things like the sound of wind through the trees, it was pure terror, it was unbelievable*"
>
> [Male, 52]

Fear was at times associated with participants holding catastrophic beliefs. These ranged from thinking that everyone they knew was dying or was going to die, thinking that the earth was going to split under their feet and swallow them, that the apocalypse was taking place, or that they were witnessing the end of the world.

[1] When descriptions of the participants' reactions are reported within quotation marks it indicates that the exact wording of the participant was used.

"I was terrified that the earth was going to split and open up, and that we were all going to be swallowed up by it, I don't know why, I kept saying "now the earthquake will continue and the earth will open", and I kept crying"

[Female, 59]

"*The earthquake began and I remember that the asphalt on the street began undulating as if it was a wave, as if there was an underground wave and I remember that I felt so much fear, even if I was in the street with no buildings around I remember that I felt so much fear, as if I felt that I could have been taken away by this wave*"

[Female, 18]

Fear was associated with thoughts of death. What seemed to be most fear-provoking and distressing to participants was the awareness of dying, together with the possibility of experiencing a painful death. When faced with the possibility of death, some participants described appealing to God or other religious figures. Religious figures were evoked generally to plead for survival but, in some cases, also for comfort when getting ready to die or when praying for a quick and painless death. An elderly woman recalled how:

"*I thought that now the ground will open up and I will go down, I was resigned to death, I made the sign of the cross and I waited for death* […]*"for all my sins" I said "please help me", God will welcome me*"

[Female, 74]

Behaviourally, the emotion of fear was often associated with possible flight responses. A considerable number of participants described experiencing an urge to flee during the earthquake shocks. This instinct was generally triggered by the feeling of being trapped when inside built structures. It was described as a sudden, rushed, and not necessarily reasoned reaction, *e.g.* participants taking the stairs without checking they were intact. Houses and internal structures were generally conceptualised as spaces of risk one had to flee rather than as safe and solid refuges inside which one felt protected. Some houses were perceived as being so unsafe that a number of participants jumped from windows in order to get out of them.

> "[Fleeing] *was such an instinctive reaction, because I didn't rationalise, I didn't think about the fact that it was dark and so maybe when going down the stairs there could have been no stairs and I would have plummeted to the ground, but instead in that moment I got up from bed and the first thing that I felt I had to do was to run away* […], *I had to get out of the house, to find an exit*"
>
> [Female, 25]

Other commonly reported negative emotions were shock and anxiety. A minority of participants (17%) also described experiencing panic at the times of the earthquake. Anxiety, tension, and worry were often connected to uncertainty and not knowing what to do during the event. Additionally, some participants reported having anxious thoughts concerning their future, such as what was going to happen

to their lives and how they were going to continue living without family members, houses, and jobs.

Some participants described how initial fear and panic, while present, were short-lived as they managed to "snap out" of them and become reactive and focused. Others mentioned how fear and anxiety actually provided the emotional fuel and energy necessary for action.

> "*In the moments of the shock, I had a moment of panic, but it was really a question of a fraction of a second, it must have lasted less than 10-15 seconds because after you immediately had to get your brain started and try to find some solutions, react to the event*"
>
> [Male, 51]

Other emotions such as sadness, anger, guilt, and shame, were also mentioned. Sadness, melancholy, crying, desperation, and emotional pain were feelings and behaviours associated with loss, often following the realisation of the death of friends, family members, and acquaintances. This emotional pain was described as deep, excruciating, and insurmountable as well as being associated with feelings of unbridgeable void. The loss of people, in particular children, created gaping holes within the close-knit pre-earthquake social fabric, which participants felt could not be mended.

A number of participants also reported reacting to the events with anger, irritability, and frustration. Anger was often fuelled by a perceived sense of injustice concerning the event. Participants often mentioned that what had happened was unfair, alluding to a tacit universal moral structure that had suddenly shattered.

People reported asking themselves *why* such a thing had happened to them and what they had done to deserve so much pain.

4.3.3.2 Action, hyper-focus, and emotion regulation

Participants reported experiencing a considerable number of agency-driven reactions indicating orientation towards action, focus, and attempts at managing one's emotions while in distress. These themes were collectively subsumed under the category of "action, hyper-focus, and emotion regulation".

These reactions were tied together by the underlying sense of agency that characterized them. In most cases, participants reported consciously making an effort to control their emotions or concentrate and focus on action. This is in stark contrast to many of the other reactions such as distress and dissociation, upon which the participants felt they had very little control. For example, the "detachment" code in the current theme might seem similar to the "numbness" code in the dissociation theme. However, the core difference is that "detachment" here indicates a purposeful attempt by the participant to put their emotions on hold and detach themselves emotionally from a particularly distressing scene, e.g., a severely injured person, in order to conduct a goal-driven action, e.g., saving the person. On the other hand, numbness in dissociation would emerge without the participant's will and was not perceived as being under one's control or as having a particular goal-oriented function.

The most commonly reported reaction in this theme concerned the process of gaining awareness of what was happening. Some participants reported quickly gaining full understanding of what was happening. Others described progressively

initiating a process of making sense of the event and "putting things into focus" in the subsequent hours and days following a period of initial confusion.

The process of gaining awareness of what was happening was generally followed by a shift to actions oriented towards a goal. These actions were both directed towards the external environment, for example when providing support to others, but also towards oneself, for example by regulating one's reactions. Participants reported "switching" to an operational mode by "unblocking" or "activating" oneself and "springing" into action. Some participants described this shift from confusion to action as that of re-setting a frozen computer or phone.

> "*It was only a moment of confusion, one second, then I saw the stones on the ground and I thought "shit, it's the earthquake", it was as if I had re-set my brain, and I went along with mechanical memory, I mean I had identified priorities 1, 2 and 3 and until I hadn't completed all of these priorities I didn't stop*"
>
> [Female, 25]

A large number of different actions oriented towards a goal were described by most participants (72% of total sample). The most commonly reported external action was that of providing both practical and emotional support to other people in need (64% of total sample). Practical support ranged from offering food and water, giving people clothes and bedcovers, up to providing first aid and rescuing people from under the debris. At times, participants reported putting their own safety at risk in order to help others. People often reported that what pushed them to provide practical support to members of their community as well as strangers was the need to

feel useful and take agency in relation to the situation together with an identification with the suffering of others during the event.

> "*I put myself in the background in order to help others, I instinctively annihilated my ego, I considered the life of another person from Amatrice just as important as my own life"*
>
> [Male, 28]

Participants also reported providing emotional support to others. This included calming and comforting others as well as being strong for people around them. One participant recalled his attempts to try and protect his elderly mother from the awareness of the loss of her town by telling her they were starring as background actors in a disaster movie and that everything she was witnessing was simply part of the movie set.

The act of providing emotional support was often associated with an attempt to put one's emotions on hold in order to concentrate on the suffering of others. Participants reported engaging in various kinds of emotional labour to regulate, postpone, and control their emotions in order to project and construct an exterior impression of calm for others, sometimes actively "lying to oneself" due to internal turmoil. Other people were conceptualised as open containers within which one could inject calmness, rationality, and tranquillity. Emotions were described as communicable entities. Participants reported having been able to maintain a state of calmness and detachment by "freezing" and "turning off" their feelings. This emotional blunting was at times identified as a "defence mechanism" to handle particularly distressing scenes such as removing corpses from the debris.

"I remember that every time that I heard of the death of someone I thought ok, in two or three days I will cry about the death of these people but now I have to try and help other people knowing that if I had let emotions take hold they might have stopped my action of helping others"

[Male, 28]

Some participants also reported being strong, firm, and courageous, often to their surprise. A process that entailed an active search and build-up of internal strength and courage within oneself was at times described in terms of "working up courage". One participant that had remained stuck under debris described how:

"*Generally I am a bit of a chicken, I faint, I am afraid of driving the car, I am afraid of everything, but when I was under there I felt such a strength, because you want to live and so you do everything in order to live*"

[Female, 60]

At the cognitive level participants also described a particular state of enhanced focus on action. This was a state characterised by heightened levels of concentration and problem-solving, enhanced awareness and perceived rationality, mental lucidity and clarity, concrete thinking, and narrowing of attention on a specific aim. Participants recalled having few particular thoughts but rather being completely immersed in an action. The actions that participants were engaged in appeared to function as mental black holes, totally absorbing the cognitive capacities of the individual. Participants described this state of hyper-focus as similar to being

in a state of trance. One participant spoke of a "compulsion" to act. This experience was generally described as spontaneously entering an altered state of enhanced cognition that, to different degrees, went beyond usual experiences of attention, awareness, and concentration. Participants mentioned feeling extremely active and reactive with one participant illustrating the experience as being similar to that of having "a thousand eyes" and another as behaving "like a clock".

> "*My head was completely empty, I was only focused on acting […], it's not that while I was lifting the debris I was thinking about things, I didn't think about anything, it was similar as when I go running and I focus on the run itself, on my breathing*"
>
> [Male, 31]

4.3.3.3 Cognitive overload

The overwhelming intensity of thoughts, feelings, and sensory stimuli experienced during the traumatic event led some participants to enter a state of cognitive overload, a reaction consisting of moderate to severe disruptions in how they processed information around them. This often led participants to feel confused during certain moments of the earthquakes. Participants described this reaction as feeling dazed or stunned and as not being able to fully take in, process, or understand what was happening. External and internal stimuli were described as being too intense and too fast-moving for cognitive capacities to keep up with them and assimilate them. The detachment from cognitive resources was described metaphorically by participants as being out of one's mind, feeling absent, like a zombie, struck by lightning or drunk, and acting "without cognition". This state was

often heightened when participants reported being woken up by the strong shaking and failing to understand what was happening.

> "*Confusion, I was in a state of confusion, you are confused, you don't know what to do, I wanted to help and maybe I helped a bit but then I left the scene and I would go somewhere else, yes in a state of total confusion* […] *especially the first seconds I remember that I turned around with my hands in my hair and asked myself "what can I do?""*
>
> [Female, 19]

Cognitive capacities were conceptualised by participants as being a finite container that was overflowing with powerful internal and external stimuli leading to confusion. Participants often compared their brains and minds to computers or mobile phones that were struggling to process the information received. Participants variously described their brain and minds as going into overload, haywire, or stand-by, as having to be reset or shut-down, or as not connecting and stalling.

> "*I had this phase of momentary blackout* […] *I was blocked, I really couldn't understand what I needed to do. In that moment everything is annihilated, it is as if you are a computer that has been reset, in that moment all the data in your brain has been zeroed by fear"*
>
> [Female, 19]

The two core underlying triggers for this state of cognitive overload were identified by participants as feeling overwhelmed by emotions and feeling flooded

by sensory stimuli, as if both the quantity and intensity of internal and external stimuli exceeded their psychological resources to process them. Two participants reported feeling as if this emotional load was making them "explode" while others used the metaphors of being physically engulfed by an avalanche of emotions or "submerged" by emotions.

> "*At the beginning you have too many emotions to manage and so your brain sort of goes in overdrive*"
>
> [Female, 28]

Participants also reported that the amount and the intensity of sights, sounds, and smells contributed to the feeling of cognitive overload. Virtually every participant clearly recalled the darkness, the stench of gas, the taste of dust in one's throat, the sound of people calling for help from under the debris and the deafening rumble of the earthquake and of houses collapsing, together with the feeling of broken glass and sharp materials under one's feet.

> "*I remember this infernal heat, this heat that was suffocating me, mixed with the dust, and these deafening sounds of the ambulances, of the police cars, the sound of helicopters* […], *this huge chaos, it disoriented me, it stunned me*"
>
> [Female, 32]

Participants reported that thoughts appeared disorganised, racing, and disconnected one from another. Thoughts were described as possessing a materiality

and a mass that caused them to “crowd”, “pile-up”, “cram”, and “condense” in one’s mind. Additionally, thoughts acquired a “stickiness” that made them clump together and made it difficult for participants to distinguish one thought from the other. Interestingly, while some participants reported an over-abundance of thoughts during cognitive overload, others also described an opposite state of thought vacuum and cognitive void where they reported experiencing no thoughts.

> “*In the first moments I couldn’t divide different thoughts one from another, I couldn’t think rationally at only one thing at a time, in that moment they were all clumped together and I couldn’t manage to divide them”*
>
> [Male, 20]

For some participants, lucidity and cognition were described as resources that had got lost in the chaos of the situation. One participant described how their mind, generally used to indicate cognitive capacities, felt “obscured” and how they were experiencing “brain fog” as they struggled to put things into focus. In particular, some participants reported that, while their basic psychological functions such as perception kept working, they would fail to be integrated at a higher cognitive level with thoughts and beliefs. One participant described this as “seeing without understanding” and another participant as “the mind being outside of what the eye sees”. An extreme example of this phenomenon is captured in the case of a woman who had found her baby lying in the dust and had felt emotionally overwhelmed by the thought that her daughter had died. While picking the baby up she had however seen that the baby was simply in deep sleep and was still breathing. Despite therefore having perceptually observed that the baby was alive she described how she still kept

cognitively believing and thinking that the baby had died for several hours. Less dramatic examples of this detachment and failure of integration between lower-level perceptual capacities and higher-level cognitive ones were also described by other participants.

> "*I didn't immediately gain awareness of the severity of the earthquake, I saw the stones of the school in the middle of the road but even here I didn't really realise, I mean I saw them, I saw them but it was as if I hadn't seen them, it was a sort of seeing them but not thinking about it, as if I didn't want to think about it*"
>
> [Female, 59]

This state of cognitive overload also led to disruptions in carrying out goal-oriented behaviours as participants reported not knowing what to do and how to react during and immediately after the events. One participant described how he was in such an intense state of confusion in the hours following the earthquake that while he thought he was tying his shoes-laces people next to him made him notice that he had stones rather than shoes in his hands.

> "*Everything people have taught you* [on what to do during an earthquake], *that you should go around and help people in this way and in that way does not exist, does not exist, you don't have the lucidity, you do stupid things like walking over debris, going under* [unstable] *structures, things that with lucidity you would never do, but you do not think*"
>
> [Male, 42]

As with emotional distress, the initial phase of cognitive overload was, in some participants, followed by the ability to gather one's cognitive resources and enter a more reactive and focused state. Others reported fluctuating between moments of cognitive overload and moments of rationality. Conversely, a minority of participants reported exiting this state of confusion and overload only days following the event.

4.3.3.4 Dissociation

Participants reported experiencing a variety of peritraumatic dissociative reactions. These reactions clustered around three key phenomena: distortions in one's sense of reality (*i.e.* derealisation), distortions in one's sense of self *(i.e.* depersonalisation), and emotional numbness. The most commonly reported dissociative reaction was experiencing distortions in one's sense of reality (51% of the entire sample). The disaster experience was permeated by a profound perception of "un-reality". Some of the most common adjectives participants used to describe what they experienced were "surreal", "absurd", "impossible", and "unbelievable" to indicate the disintegration of their perception of reality. The most widespread perception concerning derealisation described by participants was the feeling of being in a dream during the earthquake events. This recurring comment concerning the dream-like quality of the experience might have also been partially due to most participant being woken from sleep by the earthquake. Participants also described feeling part of a movie, a fiction, a parallel reality, another dimension, or a videogame.

"It felt as if I was in a dream, a thing that you don't think it's real, […] *I mean you were aware that it was all real but I had such a zeroing of emotions that I kept thinking "now I am going to wake up" I knew that it was real but at the emotional level it was as if it wasn't real, a really strange thing"*

[Female, 23]

People reported struggling internally to determine whether what they were experiencing was real or the fruit of their fantasy. Reality was described as possessing a malleable and ambiguous quality as what they experienced deviated from their concept of normality so dramatically. The veil between reality and fantasy as well as between wakefulness and sleep had acquired a porous quality allowing one to blend into the other as participants described "losing touch with reality". One participant described the urge to open the coffin of one of his deceased friends to actually make sure he had died and that he was not imagining everything. Participants proposed that derealisation could have been a form of "self-defence" that their "brain" had actively conjured as an unconscious attempt to "reject" what was happening to them. One participant described this state as a mental "shield" and another described it as "protective".

"*You don't manage to realise what you are seeing, the mind is detached from what the eye sees, the eye sees the disaster, it sees everything that has happened and your mind inside you says no, it's not like that, now you will wake up, it's not like that, there is a total rejection of the situation, in that moment it's as if you are two people*"

[Female, 47]

Participants often resorted to comparing their experience to fantasised realms of unimaginable destruction and suffering. Participants commonly compared their experience during the earthquakes to that of a war-setting likening Amatrice to their mental representations of "Kabul", "Baghdad", "Aleppo", "bombings", and "concentration camps", used as symbols to convey the unbelievable and indescribable scenarios of sudden death and destruction they witnessed. Other participants spoke about feeling like in an "alien invasion", "a lunar landscape", or in a "science-fiction". Ordinary language and terms of reference seemed to fail in portraying the uncanniness of the situation forcing participants to turn to tropes of extreme absurdity and otherness.

> "*I remember that in the place where once there was the pharmacy there was this huge tent and inside there were all the corpses, it looked like a war, I remember watching Aleppo on the television and Amatrice was worse than Aleppo* […], *dust, people that came towards you disoriented, scared, full of blood, begging for help"*
>
> [Female, 61]

Together with a disintegration in their sense of reality, a smaller number of participants also reported disintegration in their usual sense of self and personhood (*i.e.* depersonalisation). Participants reported not feeling like themselves or feeling outside of themselves. One participant described this sensation as being so acute that he started thinking he had disappeared or become invisible, a "ghost", and touched

himself to check he was still existing. Another participant described how she felt "dead". A further reaction associated with depersonalisation was the feeling of being a spectator of what was happening or being "outside reality" rather than being directly involved in the experience. Participants variously described feeling like an "alien", an actor outside of the scene, like they were watching a movie with 3D glasses, or were observing animals at the zoo.

> *"It was as if I was outside of the world for a bit, it was me and only me, and the world was outside, as if there was no one else* […], *I didn't feel like myself"*
>
> [Male, 19]

Participants who reported disruptions in their sense of self and feeling "absent" often also described how at the emotional level they felt numb, apathetic, and empty. Participants reported a perception of emotional void, of having their affective resources completely depleted, of "feeling nothing", feeling "emotionally blocked" or unmoved. Participants described feeling their emotions being hollowed out like an "emptied carcass, only bones". Another participant described how she felt in such an acute state of flat affect that she felt "drugged", as if she had taken an "overdose of Valium". A participant described how, while his two children and partner were being extracted dead from the debris:

> "*In these moments there are no emotions, it's as if everything has stopped, inside of me, I felt it was useless to scream, it's useless, I was a person of*

stone, blocked, inside you are blocked […] *I didn't shed one tear, the feelings came after, in that moment there was nothing,* […] *it's unexplainable"*

[Male, 47]

4.3.3.5 Mental defeat and loss of control

Helplessness was a prevalent (60% of total sample) peritraumatic response. The earthquake was often conceptualised as an entity that exceeded any human attempt to react to it. Indeed, while individuals reported losing their own sense of agency, they simultaneously projected a sense of all-powerful agency onto the earthquake itself. Many participants animated the earthquake constructing it as an active and intentional entity endowed with human-like traits such as cruelty, evilness, ferocity, violence, and rage while also always remaining distinctly un-human in its omnipotent strength. Participants variously described the earthquake as a monster, a giant, a beast, the devil and reported feeling chased by it or begging it to stop.

"*It felt as if we were inside the hands of a giant that did like this* [makes shaking motion with hands], *it moved us like a dice.* […]*"*

[Female, 33]

This perceived loss of human agency was at times associated with a feeling of defeat, discouragement, and resignation as some participants reported losing all hope, feeling destroyed as a person, or "psychologically annihilated". Some participants reported losing interest in whether they were going to live or die and surrendering to the event. This feeling of defeat was also associated with a

perception of exhaustion as emotional, physical, and cognitive resources had been depleted leaving participants feeling drained.

> "*I felt weak in these moments, I had a feeling of powerlessness, like when you want to do something and you don't manage to, as if you wanted to move a mountain, it's impossible"*
>
> [Male, 50]

Helplessness and the perceived loss of human agency also contributed to shifts in the perception of self and personhood during the earthquakes. Some participants reported feeling like a "pawn" or a "vegetable" at the mercy of nature. This sense of objectification was at times exacerbated to the point of participants perceiving themselves as being nothing or no-one. Other participants described how the power of the earthquake made them feel like a "shit" or an "amoeba", adding worthlessness to their sense of helplessness. Individuals felt hollowed out of their humanness as their life was perceived as becoming dependent on chance, miracles, luck, and nature rather than individual will-power. This perception was generally associated with feelings of being useless, insignificant, small, and defenceless as well as vulnerable, fragile, and lonely.

> "*In that moment you realise you are a nullity, you realise that your life is worth nothing, it doesn't matter how many people you saved or whether you built hospitals in all the world, it counts nothing, in that moment you are no-one, you are only something to get rid of, a pawn*"
>
> [Female, 27]

4.3.3.6 Immobility and somatic reactions

Participants also experienced a diverse range of psycho-somatic reactions. The most commonly reported (37% of total sample) psycho-somatic reaction was physical immobility. Participants reported generally experiencing immobility during the moments corresponding to the earthquake shock, although some participants had also experienced the reaction when exposed to very distressing scenes. Physical immobility was often associated with feelings of loss of control over one's own body. Participants generally described the sensation of having their entire body or specific body parts, usually legs and feet, blocked, heavy, stiff, rigid, paralyzed or immobilized. They described feeling as if their body was "not responding" to intentional commands. Two participants described themselves as a "mummy" and as a "doll" respectively, inanimate objects unable to move autonomously.

> "*During the moments when the shock was at its strongest, practically I felt that my legs were blocked, and therefore if I tried to take one step ahead I felt as if my legs were incredibly heavy, as if a leg weighted 200kg, I really couldn't move, completely blocked*"
>
> [Male, 25]

Some participants reported automatically feeling paralysed, despite wanting to move. Among these participants physical immobility was generally associated with feeling overwhelmed both emotionally and cognitively.

"*I remained still in my bed, clinging to my bed sheets, I remember hearing the sound of the walls crumbling and I understood that the house was breaking but I could not manage to comprehend the severity of the situation* […] *in that moment I couldn't do anything, I couldn't manage to move, I didn't manage to get up*"

[Female, 18]

Conversely, some participants reported a more deliberate instinct of trying to stay "still" due to feeling helpless. This appeared to be similar to a "playing dead" response. Indeed, as detailed in the mental defeat section, the earthquake was at times perceived as a possible predator, such as a monster or a beast. Some participants reported engaging in physical immobility as a survival strategy that could have been used against a living creature.

"*During the earthquake shock while me and my wife were hugging each other under the bed I kept telling her "be quiet be quiet be quiet" as if the earthquake went directly towards who screamed and instead the silence made you go unnoticed, as if, if he* [the earthquake] *didn't hear us he would go somewhere else*"

[Male, 46]

Participants at times struggled to precisely recall whether their immobility response was purely psychogenic or mechanical, *i.e.* due to the very strong motions of the earthquake impeding movement. People reported that they managed to exit this stage of immobility either during or immediately after the earthquake shock

usually due to other people around them encouraging them to "switch" to a reactive mode or because the acute phase of helplessness or emotional/cognitive overload had ended, *e.g.* the shock had stopped. Therefore, physical immobility was reported as being a transitory state usually lasting a few seconds or, less frequently, a few minutes. Some participants also reported that this moment of immobility was functional for them to orientate their attention in order to rationalize and understand what was happening.

> *"While if a ship is sinking you can throw yourself in the sea and try and swim in an event like this one you cannot do absolutely anything, it paralyses you, right I was paralysed because it lasts just a few seconds but it's so violent that it doesn't allow you the time to react, you only think "let's hope I survive"* […], *you don't even say "let's run away"* […], *in that minute, two minutes you are literally paralysed, you cannot move* […] *I remember being on the bed and not being able to move, I only managed to move once it* [earthquake shock] *finished*"
>
> [Male, 52]

Participants also reported psycho-somatic reactions related to fear responses such as fainting, shaking, or losing one's sense of appetite and thirst. Additionally, in a minority of participants, a variety of psycho-somatic reactions linked to immobility were reported such as not feeling pain (*i.e.* anaesthesia), not being able to scream or shout (*i.e.* vocal suppression), and feeling cold.

"*While I was inside the debris as my house was collapsing, I didn't feel any physical pain, this is adrenaline right? It felt as if I was falling in cotton-wool, but then when they brought me to the hospital I was covered in blood*"

[Female, 60]

4.3.3.7 Positive affect

A number of more positive emotions were also reported by participants. As with most other reactions, positive emotions were localised to specific moments of the traumatic events rather than generalised to the entire event. Hope was the most common positive emotion reported by participants (29% of the total sample). The earthquake events were conceptualized as spaces of intrinsic uncertainty and ambiguity and while some participants filled this lack of information with catastrophic prospects and anxiety, others filled them with hope. Participants often reported hoping that people close to them had survived the earthquake while some reported hoping that they were in a dream. Hope was generally described as being feeble with participants speaking of "glimmers" or "strings" of hope that could be easily extinguished by the harshness of reality. Hope was often reported during moments when participants had not gained full awareness of the situation, although some participants reported "clinging" to hope despite clear contrary evidence.

"*You knew that it was a real thing, but inside yourself you kept hoping that it was a dream, that you would have woken up the following day and nothing would have taken place, I would have woken up in my normal house, in my bed, but inside yourself you know* [that it has happened], *you hope that it*

hasn't, you cling to anything, you hope it's a joke but at the end you realise it's not a joke"

[Male, 19]

A number of participants also reported transient feelings of joy and happiness in certain moments during the earthquake events. Seeing people being extracted alive from the debris or being reunified with family members as well as perceiving a sense of community connectedness were key moments when participants reported feeling joyful, happy, or relieved. These emotions were often reported as being circumscribed in time and "mixed" with a diverse range of other feelings and thoughts which often changed rapidly. In the midst of terror, fear, and anxiety some participants were still able to identify moments of lightness. A participant who had lost her husband next to her under the debris described how she had felt comforted by the kindness of the medical personnel who had extracted her.

"*One moment we cried, one moment we laughed, and one moment we comforted each other, it's a mix of feelings, it's difficult to explain, it's a jumble of sentiments, of thoughts*"

[Male, 25]

"*I remember when we saw all of our family members, or people that up to the day before you had never talked with and you would hug each other, there was this feeling of brotherhood, people that maybe before you didn't even like, but seeing them there it was such a joy*"

[Female, 23]

4.4 Discussion

This is the first study to explore naturalistically the lived experience of peritraumatic reactions in a large sample of individuals exposed to the same traumatic event. Our findings provide empirical support for the identification of peritraumatic dissociation, distress, immobility, and mental defeat in the quantitative literature. While some work has explored peritraumatic reactions qualitatively during distressing events it has generally done so tangentially or in small samples (for tonic immobility see Ayers, 2007; TeBockhorst, O'Halloran, & Nyline, 2015; for peritraumatic dissociation see Mattos, Pedrini, Fiks, & de Mello, 2015). Additionally, this is the first study to explore immobility and mental defeat during an earthquake. This shows that these two peritraumatic constructs, mostly conceptualised in relation to interpersonal violence, might be relevant to other traumas as well.

The accounts provide insight into an under-studied peritraumatic reaction, that of cognitive overload, *i.e.* a state of disruption in information processing mechanisms characterised by a perceived sense of confusion, a lack of integration of sensory-perceptual stimuli into higher cognition, and disorganised, overwhelming, and racing thoughts. Certain sub-components of cognitive overload, such as confusion and disorientation, have also been identified and explored in research (Dunmore et al., 2001; Kannis-Dymand et al., 2015; TeBockhort et al., 2015) and are covered by certain items of the Peritraumatic Dissociative Experience Questionnaire (Marmar et al., 1994) and the Data-Driven Processing Scale (Halligan et al., 2002). However, no systematic research had previously investigated the phenomenological characteristics of this construct in trauma-exposed populations.

Our results also highlighted the presence of a range of more adaptive and positive peritraumatic reactions such as hyper-focus on action and positive emotions such as hope, joy, and relief. These reactions have received virtually no attention in the peritraumatic literature and its focus on more negative and dysfunctional reactions has meant that more normative aspects of trauma responses have been neglected (Bonanno, 2004). Survivors did not experience distress, dissociation, and helplessness passively but were able to respond and endeavour to manage these reactions through various coping mechanisms such as emotional regulation and cognitive focus on goal-oriented actions. This could provide some explanation for the wide-spread psychological resilience shown by survivors following disasters (Bonanno, Brewin, Kaniasty, & LaGreca, 2010) as these more neutral and adaptive reactions, and their consequent appraisal post-trauma, could play a protective role against post-trauma psychopathology. Additionally, as Wilson et al. (2012) suggest, the identification of more neutral and adaptive reactions might represent a useful area of focus during trauma therapy in order to encourage the patient to build a more comprehensive and nuanced account of their trauma narrative.

Another core finding from the data cutting across most reactions was the inherently social dimension of the peritraumatic experience in the current sample, *e.g.* most participants reported noticing the reactions of others, fearing for others, and supporting others. While the findings are limited by possible social desirability bias, they are in line with findings from social psychology highlighting the cooperative, social, and non-selfish nature of most reactions during mass emergencies (Drury, 2018). While panic and individual competition might at times take place, in particular when personal risk and time pressure are especially high (Alexander, 1995; Frey, Savage, & Torgler, 2010), they tend to be an exception to

the rule. As mentioned in the introduction to this chapter, when survivors are asked to spontaneously describe reactions during trauma, providing practical and emotional support appears to be a widely reported behavioural reaction (Wilson et al., 2012).

Studies that looked specifically at cooperative and altruistic behaviour during emergencies have provided further evidence for this. For example, various studies focusing on group behaviour during the July 7th London bombings have found consistent reports of survivors receiving and/or witnessing both emotional (*e.g.* providing reassurance) and practical (*e.g.* giving water or tying tourniquets) support by others (Cocking, 2013; Drury, Cocking, & Reicher, 2009a). Survivors reported witnessing only a small number of selfish behaviours such as pushing others away to flee. The presence of supportive and helping behaviours was further confirmed in a study investigating collective behaviour across 11 emergencies (N = 21) (Drury, Cocking & Reicher, 2009b). These behaviours were especially prevalent among individuals who felt a shared sense of togetherness and identity *emerging* with other survivors during the event.

Some theoretical models have been put forward to explain this affiliative behaviour during emergencies (Mawson, 2005). In particular, the perception of sharing a common fate during a disaster leading to the emergence of a shared social identity has been hypothesized to be the underlying factor motivating supportive collective behaviours during emergencies (Drury, 2018). This has been shown to take place at times even among people with no connection prior to the emergency (Bartolucci & Magni, 2017). Primary support for the link between shared identification and altruistic and helping behaviour has been provided in studies among survivors of the 2012 Emilia-Romagna earthquakes in Italy (Vezzali, Drury, Cadamuro, & Versari, 2016) and survivors of the 2010 earthquake and tsunami in

Chile (Drury, Brown, González, & Miranda, 2016). Therefore, supporting and collaborating with others during certain traumatic events is a peritraumatic reaction that, despite a substantial amount of evidence in the social psychology literature, has received virtually no attention in the traditional psychotraumatology literature.

On the contrary, a latent assumption underlying most of the peritraumatic literature is that individuals' reactions are internal constructs uncorrelated and independent from the reactions of others also present during the traumatic event. Across the 63 items of the six most widely used standard peritraumatic measures[2], only 3 items acknowledge the possible presence of others during the traumatic event (*e.g.* item 7 of the Peritraumatic Distress Inventory (Brunet et al., 2001) "*I felt worried about the safety of others"*). People are conceptualised as panicking, dissociating, and freezing as if existing in parallel worlds from other people involved in the traumatic event with no possibility of interaction. As many traumatic events are events where a number of people are involved, future peritraumatic research should give more weight to the interactions between different individuals.

In contrast to the literature on peritraumatic reactions in psychotraumatology, the field of social psychology has instead long been interested in the influence that individuals within groups can have on one another (Le Bon, 1895). The possibility that the reaction of one individual during a distressing event can influence that of others was first systematically studied in relation to the fear of "contagion" of mass panic among soldiers during war (Strauss, 1994). The notion of "mass panic" has since gradually lost traction due to unclear and poor conceptualisations of the construct across disciplines (Fahy, Proulx, & Aiman, 2012), lack of evidence for its

[2] Peritraumatic Dissociative Experiences Questionnaire, Peritraumatic Distress Questionnaire, Tonic Immobility Scale, Mental Defeat Questionnaire, Somatoform Dissociation Questionnaire-Peritraumatic, Data-Driven Processing Scale

presence (Sheppard, Rubin, Wardman, & Wessely, 2006), and its assumption of irrationality, a difficult assumption to prove in an emergency where people might act rationally on the basis of very limited information (Sime, 1990).

An alternative conceptualisation of people being influenced by the reactions of others during an emergency has been that of heuristics (Drury, 2018). Indeed observing how other people react during an emergency can, in many cases, be a good baseline upon which to decide how to react oneself (Gigerenzer, 2008), especially when we share a social identity with the people of which we are observing the reaction (Reicher, 1984). Considerable evidence of people modelling their reaction upon the reaction of others during emergencies comes from numerous experimental studies on evacuation behaviour (Latané & Darley, 1968; Nilsson & Johansson, 2009). Additionally, the literature on emotional, social, and behavioural contagion (Levy & Nail, 1993) further indicates how, under certain circumstances, affective states, cognitions, and behaviours can spread across individuals and groups (Hatfield, Cacioppo, & Rapson, 1994). Experimental evidence also suggests that behavioural mimicry and emotional contagion might be heightened in stressful situations (Gump & Kulik, 1997), and that the physiological markers of stress might be transmitted between individuals (de Groot, Smeets, Kaldewaij, Duijndam, & Semin, 2012; Dimitroff et al., 2017; Engert, Plessow, Miller, Kirschbaum, & Singer, 2014)

Outside of the literature on evacuation and emotional contagion, the study by Drury et al. (2016) of the 2010 Chile earthquake and tsunami found a strong link between reports of observing social and emotional support in others and providing support oneself. A meta-analysis has recently confirmed that witnessing prosocial

acts consistently inspires others to act kindly as well (Jung, Seo, Han, Henderson, & Patall, 2020).

Additionally, the study by O'Toole (2017b) on teachers during the Christchurch earthquake shows that individuals can also sometimes model their reactions in order to counter-balance the reactions of others, for example by trying to stay calm in order to reassure others in distress. This finding was confirmed in our sample. People can also use the reactions of others as a tool to self-regulate, such as in the case of a teacher repeating the breathing patterns seen in another teacher to calm herself (O'Toole, 2017b). The simple presence of others seems to be able to modify peritraumatic reactions. For example, Prati et al. (2012) reported that people were less likely to evacuate their houses during an earthquake if they were together with other family members.

Importantly, it remains unclear how findings from disasters might generalise to other traumas characterised by different social dynamics, such as rape or motor vehicle accidents. Overall, despite growing attention to socio-interpersonal dynamics in the field of PTSD (Maercker & Horn, 2013), the peritraumatic literature has traditionally studied peoples' reactions during and following trauma from an overwhelmingly individualistic perspective.

Another theme cutting across most peritraumatic reactions concerns participants struggling to describe in their own words certain reactions they experienced, a phenomenon reported by over half of participants, with a quarter of the sample describing certain reactions as "strange". Additionally, one fifth of participants reported experiencing "mixed", often contradictory, reactions simultaneously, such as feeling hopeful but sad at the same time. As a result of this, participants relied heavily on metaphors when describing their experience as

ordinary language seemed to fail in capturing its strangeness and complexity (van der Kolk & Fisler, 1995). This "indescribability" of certain traumatic constructs replicates findings from Černis, Freeman, and Ehlers (2020) and provides empirical support to the linguistic work by Caruth (1996) concerning the unspeakability of trauma as a crisis in representation. These findings suggest that therapists might investigate the experience of peritraumatic reactions using means other than words, such as imagery, drawings, or body movement. Additionally, future work might explore whether different degrees of "indescribability" of reactions are associated with different degrees of disruptions of higher-order cognitive processing, and subsequently with different levels of PTSD.

Another novel contribution to the literature was the finding that participants reported fluctuating between a considerable variety of different peritraumatic reactions during the traumatic event (M = 21, range = 6-43). As mentioned in the previous chapter, this highlights how the notion of a traumatic event might be best understood as an umbrella term containing within it many sub-events with different peritraumatic characteristics. As Marks, Franklin and Zoellner (2018) argue, in the case of sexual assault, "*an individual may experience a sense of safety that shifts to threat, and to fear leading up to the assault, intense fear, disgust, and helplessness during the assault, and relief and shame in the aftermath"* (pg. 42). Indeed, in our sample, participants reported "switching" out of initial negative peritraumatic reactions into more reactive modes, as well as fluctuating between different reactions and different degrees of the same reaction.

The current quantitative methodology that requires participants to indicate the extent to which they experience a certain reaction for the entire duration of the traumatic event might therefore be flawed. For example, the most used peritraumatic

measure, the Peritraumatic Dissociative Experiences Questionnaire (Marmar *et al*., 1994), asks participants to indicate the degree to which they experienced a list of dissociative reaction "during and immediately after the crucial incident". The other most commonly administered measures also use similar instructions. However, by referring to the entire traumatic event as a whole entity, it is unclear how participants are answering the questionnaires. Participants might be mentally calculating an average score of their recalled reaction throughout the entire trauma, based on their own perception of when the trauma began and when it ended. Alternatively, they might be answering in relation to the particular moment during the trauma in which they experienced the reaction the most or even in relation to a moment in time that is not representative of the overall experience.

The fluctuating nature of emotions, thoughts, and behaviours during trauma has received some attention, but no study has yet focused on peritraumatic reactions specifically. A study among survivors of various emergencies did find that feelings of unity gradually emerged and increased among the people involved as the emergency developed (Drury et al., 2009b). There is also some evidence coming from the study of emotional reactions among the general public during major disasters. One study used data from half a million US national text pager intercepts of the 24h period covering the September 11th attacks (Back, Küfner, & Egloff, 2010). By coding each 5-minute period of the attack for words corresponding to sadness, anxiety, and anger they found that specific time-sections of the unfolding event were characterised by differential prevalence in the three emotions. For example, the emotional timeline showed that anxiety was the most prevalent emotion during the collapse of the Twin Towers while anger became the most prevalent reaction as time passed and new information concerning the attacks became

available. Similar findings concerning the fluctuating nature of emotional reactions during emergencies were found in another study using Twitter feeds during the 2013 Boston bombings (Lee, Rehman, Agrawal, & Rao, 2016).

Future work should be more attentive to these fluctuations within and between reactions, especially since experimental work has shown that this fluctuation within peritraumatic reactions might be clinically meaningful, for example in determining which moments of the traumatic event are encoded as intrusive memories (Chou et al., 2014a), as shown in Chapter 3. Furthermore, as participants often reported "switching" between different peritraumatic reactions during the course of the trauma, future research might attempt to identify the "switches" allowing people to move from negative peritraumatic reactions to more neutral and adaptive ones.

The current study has a number of limitations. These include the retrospective nature of the peritraumatic accounts, since the accuracy and consistency of traumatic memories is a subject of controversy (Brewin, 2018). While all peritraumatic recollections will be retrospective, future studies might attempt to collect data closer to the traumatic event. Another limitation concerns the possibility of social desirability bias skewing the reporting towards socially acceptable reactions such as helping others and away from shame-provoking reactions such as selfish behaviour. As Drury (2018) suggests, future work might attempt to diminish this bias by asking participants to describe the peritraumatic reactions observed in others rather than in oneself. A related limitation is that the answers that participants gave might have been influenced by my characteristics, i.e., a young male researcher. Some participants might have omitted certain reactions out of fear I could not understand them or because I could not relate to them. For example, a mother who

had lost both her children reported not being sure whether to disclose her feelings and thoughts as she wondered how I could understand them without having had children myself. This positionality limitation is inherent to qualitative research (Bourke, 2014). However, it is likely to have been buffered by the very diverse sample of participants which would have avoided systematic bias in the reporting of reactions.

Additionally, the open and exploratory method used in the current study, while allowing for narratives to arise organically and spontaneously, might have also led to the omission of certain reactions as participants only reported those that were salient and noteworthy for them. Future studies will be necessary to test whether the current reactions are generalizable to other survivors of other types of traumatic events in other cultural contexts. Furthermore, certain participants might differ in their ability to describe their own feelings and sensations, leading to variance in the amount and detail of reactions provided. Future work might attempt to control for this effect by measuring emotional granularity and interoceptive awareness among responders. Additionally, although a number of precautions were taken such as ensuring not to inject any technical content into the interviews and having a second coder naïve to the field re-code a subsection of the data, the awareness the authors had of previous work on peritraumatic reactions could have inadvertently biased the interpretation of the data towards pre-existing conceptualisations of the reactions.

Another possible limitation is that, by aggregating the descriptions of peritraumatic reactions from both the intrusive memory and control memory moments, this will have led to participants with intrusions being able to contribute more material than participants without intrusions, who were asked to report on their peritraumatic reactions only for the most distressing moments. Therefore, while

quantity of information is not necessarily an indication of salience, the prevalence rates reported in Table 4.2 should be interpreted with caution as they might not reflect actual prevalence during trauma but simply how prevalent these reactions were in the narrative of the participants and might be influenced by a number of factors such as talkativeness of the participants or whether the participant was asked about one or two memories.

A final limitation is that of restricting the qualitative reporting of peritraumatic reactions to only those reported by more than 25% of the entire sample. Some of these reactions, despite being reported by a minority of participants, might still be relevant for subsequent psychopathology, e.g., panic and feeling trapped or loss of emotional control, and future researchers might want to explore these in more detail. Reactions endorsed by less than 25% of the sample were still qualitatively analysed and are available from the author upon request but were not included in current chapter due to space limitations. This facilitated provison of extensive qualitative information on the more commonly reported reactions. All reactions are still reported in Table 4.2.

Peritraumatic reactions, together with pre- and post-trauma factors, play a key role in the development of post-traumatic psychopathology and in influencing survivors' wellbeing. An improved understanding of their phenomenological characteristics is an important research as well as clinical priority.

This study adds to Chapter 2 in providing a new bottom-up and inductive perspective on peritraumatic reactions. The next chapter will represent an attempt to replicate the findings from Chapter 3 where I showed that the peritraumatic factors identified in Chapter 2 were more prevalent in moments of the trauma that were later experienced as intrusive memories in comparison with moments of the trauma that

did not later intrude. In the next chapter, I will build on the peritraumatic conceptualisation developed in this chapter, to once again test the association between peritraumatic reactions and intrusive memories.

5 Chapter 5: Relationship between Peritraumatic Reactions, Intrusive Memories, and Gender among Earthquake Survivors in Italy: A Mixed-Methods Analysis

A version of this chapter will be submitted for publication in the *Journal of Affective Disorders*.

Massazza, A., Joffe, H., & Brewin, C. R. (2020). Relationship between peritraumatic reactions, intrusive memories, and gender among earthquake survivors in Italy: A mixed-methods analysis

As mentioned in Chapter 4, a limitation of Chapter 2 and 3 is that they relied on a conceptualisation of peritraumatic reactions largely based on the quantitative literature with the identification of peritraumatic reactions often relying on clinical experience, animal models, or theories rather than on a systematic assessment of the lived experience of trauma survivors. Chapter 4 addressed this limitation by investigating, using a largely inductive analytic framework, the spontaneously reported peritraumatic reactions in a large sample of disaster survivors. The current chapter attempts to replicate findings from Chapter 3 by quantifying the qualitative data and testing the hypothesis that the moments of the trauma later experienced as intrusive memories would be characterised by higher levels of peritraumatic reactions when compared to the moments of the same trauma experienced as normal autobiographical memories.

5.1 Introduction

Intrusive memories can be common and persistent occurrences among earthquake survivors (Roncone et al., 2013). According to modern cognitive theories of post-traumatic stress disorder (PTSD), the way in which memory is encoded at the time of the trauma is key in determining the development of intrusive memories (Brewin, Dalgleish, & Joseph, 1996). The emotional, cognitive, and behavioural phenomena taking place during traumatic memory encoding have been collectively termed peritraumatic reactions (Gorman, Engel-Rebitzer, Ledoux, Bovin, & Marx, 2016). These include reactions such as peritraumatic dissociation and distress.

Despite the theoretical link, most research to date has focused on the link between peritraumatic reactions and overall PTSD (Ozer, Best, Lipsey, & Weiss, 2003) rather than intrusive memories specifically. Additionally, as highlighted in the previous chapters, most empirical research on the link between peritraumatic phenomena and intrusive memories has relied on the use of experimental paradigms with limited ecological validity (James et al., 2016). Finally, as mentioned in Chapter 4, peritraumatic reactions have generally been studied using deductive, quantitative measures not based on phenomenological studies. Therefore, the main aim of the current chapter is that of replicating findings of Chapter 3 by investigating the relationship between the spontaneously reported peritraumatic reactions identified in Chapter 4 and intrusive memories. Using a novel design described in Chapter 3, I set out to compare the peritraumatic reactions taking place during moments encoded as intrusive memories versus moments encoded as normal autobiographical memories.

A second aim of the study is that of investigating gender differences in peritraumatic reactions, which have been pinpointed as possible explanatory variables for the higher rates of PTSD among females in comparison with males.

5.1.1 Intrusive memories and peritraumatic reactions

Intrusive memories have been identified as one of the hallmark symptoms of the post-traumatic stress disorder (PTSD) diagnosis (Brewin, 2015). The most established cognitive theories of PTSD hypothesize that the emergence of intrusive memories is closely tied to how the memory is encoded at the time of the trauma, with disruptions in information processing identified as key causal mechanisms (Brewin et al, 1996; Ehlers & Clark, 2000). The affective, cognitive, and behavioural reactions taking place during traumatic memory encoding have been collectively termed peritraumatic reactions (Gorman et al., 2016).

As mentioned in Chapter 3, naturalistic studies investigating the link between peritraumatic reactions and intrusive memories among disaster survivors are scarce and have reported mixed findings (Duncan, Dorahy, Hanna, Bagshaw, & Blampied, 2013; Simeon, Greenberg, Knutelska, Schmeidler, & Hollander, 2003; van der Velden et al., 2006). Additionally, participants reported peritraumatic ratings for the *entire* trauma rather than focusing on the specific moments encoded as intrusive memories. However, experimental evidence indicates that fluctuation in peritraumatic reactions' levels during trauma might be an important variable in determinig *which moments* of the trauma are encoded as intruisive and which are not (Chou, La Marca, Steptoe, & Brewin, 2014a). This finding was confirmed in Chapter 3 of the current thesis by using a novel design whereby the peritraumatic reactions experienced during the specific moments encoded as intrusive memories are

compared to those experienced during moments encoded as normal autobiographical memory from the same trauma. However, Chapter 3 relied on a conceptualisation of peritraumatic reactions that has been shown to be incomplete by findings in Chapter 4. Indeed, in the previous chapter I identified a number of under-researched peritraumatic reactions such as cognitive overload as well as more adaptive reactions such as hyper-focus on action, emotional regulation and, among some participants, positive affect such as hope and joy. No study has yet investigated how these novel and under-studied reactions might relate to post-traumatic phenomena such as intrusive memories.

5.1.2 Peritraumatic reactions and gender

Women have a two to three times higher risk of developing post-traumatic stress disorder following trauma (Olff, 2017). A number of different hypotheses have been proposed to explain this difference in PTSD prevalence (Christiansen & Hansen, 2015). For example, men and women tend to experience different types of traumatic events, with women being exposed to types of trauma that tend to be more strongly associated with subsequent PTSD, such as rape (Tolin & Foa, 2006). Additionally, in the aftermath of a traumatic event women are more likely to seek social support (Olff, 2017), the absence of which has been shown to be one of the most significant predictors of PTSD (Brewin et al., 2000). Furthermore, despite most of the research being conducted with animal models (Baran, Armstrong, Niren, Hanna, & Conrad, 2009), neurobiological differences are also likely to play a role in explaining sex and gender differences in PTSD rates, for example in relation to differences in fear conditioning and extinction circuits (Lebron-Milad et al., 2012) or differences in amygdala reactivity (Frijling, 2017).

These gender differences in PTSD rates have also been identified following earthquakes (Dai et al., 2016). For example, two studies following the L'Aquila earthquake indicated that women were more likely to present symptoms of PTSD than men following exposure (Dell'Osso et al., 2011b; Dell'Osso et al., 2013). In another study among survivors of the L'Aquila earthquake, 54.7% of all women participants met criteria for a probable diagnosis of PTSD versus 27.5% of male participants (Carmassi et al., 2013).

Peritraumatic reactions have also been hypothesized as possible mechanisms for the higher rates of PTSD identified among females in comparison with males (Olff, 2017). Empirical work has suggested that peritraumatic reactions might play a role in determining higher levels of PTSD among females than males (Irish et al., 2011). Indeed, during the acute phase of a traumatic event, women tend to report higher rates of peritraumatic responses such as threat perception and distress in comparison with men (Lilly, Pole, Best, Metzler, & Marmar, 2009; Olff, 2017). However, the findings concerning gender differences in peritraumatic reactions are not consistent. For example, a number of studies have failed to identify sex differences in rates of peritraumatic dissociation (Demarble, Fortin, D'Antonio, & Guay, 2018; Punamäki, Komproe, Qouta, Elmasri, & de Jong, 2005). As a result of these inconsistent findings, the current study set out to investigate in more depth possible sex differences in the rates of peritraumatic reactions.

5.1.3 Research questions

The aim of the current chapter is that of investigating the relationship between spontaneously reported peritraumatic reactions with intrusive memories as well as

gender in a sample of earthquake survivors. In particular the present study will address the following research questions:

- How do spontaneously reported peritraumatic reactions among earthquake survivors relate one to another?
- Do the specific moments of the trauma encoded as intrusive memories differ from moments encoded as distressing but non-intrusive memories in terms of peritraumatic reactions? (replication of Chapter 3)
- Do female survivors report different levels of certain reactions in comparison with male counterparts?

5.2 Methods

5.2.1 Participants and recruitment

The participants in the current chapter are the same participants described in Chapter 3 and 4 and a subset of participants described in Chapter 2. All 104 participants were directly exposed survivors of the 2016-2017 Central Italy earthquakes.

This sample was identified building on a previous study conducted by the authors (Massazza et al., 2019) through the help of local health services and the local municipality. Participants were contacted individually either in person or by telephone and invited to participate. The purposive sampling strategy was aimed at reproducing the approximate demographic distribution of the population of Amatrice as a whole in terms of age and gender as per 2016 census (Istituto Nazionale di Statistica, 2016).

5.2.2 Materials

As described in Chapter 4, all interview transcripts were analysed thematically allowing spontaneously reported peritraumatic reactions to emerge inductively from the data. Detailed description of the qualitative analysis is reported in Chapter 4. 85 different peritraumatic reactions were identified and grouped into the following 7 different groups of codes:

- Emotional distress: including the 18 codes corresponding to fear, uncertainty, sadness, anger, anxiety, thoughts of death, guilt, shame, and panic.
- Action, hyper-focus, and emotional regulation: including the 18 codes corresponding to being aware, acting in a goal-oriented manner, staying calm, trying to be useful, being reactive, maintaining clarity of thought, helping others, being concentrated and focused, and detaching oneself emotionally.
- Cognitive overload: including the 9 codes corresponding to confusion, not knowing what to do, feeling overwhelmed, having racing and disorganised thoughts, failing to integrate information, and feeling disoriented.
- Dissociation: including the 9 codes corresponding to derealisation, numbness, distortions in sense of time, depersonalisation, and acting as if on automatic pilot.
- Mental defeat and lack of control: including the 8 codes corresponding to helplessness, feeling defeated/useless/insignificant/defenceless/vulnerable/lonely, being exhausted, feeling without control, and as if losing control over one's emotions.

- Immobility and somatic reactions: including the 11 codes corresponding to physical immobility, anaesthesia, and other arousal-related physiological reactions such as shaking, fainting or loss of appetite and thirst.
- Positive affect: including the 5 codes corresponding to hope, joy, social connectedness, sense of invincibility/exaltation, and awe.

More detailed descriptive information on the qualitative content of each code is provided in Chapter 4. For the mixed-methods analysis to take place, a process of "quantitizing" of the qualitative codes was undertaken (Sandelowski, Voils, & Kanfl, 2009). For the current mixed-methods analysis each individual qualitative code was transformed in a quantitative binary variable depending on whether the participant reported experiencing (coded numerically as 1) or not experiencing (coded as 0) the reaction. Each individual qualitative code was then summed together with the other individual qualitative codes belonging to the same peritraumatic group. The result of this was that the qualitative group of codes were transformed into 7 composite scores to be used in the statistical analysis.

The range of values for each peritraumatic group of codes was as follows: distress (0-18); action, hyper-focus, and emotion regulation (0-18); cognitive overload (0-9); dissociation (0-9), mental defeat and lack of control (0-8), immobility and somatic reactions (0-11), positive affect (0-5). These composite scores measured the number of different reactions participants mentioned experiencing within one peritraumatic group of codes and were used as proxy measures for the degree to which the participant experienced such peritraumatic reaction.

Finally, participants also completed a demographic questionnaire investigating traumatic exposure, gender, age, level of education, religious affiliation, and residency.

5.2.3 Procedure

As described in Chapter 3 and 4, all 104 participants participated in semi-structured interviews focused on their memories of the earthquake and their lived experience of peritraumatic reactions in the moments corresponding to those memories (for a detailed account of the procedure please see Chapter 3 section 3.2.2 and Chapter 4 section 4.2.2). If the participants reported having experienced an intrusive memory of the earthquake events, the participant was asked to go back in time with their memory to the exact moments they had described and to describe in as much detail as they could what they felt, thought, and did in these moments (script reported in full in Appendix E). As described in Chapter 4, participants with intrusions were also asked to identify a memory from the same trauma that was just as distressing as the intrusive memory but that had never intruded involuntarily and to describe the peritraumatic reactions experienced in those moments.

As described in Chapter 4, if a participant did not report experiencing any intrusive memories, they were asked to identify the most distressing memory they had of the earthquake events and to describe in as much detail as they could the content of the memory as well as the feelings, thoughts, and behaviours experienced in those exact moments (same script as for participants for intrusions reported fully in Appendix E).

5.2.4 Data collection

Data collection took place in the months of May, June, and July 2018, approximately 20 months following the earthquake in August 2016 and 15 months following the last major earthquake in January 2017.

5.2.5 Data analysis

Firstly, descriptive statistics were calculated for the entire sample, including how many participants reported experiencing intrusive memories of the earthquake and the content of such memories.

Importantly, the control memories of participants with intrusions and their corresponding peritraumatic reactions were excluded from the current chapter. The rationale behind this choice was that participants often struggled in the qualitative interview to report the peritraumatic reactions experienced *only* in the moments of the control memory as they had just finished describing the peritraumatic reactions experienced during the moments experienced as intrusive memories. This meant that, while describing the peritraumatic reactions experienced during the control moments, they would often refer back to the peritraumatic reactions experienced during the moments experienced as intrusive memories. This made it impossible for the author to clearly distinguish during the thematic analysis which reactions were experienced during the control moments and which during the intrusive moments in the qualitative transcripts of the control memories, leading to the exclusion of the control memories in this chapter.

Another reason for the exclusion of the control memories was that having spent considerable time describing the peritraumatic reactions experienced during the intrusive moments, participants often spent significantly less time describing the peritraumatic reactions experienced during the control moments (indeed the word

count for the description of peritraumatic reactions experienced during the intrusive moments was approximately twice the size as the word count for the peritraumatic reactions experienced during the control moments). This inevitably hindered the possibility of accurately comparing the composite scores of peritraumatic reactions experienced in the two moments. As a result, this chapter will only compare spontaneously reported peritraumatic reactions during moments experienced as intrusions with those experienced during moments experienced as most distressing memory among participants without intrusions.

After the exclusion of two participants[3], the remaining 102 participants were included in all the analyses.

Secondly, in order to investigate the relationship between different peritraumatic reactions, Pearson bivariate correlations were conducted between the 7 peritraumatic composite scores. All 7 peritraumatic composite scores were standardised in order to have a mean of 0 and a standard deviation of 1 throughout the analyses.

Thirdly, to investigate whether moments encoded as intrusive memories differed in peritraumatic reaction levels in comparison with moments encoded as non-intrusive most distressing memories I conducted a between-subjects multivariate analysis of covariance (MANCOVA) with memory type as independent variable and peritraumatic composite scores as dependent variables. In order to control for different lengths in qualitative narratives, the number of words each participant used when describing their experience of peritraumatic reactions was calculated and used

[3] One participant was excluded from the analysis as their most distressing memory did not happen during the peritraumatic timeframe (*i.e.* they reported that their most distressing memory was the dishonesty of politicians in the months following the earthquakes). Another participant was excluded from the analysis because of technical issues with the recording device which hindered a precise "quantitization" of the peritraumatic scores

as a co-variate in the model. Memory type differences for specific peritraumatic composite scores controlling for word count were then explored using individual one-way analysis of covariance (ANCOVA).

Finally, to explore whether female participants reported different levels of peritraumatic reactions than their male counterparts, I conducted another MANCOVA with gender as independent variable and the peritraumatic composite scores as dependent variables controlling for word count, followed by individual one-way ANCOVAs.

The composite scores for peritraumatic reactions were explored to assess univariate normality. Problematic deviations from normality were defined as variables that displayed skewness greater than ± 2 and kurtosis greater than ± 2 (Byrne, 2010; George & Mallery, 2010; Hair et al., 2010, Kline, 2011). Q-Q plots and box plots were also inspected. All of the composite scores displayed a distribution that approximated normality. Parametric testing was therefore deemed appropriate.

5.3 Results

5.3.1 Descriptive statistics

Detailed demographic information concerning the sample and its characteristics in terms of traumatic exposure is provided in section 3.3.1 in Chapter 3.

Fifty participants (49%) reported experiencing at least one intrusive memory since the earthquake events whereas 52 participants (51%) reported never experiencing an intrusive memory of the earthquakes. Eighty-tree percent (n = 43) of participants with intrusions were experiencing intrusions at the time when the

interview was conducted. As described more in detail in Chapter 3, differences in traumatic exposure between participants with intrusive memories and without intrusive memories were tested statistically. However, since the results were inconsistent, trauma exposure was not included as a covariate in the analyses.

The contents of the described memories are presented below in Table 5.1. As mentioned in the Methods section, the control memories of participants with intrusions were excluded from the current chapter.

Table 5.1 *Content of Memory According to Memory Type with Percentage of Times Mentioned in Brackets*

Intrusive memory (*n* = 50)	Most distressing memory (*n* = 52)
Earthquake shock on the 24th of August (32%)	Earthquake shock on the 24th of August (33%)
Seeing corpses or body parts in the debris (18%)	Collapsing buildings and material devastation (17%)
Collapsing buildings and material devastation (16%)	Seeing corpses or body parts in the debris (15%)
Rescue of individuals out from debris (16%)	Rescue of individuals out from debris (13%)
Witnessing people in distress, suffering (14%)	Moments of realisation of death of people (12%)
Getting out of collapsing buildings (12%)	Recognition and management of corpses (10%)
Moments of realisation of death of people (8%)	Earthquake shock on the 18th of January (6%)
Finding out/being told of death of people (8%)	Witnessing people in distress, suffering (4%)
Being stuck under debris (6%)	Finding out/being told of death of people (4%)
Recognition and management of corpses (2%)	Earthquake shock on the 30th of October (2%)
Earthquake shock on the 30th of October (2%)	Getting out of collapsing buildings (2%)
	Being stuck under debris (2%)

Note. One memory could contain more than one content themes.

The mean and standard deviation of the 7 unstandardised peritraumatic composite scores were as follows: emotional distress (*M* = *5*.31, *SD* = 2.45), action, hyper-focus, and emotion regulation (*M* = 5.19, *SD* = 3.1), cognitive overload (*M* = 2.61, *SD* = 1.75), dissociation (*M* = 1.91, *SD* = 1.62), mental defeat (*M* = 1.71, *SD* = 1.44), immobility and somatic reactions (*M* = 2.02, *SD* = 2.53) and positive affect (*M* = 0.79, *SD* = 0.79).

5.3.2 Relationship between peritraumatic composite scores

Bivariate Pearson correlations were calculated between the different peritraumatic composite scores. A correlation matrix is shown at Table 5.2.

Table 5.2 *Bivariate Pearson Correlation Matrix between Different Peritraumatic Composite Scores*

	Emotional distress	Hyper-focus, emot. regul.	Cognitive overload	Dissociation	Mental defeat	Immobility, somat. react.	Positive affect
Emotional distress	-						
Hyper-focus, emot. regul.	-.08	-					
Cognitive overload	.22*	-.05	-				
Dissociation	.13	.06	.35***	-			
Mental defeat	.35***	.06	.18	.21*	-		
Immobility, somat. react.	.25*	-.04	.19	.26**	.12	-	
Positive affect	.02	.23*	-.01	.15	-.02	.05	-

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

5.3.3 Relationship between peritraumatic composite scores and intrusive memories

To investigate whether the moments experienced as intrusive memories were associated with different levels of peritraumatic reactions in comparison to the moments experienced as most distressing memories of participants without intrusions, a one-way between-subjects MANCOVA was conducted with memory type as independent variable and peritraumatic composite scores as dependent variables, controlling for word count. The MANCOVA for memory type was found to be statistically significant with a Wilk's $\Lambda = .80$, $F\ (7,93) = 3.31$, $p = .003$. Separate univariate ANCOVAs were then conducted between memory type and each peritraumatic composite score, controlling for peritraumatic word count. The results are reported in Table 5.3. Moments experienced as intrusive memories were characterised by higher levels of immobility, cognitive overload, emotional distress, dissociation, and mental defeat when compared to moments experienced as most distressing memories among participants without intrusions.

Table 5.3 *One-way Between-Subjects ANCOVAs with Peritraumatic Composite Scores as Dependent Variables and Memory Type as Independent Variable*

Peritraumatic composite score				Intrusive memory moments (n = 50)		Most distressing memory moments (n = 52)	
	F(1,99)	p	Partial $\eta 2$	*M*	*SD*	*M*	*SD*
Emotional distress	6.42*	.012	.05	5.84	2.31	4.81	2.49
Hyper-focus and emotion regulation	1.93	.167	.01	4.72	3.09	5.63	3.07
Cognitive overload	8.12**	.005	.07	3.08	1.84	2.15	1.54
Dissociation	5.55*	.020	.04	2.24	1.66	1.60	1.52
Mental defeat	4.82*	.030	.04	2.00	1.43	1.42	1.41
Immobility and somatic reactions	9.74**	.002	.08	2.72	2.93	1.37	1.86
Positive affect	0.01	.909	.00	0.78	0.79	0.81	0.79

Note. Analyses conducted controlling for word count.
* $p < .05$, ** $p < .01$, *** $p < .001$

5.3.4 Relationship between peritraumatic composite scores and gender

To investigate the relationship between reported peritraumatic reactions and gender, a one-way between-subjects MANCOVA was conducted with gender as the independent variable, peritraumatic composite scores as dependent variable, and peritraumatic word count as a co-variate. The MANCOVA for gender was found to be statistically significant with a Wilk's $\Lambda = .77$, $F(7, 93) = 3.93$, $p < .000$. Gender differences among the individual peritraumatic composite scores were explored with a series of analyses of co-variance (ANCOVA) between gender and individual peritraumatic composite scores, controlling for peritraumatic word count. Results are reported below in Table 5.4.

Table 5.4 *One-Way Between-Subjects ANCOVAs with Peritraumatic Composite Scores as Dependent Variables and Gender as Independent Variable*

Peritraumatic composite score				Male (n = 45)		Female (n = 57)	
	$F(1,99)$	p	Partial $\eta 2$	M	SD	M	SD
Emotional distress	10.11**	.001	.08	4.44	2.21	6.00	2.42
Hyper-focus and emotion regulation	16.16***	.000	.12	6.29	3.07	4.32	2.86
Cognitive overload	0.59	.444	.00	2.73	1.81	2.51	1.70
Dissociation	0.04	.842	.00	1.89	1.65	1.93	1.60
Mental defeat	0.04	.829	.00	1.71	1.44	1.70	1.45
Immobility and somatic reactions	1.91	.169	.01	1.58	2.37	2.39	2.61
Positive affect	0.89	.347	.00	0.87	0.76	0.74	0.81

Note. Analyses conducted controlling for word count.
* $p < .05$, ** $p < .01$, *** $p < .001$

5.4 Discussion

This represent the first study to address naturalistically differences in levels of *spontaneously reported* peritraumatic reactions between moments experienced as intrusive memories and moments experienced as normal autobiographical memories in a sample of individuals exposed to the same trauma. The main finding from this chapter is that, replicating Chapter 3, the *specific moments* during trauma later experienced as intrusive memories were characterised by higher scores on dissociation, mental defeat, immmoblity and somatic reactions, cognitive overload, and emotional distress in comparison with moments experienced as most distressing by participants without intrusions. No significant differences were found between the two memories on levels of hyper-focus/emotion regulation and positive affect.

This provides an important confirmation to findings from Chapter 3 replicating the same pattern of results but using different data on peritraumatic reactions collected using a different method. This allowed for the inclusion of novel and under-studied peritraumatic reactions elicited using inductive methods, *i.e.* cognitive overload, hyper-focus, and emotion regulation as well as positive affect, while still considering more widely studied reactions such as dissociation, immobility, distress, and mental defeat. As in Chapter 3, composite scores for immobility and somatic reactions as well as cognitive overload appeared to be particularly relevant and future research should explore more systematically the role of these reactions in the development of intrusive memories (Kuiling, Klaassen & Hagenaars, 2019).

Findings presented also confirm that intrusive memories can be a common and persistent occurrence following disaster with 49% of participants reporting having experienced intrusions and 83% of those participants still experiencing

intrusions 15-20 months following the disaster. This confirms findings from previous studies on re-experiencing following earthquakes (Roncone et al., 2013; Tian et al., 2014), but using more in-depth and precise probes to investigate the presence of intrusive memories specifically.

Furthermore, it is interesting to note that the content of intrusive memories among participants with intrusions is remarkably similar to the content of the most distressing memories of participants without intrusions (see Table 5.1). Across both types of memories, the most common themes concerned the earthquake shock itself and exposure to death and material devastation. This provides support to the idea that, more than the objective trauma exposure, a better predictor of post-trauma psychopathology is how the person reacts to and appraises the exposure (Başoğlu et al., 1997). Additionally, this finding does not seem to provide support for the warning signal hypothesis of intrusive memories (Ehlers et al.,2002). Intrusive memory content tended to correspond to moments of peak distress, *e.g.* during the earthquake shock or corpse recognition, or to moments when people became aware of what had happened, *e.g.* understanding that a friend had died from observing the material destruction of their house. This is more in line with the idea that intrusive memories might correspond to peritraumatic "hotspots" experienced during the trauma (Holmes, Grey, & Young, 2005). However, the current research design did not specifically test for this hypothesis and more targeted research is needed. Additionally, the fact that the earthquake happened suddenly during the night without any warning might further limit the possibility of effectively testing the warning signal hypothesis.

Gender differences in levels of peritraumatic reactions were also identified with males reporting higher levels of hyper-focus and emotional regulation while

females reported higher levels of emotional distress. These findings confirm previous studies reporting higher levels of peritraumatic distress among females than males (Lilly, Pole, Best, Metzler, & Marmar, 2009) but no gender differences in levels of dissociation (Demarble, Fortin, D'Antonio, & Guay, 2018; Punamäki, Komproe, Qouta, Elmasri, & de Jong, 2005). The higher rate of hyper-focus and emotion regulation among male participants might hold some explanatory potential concerning the lower rates of PTSD among males reported in the literature (Olff, 2017). Indeed, some components of this reaction such as emotion regulation abilities have been found to be important moderating factors for PTSD development (Ehring & Quack, 2010).

However, these findings on gender differences need to be interpreted cautiously due to the possible effect of social desirability bias tied to Italian conceptualisations of masculinity (Pozzo, 2013). Importantly, differences in levels of hyper-focus and emotion regulation might have little to do with the status of being male *per se* but rather more with the socio-cultural implications of this status. Evidence from the qualitative data indicated that the gender norms in this rural region predisposed men to engage in actions such as rescuing people from under the debris[4]. Conversely, women were generally left waiting or tending to children and the elderly, possibly fuelling feelings of helplessness and lack of control.

The current results also have a number of more technical implications. Peritraumatic cognitive overload was defined in the previous chapters as a transitory state characterised by disruptions in information processing associated with a

[4] One item in a questionnaire not discussed in the current thesis but completed by all participants did specifically enquire about whether the participant had been involved in the rescue efforts. Males were significantly more likely to report having engaged in the rescue efforts than females (χ^2 (1) = 10.90, p < .000). However, this item might have also been subjected to methodological issues such as social desirability bias.

perceived sense of confusion, lack of integration of sensory-perceptual stimuli into higher cognition, and disorganised and racing thoughts (see Chapter 4 for a more detailed description of its phenomenology). In the qualitative accounts cognitive overload was generally identified as being triggered by overwhelming sensory and emotional stimuli and as further contributing to emotional distress in a feedback loop. The current study provides quantitative confirmation for the positive correlation between cognitive overload and emotional distress as shown in Table 5.2. This finding is supported by experimental evidence indicating a positive association between increasing cognitive load and stress (Conway, Dick, Li, Wang, & Chen, 2013).

Cognitive overload was also highly correlated with peritraumatic dissociation. Dissociation has indeed been linked with disruption in normal cognitive functioning (Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2008) and feelings of confusion can be prominent during dissociative experiences (Černis, Freeman, & Ehlers, 2020) and are often included in the definition of peritraumatic dissociation itself (Engelhard, van den Hout, Kindt, Arntz, & Schouten, 2003). Two items of the Peritraumatic Dissociative Experiences Questionnaire (PDEQ) (Marmar, Weiss & Metzler, 1997) do align with possible cognitive overload, item 9 "*I felt confused…"* and item 10 "*I felt disoriented*…". Indeed, the exploratory factor analysis conducted in Chapter 2 on six standard peritraumatic measures (Massazza, Joffe, Hyland, & Brewin, 2020) indicated that these last two PDEQ items significantly loaded on the "cognitive overload" factor together with items from the data-driven processing questionnaire (Halligan et al., 2002). Future studies should investigate more systematically cognitive overload and its relationship and distinctiveness from dissociation.

Additionally, the composite scores for peritraumatic dissociation and distress were correlated with mental defeat and immobility composite scores while hyper-focus/emotion regulation scores were correlated with positive affect scores. While the naturalistic design of this study allowed for spontaneous and novel reactions to be captured, the correlational nature of the data hinders precise interpretations concerning the effect of one reaction on another and future studies should explore the linkages between different peritraumatic reactions more systematically (Fikretoglu et al., 2006).

As with previous chapters, the current study contains a number of limitations concerning retrospective recall of peritraumatic reactions and the correlational nature of the study design. However, the key limitation in the current chapter concerns the process of "quantitization" of qualitative data, which holds several epistemological and methodological challenges (Sandelowski et al., 2009). Firstly, I only assessed whether a person reported experiencing a certain peritraumatic reactions but due to the nature of the data I could not assess *how intensely* the reaction was experienced. While our method of clustering together similar reactions in a composite peritraumatic score could be interpreted as a proxy measure of intensity, it still warrants more systematic quantitative assessments. Additionally, due to the open-endedness of our qualitative interviews, some participants might have not mentioned certain reactions but might still have experienced them. Finally, by considering the composite peritraumatic score rather than individual codes I am unable to precisely identify which specific components of the peritraumatic reactions might be particularly relevant for intrusive memories and gender.

As mentioned in Chapter 3, another possible limitation lies in the impact that a number of unmeasured covariates could have had on the relationship between

peritraumatic reactions and intrusive memories, such as traumatic brain injury, alcohol, or in the case of gender differences, neurobiological sex and gender differences. Future studies should investigate the possible mediating role of these variables more systematically. Additionally, a number of statistical limitations are present in the current chapter. Importantly, certain peritraumatic variables such as positive affect had very low scores with mean rates close to zero. This might have led to floor effects which could result in the underestimation of the size of group differences or in difficulties in clearly interpreting the findings.

Another statistical limitation concerns the multiple tests undertaken which might have resulted in possible alpha inflation. While the overall pattern of results concerning the relationship between peritraumatic scores and intrusive memories is clear and consistent with findings from Chapter 3, and while the findings for gender would likely remain significant even if a correction had been applied, this chapter was exploratory in nature and findings should be interpreted with caution. Finally, as discussed in Chapter 3, possible issues with sampling bias and lack of data for non-respondents represent a further limitation of the current thesis. While these issues were due to the complex post-disaster setting in which the data was collected, future work should attempt replication using more robust sampling technques such as random sampling.

Peritraumatic reactions represent important phenomena with key ramifications for the study of post-trauma psychopathology, such as the development of intrusive memories and gender differences in rates of PTSD. This represents the first study to investigate spontaneously reported peritraumatic reactions and their associations with intrusive memories and gender in a sample of individuals exposed to the same trauma using a novel naturalistic design. These findings replicate the

main results from Chapter 3 on the relationship between intrusive memories and peritraumatic reactions using different data on peritraumatic reactions elicited using a completely different method. As intrusive memories can be common reactions following exposure to trauma and, in some people, can persist months and years following the event causing considerable distress, an improved understanding of their aetiology and relationship with peritraumatic reactions represents an important avenue of research.

Having presented the four empirical chapters of the current thesis and having described how they address the existing limitations in the literature highlighted in Chapter 1, I will now provide an overall summary of the thesis and a general conclusion by highlighting possible clinical and practical implications, methodological considerations, and future research directions.

6 Chapter 6: Summary and Conclusions

In this thesis I presented a number of studies concerning peritraumatic reactions, intrusive memories, and their relationship. These studies were aimed at addressing a number of limitations in the literature on peritraumatic reactions, intrusive memories, and the association between them. I will now present a brief summary of each chapter and discuss a number of practical implications, methodological considerations, and future research directions that can be drawn from the work presented.

6.1 Summary

Chapter 1 provided an overview of the theoretical and empirical literature on memory and PTSD with a focus on intrusive memories and their risk factors. It focused in particular on risk factors taking place either during or immediately after exposure to trauma, *i.e.* peritraumatic reactions.

In Chapter 2, the six most widely used peritraumatic measures were administered to a sample of earthquake survivors (N = 308). An exploratory factor analysis was conducted on all six peritraumatic measures to identify their latent structure. This resulted in the identification of five robust distinct peritraumatic factors which were labelled: Mental Defeat, Somatoform Dissociation, Cognitive Overload, Immobility, and Distress. Additionally, Chapter 2 investigated, using exploratory structural equation modelling, the relationship between each of the five factors and PTSD symptoms.

Building on the findings presented in Chapter 2, Chapter 3 investigated the association between the peritraumatic factors previously identified and intrusive

memories in a sub-set of participants (N = 104). Chapter 3 specifically tested, using a novel design, predictions made from modern cognitive theories of PTSD (Brewin et al., 2010; Ehlers & Clark, 2000) concerning the role of peritraumatic reactions in the development of intrusive memories. As hypothesized, the moments experienced as intrusive memories were characterised by higher levels of all peritraumatic factors, except for Mental Defeat, in comparison with moments experienced as normal autobiographical memories, both among participants with intrusions and among participants without intrusions. This relationship remained significant also when controlling for PTSD symptom levels in the between-subjects analyses.

Furthermore, intrusive memories at recall were characterised by higher levels of primary traumatic emotions such as anxiety, fear, and helplessness than non-intrusive memories. Additionally, intrusive memories at recall were accompanied by higher levels of distress, re-experiencing, and attempts to suppress them in comparison with non-intrusive memories. Finally, intrusive memories were more likely to be experienced as images or emotions than non-intrusive memories.

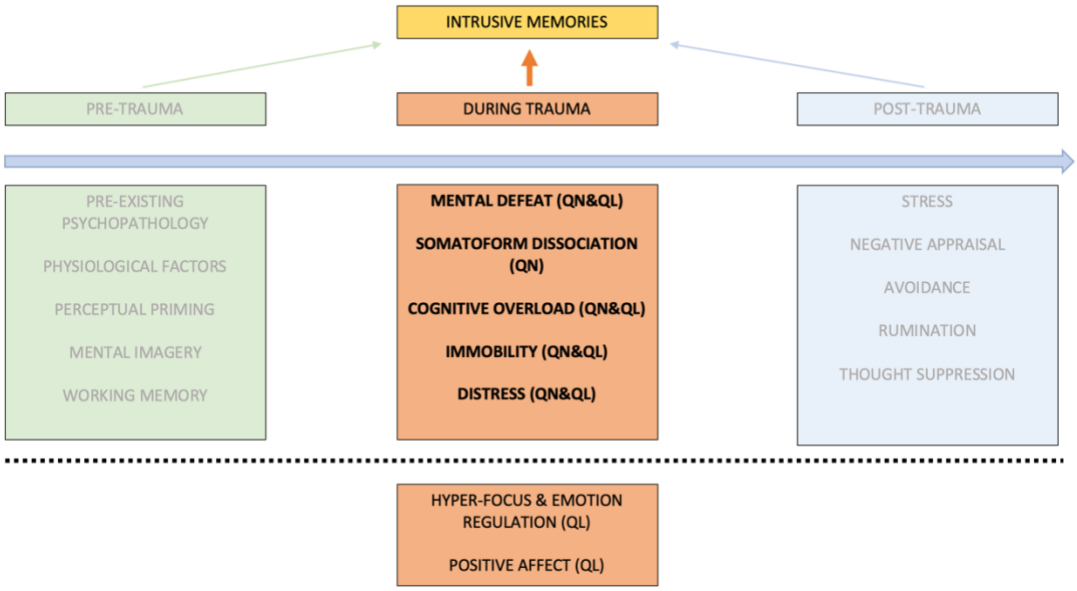
Chapter 4 took a similar approach as that of Chapter 2 in using an exploratory approach to investigate peritraumatic reactions. However rather than using quantitative methods, it relied on qualitative data from interviews where participants were asked to spontaneously report their thoughts, feelings, and behaviours experienced at the time of the trauma. A largely inductive analytical framework was used when analysing the data. This led to the identification of 85 different peritraumatic reactions that were clustered into 7 peritraumatic groups of codes. These included: emotional distress; action, hyper-focus, and emotion regulation; cognitive overload; dissociation; mental defeat and loss of control; immobility and somatic reactions; and positive affect.

Additionally, a number of cross-cutting themes emerged from the qualitative data. Firstly, participants reported experienced many different reactions during the trauma (M = 21, range = 6-43), as well as fluctuating between different reactions and different degrees of the same reaction throughout the trauma. Furthermore, many reactions were inherently social in nature, with participants reporting more fear for others than for themselves and reporting a high degree of prosocial behaviours during the event. Finally, some participants reported struggling to describe their experience of peritraumatic reactions using words, with a quarter of the sample describing certain reactions as "strange" and one in five participants reporting experiencing a "mix" of different, at times contradictory, peritraumatic reactions at the same time.

Just as Chapter 3 was based on peritraumatic factors from Chapter 2, Chapter 5 built upon findings from Chapter 4 to investigate the relationship between the newly identified peritraumatic groups of codes and intrusive memories. The same analytic design as that described in Chapter 3 was used. Qualitative peritraumatic data were transformed through a process of "quantitization" to undergo statistical analysis. Largely replicating findings from Chapter 3, moments encoded as intrusive memories were characterised by higher levels of peritraumatic immobility and somatic reactions, cognitive overload, distress, dissociation, and mental defeat in comparison with the most distressing moments of participants without intrusions. Additionally, female participants reported higher levels of peritraumatic distress but lower levels of hyper-focus and emotion regulation than males.

A visual summary of the key findings from this thesis is presented below in Figure 6.1, which represents an update of Figure 1.3 presented in Chapter 1 in light of the findings from the current thesis.

Figure 6.1 *Visual Summary of Key Findings in the Current Thesis in the Context of Intrusive Memories' Predictors*



Note. Schematic representation of findings in current thesis with list of peritraumatic reactions identified in quantitative chapters (QN) and qualitative chapters (QL). Peritraumatic reactions in bold were those found to be associated with intrusive memories whereas those not in bold (below the dotted line) were not found to be associated with intrusive memories.

6.2 Clinical and practical implications

Technical implications and limitations concerning each specific chapter have been described individually in the discussion sections of each chapter. However, a number of overall implications for clinical work and practice can be drawn from this thesis.

6.2.1. Trauma and PTSD in a global scenario

Exposure to trauma is a global public health issue (Frewen, Schmahl, & Olff, 2017; Magruder, Jassam-Adams, Thoresen, & Olff, 2016) with issues such as climate change (Berry, Waite, Dear, Capon, & Murray, 2018), armed conflict and the resulting refugee crisis (Charlson et al., 2019), as well as the current COVID-19

pandemic (UN, 2020) all contributing to exposure to possibly traumatic events. These various events highlight the centrality of trauma and PTSD within a global health framework. In turn, this stresses the importance for an improved understanding of key risk factors for the development of the condition and of preventative and clinical interventions aimed at addressing post-trauma symptomatology. Importantly, while a number of simple interventions delivered by non-specialists have been developed for the management of anxiety, depression, and general psychological distress (de Graaff et al., 2020; Patel, Chowdhary, Rahman, & Verdeli, 2011), no simple scalable intervention yet exists for the treatment of PTSD symptoms. Additionally, little evidence exists for the effectiveness of interventions in the acute peritraumatic phase of mass trauma (Hobfoll et al., 2007; Roberts et al., 2019), with even widely used interventions such as psychological first aid (PFA) recently showing no effect when compared to usual services (McCart, Chapman, Zajac, & Rheingold, 2020). The next sections will highlight how the current thesis may provide practical insight into the improvement of prevention and management of trauma-related psychopathology as well as general wellbeing among disaster survivors by focusing on four different areas: improved measurement and conceptualisation of peritraumatic reactions, improved interventions aimed at preventing intrusive memories and PTSD, improved treatment for intrusive memories and PTSD, and improved disaster preparedness and response plans. A "big picture" overview of the practical implications of the current thesis is provided below in Figure 6.2. Each practical implication will be discussed below in turn.

Figure 6.2 *"Big Picture" Visual Summary of Practical Implication of Thesis*

Improved measurement and conceptualization of peritraumatic reactions	**Improved interventions aimed at preventing intrusive memories and PTSD**	**Improved treatment for intrusive memories and PTSD**	**Improved disaster preparedness and response plans**
Development of measures that clearly distinguish between different peritraumatic constructs	Exposure of individuals at high risk of trauma exposure (*e.g.* military personnel, disaster respondents) to situations eliciting peritraumatic reactions in controlled environment (*e.g.* virtual scenarios)	More fine-tuned personalisation of treatment options in light of different peritraumatic experiences (*e.g.* individuals who experienced mental defeat less likely to respond to exposure therapy)	Anecdotal effectiveness of psychological first aid in the aftermath of emergencies might be explained by its role in diminishing peritraumatic reactions
Development of unified peritraumatic measure including most characteristic items of most common peritraumatic reactions	Extending existing preventative interventions for intrusive memories (*e.g.* Tetris) to assess impact of disrupting other peritraumatic reactions (*e.g.* immobility)	Having patients focus on more purposeful and agency-driven peritraumatic reactions (*e.g.* helping others) during therapy to re-appraise trauma in more balanced light	Better public health communication in aftermath of disasters aimed at normalising peritraumatic reactions that can be perceived as strange and upsetting (*e.g.* derealisation)
Unified peritraumatic measure could be used as screening instrument in the aftermath of trauma	Identification of "switches" that make individuals move from one peritraumatic reactions (*e.g.* dissociation) to another (*e.g.* focus on action)	Normalising the experience of upsetting peritraumatic reactions (*e.g.* not reacting due to immobility) by therapist	Integrating knowledge of peritraumatic reaction in disaster preparedness interventions to foster adaptive peritraumatic reactions (*e.g.* exposing individuals to peritraumatic reactions during drills)
	Development of interventions aimed at building capacity to respond to trauma with more adaptive peritraumatic reactions (*e.g.* hyper-focus) in occupations at high risk of trauma exposure	Understanding what factors might lie behind spontaneous changes through time in content and structure of intrusive memories	Training could be developed on how disaster first respondents can interact with highly distressed individuals to encourage shifts in peritraumatic reactions (*e.g.* from dissociation to action)

6.2.2 Improved measurement and conceptualisation of peritraumatic reactions

Chapter 2 highlighted a number of limitations concerning the existing standard peritraumatic scales. Besides issues concerning substantial conceptual overlap between the measures, there is currently no single measure that captures all key peritraumatic reactions in a single scale. This is a considerable limitation as a researcher interested in providing a complete overview of peritraumatic reactions in a sample would have to administer a minimum of 6 different peritraumatic scales to participants. In the current study the administration of all 6 measures took participants an average of between 30 minutes to 1 hour to complete. This could trigger substantial respondent fatigue compounded by the fact that many questionnaires ask very similar questions to participants. Additionally, ethical concerns could be raised about asking participants multiple times similar questions about distressing aspects of their traumatic experience (*e.g.* question 8 in the TIS "*Rate the extent to which you feared for your life or felt as though you were going to die*" and question 13 of the PDI "*I thought I might die*"). Finally, because of the conceptual overlap, even if a researcher did administer all standard peritraumatic scales it would still remain unclear what exactly each measure is capturing, therefore hindering a clear interpretation of the data.

Findings from the current thesis, in particular findings from Chapter 2, could be used to construct a new more comprehensive tool that could effectively distinguish between different peritraumatic responses. The analyses from Chapter 2 do indeed point to the possibility of reducing the number of items necessary to measure peritraumatic reactions from 63. These findings could be used as a baseline for the construction of an overall measure including only the most representative items for each reaction. Additionally, this new overarching measure might also

attempt to capture understudied peritraumatic reactions such as those identified in Chapter 4, *e.g.* hyper-focus and positive affect.

A single measure including various peritraumatic reactions has already been developed by Agorastos et al. (2013) in the Peritraumatic Behaviour Questionnaire (PBQ). As shown in Table 6.1, the measure includes items belonging to a variety of different peritraumatic construct such as mental defeat (PBQ7), psychic dissociation (PBQ1), tonic immobility (PBQ11), cognitive overload (PBQ8), and distress (PBQ14, PBQ15). However, the generalizability of the measure is limited by its specific focus on military personnel engaged in combat (*e.g.* PBQ13 "*For a period of time, I was not able to fully carry out my duties"*). Additionally, another limitation concerns the decision of selecting the items to include in the measure on the basis of expert consensus rather than on psychometric methods.

Interestingly, the PBQ does include one understudied peritraumatic reaction which was also identified in Chapter 4 and labelled under "sense of invincibility/exaltation" (*i.e.* PBQ2 "*For a period of time, I felt fearless and invulnerable, as if nothing could harm me"*). As this reaction was endorsed by 10% of the current sample, it indicates that it might not be unique to military samples and warrants future research on its phenomenology as well as its association with post-trauma psychopathology.

Table 6.1 *Items of the Peritraumatic Behaviour Questionnaire by Agorastos et al. (2013)*

	Items
1	For a period of time, I did not act like my normal self
2	For a period of time, I felt fearless and invulnerable, as if nothing could harm me
3	For a period of time, I did not care about my own or others' welfare or safety
4	For a period of time, I felt no remorse for doing things that would have bothered me in the past
5	For a period of time, I was determined to get revenge
6	For a period of time, I was unable to stop laughing, crying, or screaming
7	For a period of time, I felt helpless and was unable to look out for my own welfare
8	For a period of time, I was confused and had difficulty making sense of what was happening
9	For a period of time, I was disoriented and was uncertain about where I was or what day or time it was
10	For a period of time, I could not move parts of my body
11	For a period of time, I froze or seemed to be moving very slowly, such that I could not do everything I wanted to do
12	For a period of time, my speech changed (such as stuttering, repeating words or phrases, or having a shaky or squeaky voice)
13	For a period of time, I was not able to fully carry out my duties (during or immediately after the event)
14	For a period of time, I believed I was going to die
15	For a period of time, I had an intense physical reaction such as sweating, shaking, or heart pounding

An important assumption that would need further testing prior to the development of an overarching peritraumatic measures based on the current findings concerns the replicability of these findings in populations exposed to different types of trauma. Firstly, different types of reactions might be identified if qualitative work

was to be conducted with populations exposed to different traumas. Secondly, the same peritraumatic reactions might be characterised by slightly different phenomenological characteristics between samples exposed to different types of trauma (*e.g.* while derealisation was more prominent than depersonalisation in the characterisation of dissociation in the current sample this might not hold true among populations exposed to other traumas). Finally, there is the possibility that the factor structure itself identified in Chapter 2 could vary depending on the type of trauma.

As a result of these concerns, the shortened peritraumatic questionnaire described in Chapters 3 and 5 will be administered to adolescents exposed to high levels of urban violence in Brazil. The same study design which asks participants to complete the shortened peritraumatic questionnaire in relation to intrusive memories, control memories, or most distressing memories, will be implemented in the context of urban violence. Data are going to be collected in schools located in neighbourhoods with high levels of violence as well as in detention centres in São Paulo city. This preliminary study will allow to investigate differences and similarities in peritraumatic responses between samples exposed to different types of trauma in two different cultural settings.

Another limitation of the approach to conceptualising peritraumatic reactions presented in the current thesis concerns the nature of the data that were collected. Indeed, all data on peritraumatic reactions in the current thesis represent subjective appraisals and recollections. Therefore, their structure might not necessarily coincide with frameworks based on more objective measurements, *e.g.* biological markers. Additionally, theory-driven constructs (*e.g.* data-driven processing) might provide superior predictive validity, for example in forecasting the course of disorder over time. These are questions that can only be resolved empirically. While the focus on

phenomenology, subjective appraisal, and lived experience are at the core of the current thesis, they represent only one epistemological position that can be taken when studying a phenomenon.

Despite these conceptual and methodological limitations, the creation of a short questionnaire capturing common peritraumatic experiences could have important academic as well as clinical implications. As most peritraumatic reactions have been found to be associated with increased rates of PTSD (Gorman et al., 2016), screening instruments for PTSD might include a number of items that capture the reactions that have been found to be the strongest predictors of PTSD. Findings from Chapter 2 indicate that items that capture mental defeat reactions were among the most highly associated with overall PTSD. Future work could test the value of including these kind of questions in brief screening instruments for PTSD following disasters (Brewin et al., 2002, Olff, 2015).

However, attention should be paid to the risks of asking trauma survivors about their peritraumatic reactions soon after exposure, as highlighted by the literature on the potentially iatrogenic effects of interventions such as critical incident stress debriefing (Rose, Bisson, Churchill, & Wessely, 2002; Wesemann, Mahnke, Polk, Bühler, & Willmund, 2020; but see Tamrakar, Murphy, & Elklit, 2019 for a recent critical appraisal). Additionally, the value of screening instruments lies in their brevity, meaning that careful thought should be given at whether the value of additional items counterbalances the additional length of the measure.

6.2.3 Improved preventative interventions for intrusive memories and PTSD

Our findings concerning the structure of different peritraumatic reactions and their strong association with intrusive memories and PTSD can also have

implications for interventions aimed at reducing the risk of developing intrusive memories and PTSD both before and/or immediately after traumatic exposure.

Preventative interventions might attempt to expose individuals that have a high risk of being faced with traumatic events such as military personnel or disaster first-responders to thoughts, emotions, and feelings that might hold some resemblance with peritraumatic reactions in order to identify them and learn how to manage them. An intervention that targeted peritraumatic ruminative thinking by encouraging a more peritraumatic concrete thinking style prior to exposure to analogue trauma led to significantly fewer intrusive memories and PTSD symptoms (White & Wild, 2016) and is currently being rolled out among student paramedics (Wild et al., 2018).

Another pre-trauma preventative intervention could involve the exposure of individuals to virtual scenarios that hold some similarities with possible traumatic events they might be exposed to as part of their work duties. For example, military personnel involved in the retrieval of human remains in the US are sometimes exposed to pictures of human remains prior to exposure to real bodies in order to allow for habituation to the stimuli and associated feelings, thoughts, and behaviours (Cozza, Biggs, Hefner, Brymer & Flynn, 2019). Similarly, exposure to possible trauma scenarios using virtual reality could allow for the experience of certain peritraumatic reactions such as peritraumatic dissociation and distress in a controlled environment. Following virtual exposure, the participants might discuss ways to manage these peritraumatic reactions. This might lead to perceptions of increased preparedness by knowing what to expect during a traumatic event as well as an increased perception of self-efficacy in managing certain reactions (Horn, Charney, & Feder, 2016). Indeed, growing evidence is emerging concerning the role of virtual

reality in providing resilience training to military personnel prior to deployment (Rizzo & Shilling, 2017).

Additionally, in the aftermath of traumatic events, a number of simple interventions thought to impact the way traumatic memory is encoded during the peritraumatic phase have been found to be successful in addressing intrusive memories and PTSD symptoms in general. As discussed more in detail in Chapter 1, these include using a visuospatial computer game (*i.e.* Tetris) intervention following motor vehicle accidents (Iyadurai et al., 2018) or following emergency caesarean section (Horsh et al., 2017). While the evidence for these interventions is still preliminary, they represent important starting points. These interventions have mainly been developed within a dual-task framework to impair the consolidation of the visuo-spatial components of the memory by providing a competing source of stimulation. Future research could explore whether targeting other peritraumatic reactions such as immobility in the encoding phase results in similar effects among trauma survivors.

Findings from Chapter 3 highlight that certain peritraumatic reactions, such as distress, immobility, or cognitive overload, might be more relevant targets for interventions aimed at addressing intrusive memories than other peritraumatic reactions, such as mental defeat. These findings were confirmed in Chapter 5. Simple interventions aimed at tackling these reactions specifically might be devised and their efficacy in diminishing intrusive memories following trauma tested. Future experimental studies might also plan on targeting the core traits of one peritraumatic reaction at a time using tailored cognitive tasks and assess which interventions are most effective in addressing intrusive memories and whether a combination of tasks might also be effective.

An important finding from the qualitative work presented in Chapter 4 is that individuals fluctuated between different types and degrees of peritraumatic reactions throughout the trauma. Individuals often reported certain reactions being "switched" on and off by certain triggers (*e.g.* exiting immobility by being stimulated by someone close to them). Future qualitative work might investigate more systematically what these "switches" might be. This could allow for the identification of certain candidate variables that might be assessed more systematically for their potential in diminishing certain peritraumatic reactions as part of preventative interventions.

Another important finding from the qualitative component presented in Chapters 4 and 5 concerns the role of more adaptive peritraumatic reactions such as hyper-focus, emotion regulation, and positive affect. While in Chapter 5 these reactions were not significantly associated with intrusive memories, future work could investigate this more systematically as possible components of preventative interventions. Indeed, preliminary evidence from military psychology suggests that pre-trauma interventions aimed at fostering feelings of personal strength and enhancing positive emotions and meaning could enhance resilience in the aftermath of trauma exposure (Cornum, Matthews, & Seligman, 2011; Horn et al., 2016). However, two important assumptions behind such an intervention warrant testing. First, that individuals can be trained in these specific peritraumatic reactions. Second, that the training will be applied when the individual is exposed to real-life trauma.

Finally, another possible preventative intervention in the aftermath of trauma that could be informed by the current improved conceptualisation of peritraumatic reactions concerns psychoeducation. For example, personnel who frequently

encounter trauma survivors soon after exposure such as A&E personnel or disaster first responders could provide support in normalising peritraumatic reactions perceived as unsettling or distressing by survivors. This could possibly lead to decreased peritraumatic distress by highlighting how certain unsettling feelings, thoughts, and behaviours such as derealisation and depersonalisation can be normal responses to situations of high stress and can be commonly experienced.

Important issues that would warrant consideration for any preventative intervention would include the cross-cultural adaptability of such interventions, especially considering the cross-cultural and linguistic variability in completion of cognitive tasks (Janssen & Geiser, 2012; Lupyan & Ward, 2013; Gibson et al., 2017) as well as the possibility of implementing these interventions in resource-poor settings. For example, the Tetris-based interventions (Horsh et al., 2017; Iyadurai et al., 2018), relied on a videogame console (Nintendo DS or Nintendo DS XL) which might hinder implementation in resource-poor settings and in situations that involve millions of people (*e.g.* war, disaster *etc.*). Interventions using mobile phones (Farrington, Aristidou, & Ruggieri, 2014) or less expensive visuospatial tasks such as using building blocks or paper and pen visuospatial games might allow for more cost-effective and extensive implementation and scale-up.

6.2.4 Improved treatment of intrusive memories and PTSD

In addition to preventative interventions in the acute phase, a more streamlined conceptualisation of peritraumatic reactions could be helpful to clinicians once survivors access treatment. This is particularly relevant in the face of evidence indicating that the experience of certain peritraumatic reactions might make certain individuals less likely to respond effectively to certain treatments. For

example, a study among rape victims showed that survivors who had experienced mental defeat during the trauma showed little improvement after exposure treatment (Ehlers et al., 1998). Indeed, while a number of effective treatments for PTSD have been identified (International Society for Traumatic Stress Studies, 2019), it is still unclear why certain treatments work for some people but not for others and what determines the degree of effectiveness among individuals (Olff et al., 2019). One possibility, as shown in the study by Ehlers et al. (1998), is that experiencing certain peritraumatic reactions during trauma might have an effect on treatment response. Future work might investigate this possibility more systematically, for example by routinely including a brief peritraumatic tool capturing the most characteristic peritraumatic reactions as part of intervention effectiveness studies. As mentioned above, findings from the current thesis could provide a starting point for the development of this general peritraumatic questionnaire.

As briefly mentioned in the discussion section of Chapter 4, the identification of a set of more adaptive peritraumatic reactions could represent an important area of focus during treatment (Wilson et al., 2012). The vast majority of participants reported engaging at some point during the trauma in goal-oriented actions often aimed towards trying to be useful or helping others. Additionally, more than one in four participants reported experiencing a degree of positive emotions such as hope, joy, and relief during the traumatic event. During treatment, practitioners might purposefully probe the patient to identify moments in which these reactions were prominent in order to achieve a more balanced perspective of the traumatic event and to allow the patient to possibly re-appraise the traumatic event in a more adaptive light.

For example, one participant in the current study was highly ashamed of not having provided support during the extraction of the corpses of two children and their narrative of the event was dominated by feelings of guilt and shame. However, prior to that moment, they had helped a number of people to exit their houses often by engaging in brave actions such as climbing an unstable roof to save a toddler. During therapy, the clinician might support the patient in identifying and highlighting such moments, thereby contrasting a more pessimistic perception of one's behaviour during the event.

A more precise conceptualisation of peritraumatic reactions can also support patients in normalising and talking about different peritraumatic reactions. For example, certain patients might be hesitant to mention certain reactions out of shame (*e.g.* not reacting due to immobility or loss of control over bowel and bladder) or out of fear of being perceived as "crazy" (*e.g.* derealisation and depersonalisation). Building on the qualitative findings from Chapter 4, clinicians might provide patients with a simplified version of Table 4.2 to highlight the complexity and variety of responses during trauma and to normalise these. A simplified table detailing peritraumatic reactions might represent a useful starting point to discuss more in detail certain peritraumatic reactions that the patient might have experienced. As highlighted by Bovin et al. (2014) in the context of tonic immobility, psychoeducational activities aimed at normalising peritraumatic reactions and at explaining their function can have a number of benefits for patients, such as reducing guilt for one's reaction.

Additionally, as a number of participants reported struggling to describe their peritraumatic reactions in their own words, the provision of a simplified table with a brief definition of each peritraumatic reaction next to it could improve the

identification and discussion of such reactions in clinical settings. When completing the standard peritraumatic scales, many participants were surprised with how precisely certain questionnaire items captured what they had felt and what they had struggled to put into words during the qualitative interview. However, possible limitations to this approach include that of imposing a specific conceptualisation of peritraumatic reaction which might not reflect the lived experience of the patient as well as influencing participants' recall of the event by suggesting that they must have experienced some of these reactions.

In terms of the treatment of intrusive memories, one particularly interesting finding is that 17.6% of participants with intrusions reported changes through time in the structure and content of their intrusive memories. Some participants reported a strengthening of their memory with time as new details emerged and the memory gained in vividness whereas other participants reported the opposite trend of the memory becoming "more blurred". Future research might investigate what factors might be responsible for these changes and whether any of these factors can be catalysed to, for example, diminish the visual strength of a particularly distressing memory. One possible option responsible for the changes in the structure and content of intrusive memories could be psychotherapy as the vividness, frequency, distress, and nowness of intrusions has been found to decrease with treatment (Hackmann et al., 2004). Indeed, one participant mentioned how they had purposefully substituted during psychotherapy the content of their intrusive memory with something less distressing. However, very little attention has been devoted to systematically investigating spontaneous changes in the structure and content of intrusive memories through time in samples of trauma survivors.

6.2.5 Improved disaster preparedness and response interventions

Despite growing evidence concerning psychosocial interventions in the aftermath of disasters (Reifels et al., 2013), a research gap remains concerning the appropriate mental health response in the acute phase of emergencies (Olff et al., 2019). Current recommendations include the delivery of psychological first aid (PFA) in the immediate aftermath of an emergency (Sphere, 2018). PFA is defined as a "*humane and supportive response to a fellow human being who is suffering*" (WHO, 2011: 3). It involves providing non-intrusive practical care and support, assessing needs and concerns, helping people addressing basic needs, listening to people without pressuring to talk, comforting people and helping them feel calm, helping people connecting to information, and protecting people from further harm. Despite its widespread implementation and recommendation as part of international guidance on mental health and psychosocial support in emergency settings (*e.g.* Inter-Agency Standing Committee, 2007) there is little systematic evidence concerning its effectiveness and its possible mechanisms of impact (McCart et al., 2020).

One possible hypothesis that could explain the anecdotal effectiveness of PFA concerns its role in diminishing negative peritraumatic reactions. Findings from Chapter 2, 3 and 5 indicate that extreme fear and mental defeat at the time of the trauma are associated with subsequent intrusive memories and PTSD symptoms. By "comforting people and helping them to feel calm" PFA might lead to reductions in extreme fear and by encouraging people to feel "able to help themselves, as individuals and communities" it might foster a sense of agency and self-efficacy therefore diminishing mental defeat. Addressing and diminishing negative peritraumatic reactions is also in line with the five essential principles of immediate

mass trauma interventions proposed by Hobfoll et al. (2007) that focus on promoting a sense of safety, calm, a sense of self- and community-efficacy, connectedness, and hope. Future studies investigating the effectiveness of early interventions for psychological trauma in the context of disaster might systematically investigate whether the reduction of specific peritraumatic reactions might represent an important mediating factor for subsequent psychopathology and wellbeing.

An improved understanding of peritraumatic reactions can also inform public health communication concerning the mental health impacts of large emergencies. For example, public health officials might attempt to normalise certain peritraumatic reactions that survivors might experience as particularly worrisome and distressing through public health communication. This approach was taken by the WHO Country Office in Lebanon and the Lebanese Ministry of Public Health in the aftermath of the Beirut explosion in August 2020. As shown in Figure 6.3 a social media campaign was initiated in the aftermath of the explosion to educate the public about possible psychological reactions such as derealisation and depersonalisation highlighting their normality and their short duration. Future research might explore more systematically the effectiveness of such campaigns in reducing distress during the acute phase of the emergency.

Figure 6.3 *Example of Public Health Messaging on Peritraumatic Reactions by WHO Lebanon and Lebanese Ministry of Public Health in the Aftermath of the Beirut Explosion*

Importantly, a clearer understanding of how people think, feel, and behave during disaster can have implications beyond the study of PTSD and intrusive memories. Indeed, how people react during emergencies can have a fundamental impact on the chances of the person's survival. For example, reports from the MS Estonia sinking in 1994 suggest that many of the people who perished on the ship did so because they froze and were unable to react and escape during the event (Leach, 2004). Similar evidence exists for reactions during airplane crashes (Leach,

2004). As reported in Chapter 4, a substantial number of participants also reported not being able to move during the earthquake shock because of immobility while other reported engaging in hazardous behaviours such as fleeing their homes without checking for collapsing buildings outside or taking the stairs without making sure they were still intact. This confirms findings from the 2012 Northern Italy earthquakes where a number of injuries and fatalities were due to inappropriate or hazardous behaviours during the earthquake shocks (Prati, Saccinto, Pietrantoni, & Pérez-Testor, 2013). Therefore, actively attempting to reduce reactions such as immobility and foster reactions such as hyper-focus and emotion regulation identified in Chapter 4 might be an important target for future intervention research for disaster preparedness and response interventions.

The findings concerning the inappropriate behavioural reactions of many participants during earthquakes indicates that earthquake preparedness interventions are urgently needed in Central Italy. Indeed, global evidence indicates that even in geographical areas where the awareness of earthquake risk is high, community preparedness remains low (Joffe, Rossetto, Solberg, & O'Connor, 2013). Findings from this thesis could inform certain components of such an intervention. For example, disaster preparedness interventions aimed at the general public might describe the vast array of different reactions that a person could experience during a disaster, highlight that it might be hard to predict how one will react during an earthquake, and present a number of possible tips on how to manage certain distressing reactions and exit them. These insights might be integrated into earthquake preparedness interventions that have been proved effective in increasing preparedness behaviour (Joffe et al., 2019). These interventions could be delivered by the Civil Protection or by the Region, although a feasibility assessment

concerning its acceptability and possible modes of delivery should be first carried out due to the widespread mistrust and anger towards the State shared by many of the participants, as highlighted in our previous work in the region (Massazza, Brewin, & Joffe, 2019; Massazza, Joffe, & Brewin, 2019).

Importantly, a recurring finding from the disaster preparedness literature is that only giving people the information on how they should behave during a disaster is not sufficient as people might end up acting differently during an actual emergency (Paton & McClure, 2013). Indeed, in the qualitative accounts some participants reported how they *knew* on a cognitive level what they were supposed to do (*e.g.* drop, cover, and hold) but they nonetheless acted differently. One of the reasons for the disconnect between knowledge and action observed during emergencies might be due to certain peritraumatic reactions, such as cognitive overload or dissociation, interfering with cognitive processes and impairing the retrieval of relevant information.

A possible way in which participants might expose themselves to peritraumatic reactions and understand how these might affect their behaviour during an emergency is drills. Indeed, a growing amount of literature has shown that participation in drills is associated with a higher use of protective actions during actual earthquake shaking (Vinnel, Wallis, Becker, & Johnston, 2020). The effectiveness of drills in increasing preparedness behaviour is usually interpreted as resulting from decreased fatalism, more realistic risk perceptions, and increased positive expectations of one's actions, behavioural intention, and self-efficacy (Vinnel et al., 2020).

However, another possible reason for their effectiveness could be that, during drills, participants experience certain peritraumatic reactions in a controlled

environment and as a result develop ways of managing and recognising these through habituation. During an actual earthquake, they might then build on this previous experience, and find it easier to remain calm and focused in order to carry out earthquake protective actions. Another possible hypothesis for the effectiveness of drills is that the increase in a sense of self-efficacy might counterbalance fatalism or mental defeat during the earthquake itself and foster protective action. Indeed, a core finding from the qualitative account was the extreme sense of helplessness and powerlessness that most participants experienced during the earthquake shock which would have likely hindered engagement in protective action. Future disaster preparedness research might systematically assess the impact of earthquake preparedness interventions on different peritraumatic reactions by including peritraumatic measurements as part of the research design.

The current findings hold a number of implications not only for disaster preparedness interventions but also for disaster response. For example, disaster first responders might be trained in how to interact with highly distressed individuals or with individuals in dissociative states in order to support them in entering a more reactive state. Some of these insights are present in the psychological first aid model proposed by Farchi et al (2018) which stresses the importance of ensuring individuals during trauma perceive themselves as active coping individuals (Levy, Farchi, Gidron, & Shahar, 2020). However, evidence for the effectiveness of this model is lacking. Importantly, it remains to be investigated what specific strategies could be effective in allowing the person to exit dissociative states or re-gain a sense of agency during a disaster. One possibility might involve the use of techniques used in trauma-focused therapy to help patients exit dissociative states such as grounding techniques (Chessell, Brady, Akbar, Stevens, & Young, 2019).

However, it remains unclear how these techniques might be applied in an emergency setting and one concern is that they might detract time and resources from more pressing life-saving priorities in a mass casualty emergency. Additionally, our findings from Chapter 4 indicate that other survivors were often the key players in regulating one another's emotions and future disaster response plans should explore more systematically the possibility of capitalising on survivors' capacity to help themselves and to help others (Ashkenazi & Hunt, 2019).

6.3 Methodological and practical considerations

A number of methodological and practical issues emerged during the research process which are worthy of mention, particularly in the context of disaster mental health research. I will focus on issues concerning recruitment of participants, the relationship with participants, data collection, data-analysis, and reflexivity.

6.3.1 Recruitment of participants

In the initial phases of the research process, the recruitment of participants was particularly complex due to the post-disaster context in which the data was collected. The initial plan was that of collecting a random sample. However, upon arrival in the field it was clear that a number of issues would have hindered this recruitment strategy. One of the recommended strategies for achieving a random sample in disaster settings is that of using probability household sampling (Kessler, Keane, Ursano, Mokdad, & Zaslavsky, 2008). However, as the vast majority of participants' houses had been destroyed or made uninhabitable by the earthquake, most participants lived in temporary shelters such as containers or campers as shown in Figure 6.4. These temporary shelters were not officially recorded by the

municipality in a land registry therefore making randomisation impossible. The rural and remote setting further complicated the recruitment process. Participants were scattered across 69 different hamlets in the Apennines with roads often made inaccessible by debris and certain areas accessible only by foot.

Figure 6.4 *Example of a Container Used as Temporary Shelter by Participants*

Two factors were paramount in the effective recruitment of participants. Firstly, the support provided by the local health services and the municipality. The identification of gatekeepers to the community in both the local health services and the municipality that understood and valued the research project was fundamental in the initial recruitment process. The second factor that contributed to effective recruitment was the trusting relationship that had been built with the community. This took time and purposeful effort. Participants had become habituated to the constant arrival of new people within their community and some participants had become sceptical of outsiders that "parachuted" in for just a few days. Factors that helped in building trust with the local community included: spending a substantial amount of time, *i.e.* several months, living with the community, living in similar conditions as members of the community (*e.g.* staying in a container, going to eat in

the Civil Protection canteen), participating in community events, as well as keeping participants updated with the progress of the research and communicating the outcomes in an accessible manner (*e.g.* posting lay translation of published papers on community Facebook groups, sending a message to participants before the yearly anniversary of the earthquakes).

6.3.2 Relationship with participants

The trust built with members of the community did however have a number of potential drawbacks. Importantly, traditional boundaries between researcher and participant in more conventional psychological research could not always be maintained. For example, participants often invited me for lunch or dinner at their table in the communal canteen or simply to go and visit them and do activities together with them. Refusing to participate in these activities in such a small community would have been perceived as strange, rude, and could have negatively impacted the recruitment and data collection process while also reinforcing harmful power imbalances between researcher and disaster survivors (Gaillard & Peek, 2019). Still, a number of implicit rules were followed throughout the research process such as accepting such invitations only after the research process had ended with the participant as well as not discussing matters concerning the research outside of the data collection period.

While these dynamics have been discussed at length in other social sciences (*e.g.* anthropology), it remains a largely untouched topic in psychology where the researcher is often constructed as a detached "blank slate" whose main aim is that of maintaining objectivity (but see Walsh, 2014, for a critical overview of the history behind the researcher-participant relationship in psychology). This leaves the

decision concerning how to conduct ethical disaster mental health largely up to the individual researcher. However, more in depth discussion on the ethics of conducting sensitive research among disaster survivors is needed and should inform the development of standardised guidance (Gaillard & Peek, 2019). This is particularly needed in areas of disaster research addressing sensitive topics such as trauma and mental health.

6.3.3 Data collection

The practicalities of data collection in a disaster setting should not be underestimated at the onset of the research project. Issues such as practical access to participants in areas with no public transport can easily bring the research process to a halt. This means that a number of extra-academic skills had to be developed in order to conduct the current research. For example, during the first year of the PhD, I had to learn how to drive so to access participants living in more remote mountainous areas. Key to anticipating the various challenges involved in data collection for the current thesis was the experience of working in the same context and with the same population one year prior to this research project for my Master's thesis.

A further key advantage for data collection was having access to a private office space in the local health facility. The local health facility is shown below in Figure 6.5. This was thanks to the rapport built with the local health services and municipality prior to the beginning of the research. While in an ordinary setting data collection would likely take place in a university or in participant homes, this was not feasible in the current context. Due to the rural setting no academic institution was accessible. Additionally, participants' housing situation often made the

participation in an interview focused on peritraumatic reactions in their houses problematic. Structures such as containers or campers or the temporary housing shelters provided by the State would have been too small to ensure confidentiality for the participant if other household members were present. The complexity of finding appropriate spaces for collecting data, especially sensitive mental health data and qualitative data, in post-disaster settings is likely to be an issue in most disasters due to their potential of causing structural damage to private and public buildings. Despite the fundamental importance of practical issues of access and location of data collection, very little methodological guidance on conducting disaster mental health research exists (see Norris, Galea, Friedman, & Watson, 2006 for an exception) and more precise and updated practical guidance is urgently needed.

Figure 6.5 *Local Health Facility where Majority of Data Collection Took Place*

6.3.4 Data analysis

An overarching aim of the current thesis was that of addressing the same topic and research questions using both quantitative and qualitative data in order to triangulate findings. Despite possible epistemological controversies (Creswell, 2011) integration of findings is an important step of mixed-methods research (O'Cathain, Murphy, & Nicholl, 2010). When comparing the results of quantitative data with those elicited through qualitative data a number of consistencies emerged, as well as a few inconsistencies.

Overall findings using qualitative and quantitative data largely converged. Importantly, moments encoded as intrusive memories were characterised by higher levels of peritraumatic reactions, both when those reactions were operationalised using quantitative data (Chapter 3) as well as when they were operationalised using

qualitative data (Chapter 5). Additionally, the association between specific peritraumatic reactions and memory type appeared to remain relatively constant with immobility and cognitive overload being the reactions most characteristic of moments experienced as intrusive memories versus moments encoded as most distressing memories, both when using the quantitative factors (Chapter 3) and the composite peritraumatic scores (Chapter 5). Another important area of convergence between the two methods was the identification of an under-researched reaction, *i.e.* cognitive overload (Chapter 2 and 4). Additionally, qualitative data complemented quantitative data by providing in-depth phenomenological detail on commonly studied peritraumatic reactions such as dissociation and immobility while also leading to the identification of a number of more novel reactions (Chapter 4).

Some small discrepancies did emerge between the quantitative and qualitative data. For example, a number of reactions included in the standard peritraumatic questionnaires were not spontaneously mentioned by participants during interviews. Examples of these items include PDEQ question 7 "*I felt as though things that were actually happening to others were happening to me*…", SDQ-P question 6 *"My sense of taste diminished or was absent*", or MDQ question 7 "*I wanted to die*". The reason behind this discrepancy might be explained by these items being more relevant to other types of trauma, *e.g.* interpersonal violence such as rape and torture for MDQ items, and rarer in disaster settings.

Another discrepancy between quantitative data and qualitative data concerns the association between mental defeat and memory type. When using quantitative factor scores, mental defeat rates were not significantly different between moments experienced as intrusive memories and moments experienced as most distressing memories among participants without intrusions ($F(1,99) = 2.65$, $p = .107$).

However, when using composite scores derived from the qualitative data, mental defeat appeared significantly higher in the moments experienced as intrusive memories compared to the moments experienced as most distressing memories among participants without intrusions ($F(1,99) = 4.82$, $p = .030$). This might be due to slight differences in the phenomenological content of mental defeat as conceptualised in the standard measure versus the qualitative data. For example, the composite score of mental defeat derived from qualitative data included elements such as "exhaustion" and "lack of control" which are not present in the standard measure and that might have been responsible for this difference.

6.3.5 Reflexivity

Working intensively with trauma-exposed populations can be complex on an emotional level. I sometimes felt out of my depth when faced with stories of death, profound suffering, and loss. A number of lessons were learnt through the experience of conducting this work.

Firstly, the in-depth qualitative work was considerably more challenging on an emotional level than the quantitative work. In order to accommodate for participants' needs there were days in which I would have no interviews planned and other days in which I would have up to 5 interviews in the same day. Days with a high number of interviews were particularly challenging and, with hindsight, should have been avoided. Additionally, as some participants worked during the week, I also conducted interviews and data collection during weekends or evenings meaning that for several months I did not have a break from the research process. This, in hindsight, added to the emotional burden of the process, left me feeling drained at times, and could have been avoided.

Secondly, research on intrusive memories can be particularly challenging as most discussion with participants will focus on the most distressing moments of their trauma. As a result, I sometimes found it hard to have a more holistic perspective of the participants as it felt as if participants' narratives had remained "stuck" in the worst moments of their trauma. Trying to purposefully keep in mind that these narratives were not necessarily representative of the entire trauma or of the participant as well as trying to be more aware of the resilience showed by some of the participants was helpful. Another helpful strategy was discussing some of the most distressing aspects of interviews with other people, although this was not always possible as most people around me during fieldwork were survivors themselves and obvious ethical issues limited what I could discuss.

Thirdly, I felt that the research process itself on intrusive memories was at times difficult emotionally. Indeed, while a clinician working with intrusions might find purpose and meaning in using techniques they believe in in order to address these symptoms, as a researcher my role was simply that of receiving that information without being able to do much about it in the short term. This left me feeling somewhat powerless at times. In these moments I found it helpful to think that, for some participants, simply being able to tell their story was a meaningful experience and I cherished participants telling me how important it had been for them to speak about certain distressing things for the first time with someone. Another issue that added to the emotional difficulty of working on this project was the quantity of distressing stories. While a clinician might work with a small number of patients for a certain amount of time, as a researcher I was exposed to 104 different stories in a few months. In hindsight, this could have been avoided by lengthening the research period or simply by reducing the number of interviews.

While guidelines exist for self-care among humanitarian workers in disaster settings (Antares Foundation, 2012) and for clinicians working with trauma populations (Pearlman, 1995), there is little guidance and recommendations on self-care strategies specific to researchers working with populations affected by trauma. Self-care guidance could be helpful for researchers working with populations affected by trauma, especially when conducting qualitative work. This is of particular importance in light of evidence indicating that individuals can develop intrusions even simply by listening to traumatic verbal reports (Krans, Näring, Holmes, & Becker, 2010b).

6.4 Future research directions

In additional to a number of possible practical and clinical implications, the findings presented in the current thesis also open the possibility for a number of further research questions. In this final section I will outline a number of key possible future research directions that could build upon the current findings.

6.4.1 Active peritraumatic reactions, PTSD, and post-traumatic growth

A small amount of research has indicated that active behaviours during trauma such as biting, cursing, kicking, and fighting back tend to be negatively associated with PTSD (Atkeson, Calhoun, & Morris, 1989; Punamäki, Qouta, & El-Sarraj, 2001; Rizvi, Kaysen, Gutner, Griffin, & Resick, 2008). It has been hypothesized that these behaviours could be collectively classified under a “fight response” reaction (Gorman et al., 2016). In the current study, a number of more active responses were also identified such as hyper-focus and goal-oriented actions. However, these reactions were found not to be associated with less intrusive

memories in the current sample. Future research might investigate more systematically whether these under-studied reactions could represent a protective factor for PTSD development.

Additionally, while they might still not represent a protective factor for PTSD specifically, they might still positively contribute to survivors' general wellbeing through an increased sense of worth and purpose as a result of how they appraise their reaction during the trauma. This points to the possibility that these reactions might be associated with post-traumatic growth (PTG) (Calhoun & Tedeschi, 2006), defined as "*the experience of positive change that occurs as a result of the struggle with highly challenging life crises*" (Tedeschi & Calhoun, 2004). For example, a number of respondents reported being positively surprised by how they reacted, discovering themselves to be braver or stronger than they previously thought. However, there is currently limited evidence concerning the association between peritraumatic reactions and PTG with mixed findings concerning the relationship between peritraumatic distress or dissociation and PTG (Blix, Hansen, Birkeland, Nissen, & Heir, 2013; Greene, 2018; McCaslin et al., 2009). To the best of the author's knowledge, no research has been conducted exploring the relationship between more active peritraumatic reactions and PTG.

6.4.2 Study of peritraumatic reactions in different populations

The current study has been conducted in a very specific population, *i.e.* Italian adult earthquake survivors living in a rural setting. Future research should attempt to replicate these findings in different sub-populations. Indeed, a general limit of the peritraumatic literature and of the literature on the association between peritraumatic reactions and intrusive memories is its focus on adult populations

living in the Global North. However, there is evidence that peritraumatic reactions themselves as well as their relationship with psychopathology might differ according to demographic characteristics such as gender (Irish et al., 2011). Indeed, in the current study, gender differences in the level of certain peritraumatic reactions were identified.

One demographic sub-group for which more evidence is needed is children. Indeed, in a recent review of peritraumatic distress only 6 out of 57 studies focused specifically on children (Vance et al., 2018). Additionally, a major limitation in studies investigating peritraumatic reactions among child populations exposed to trauma is their reliance on scales that have been developed for adult populations. This approach seems to assume that the experience of peritraumatic reactions among children is similar to that of adults. However, a number of key items present in standard peritraumatic scales are likely to be experienced differently among children. For example, the thought that one is dying is considered a pillar of peritraumatic distress, but evidence indicates that the understanding children have of the concept of death is unique to this age group (Slaughter & Griffiths, 2007). Similarly, a number of peritraumatic reactions that might be highly relevant for this age group, *i.e.* fear for the death of one's parent/carer, being upset when observing one's parent/carer in distress, are not accounted for in standard peritraumatic scales. Given the importance of parental responses in predicting children's post-traumatic distress (Hiller et al., 2018), peritraumatic research in this age group should be attentive to the impact of parental peritraumatic reactions on the child's peritraumatic responses and subsequent mental health. Additionally, in-depth qualitative work exploring the phenomenological experience of peritraumatic reactions in this age group is urgently needed.

Another limit of the peritraumatic literature concerns its focus on populations living in the Global North. Additionally, when peritraumatic reactions are explored in populations living in the Global South, they are usually assessed using standard scales that have been developed in different contexts (Klasen et al., 2010; Nobakht et al., 2018; Peltonen, Kangaslampi, Saranpää, Qouta, Punamäki, 2017). However, a number of items included in standard peritraumatic questionnaires, *e.g.* PDEQ question 2 "*I found that I was on "automatic pilot*"" or PDEQ question 4 "*What was happening seemed unreal to me, like I was in a dream or watching a movie or play*", might be interpreted as having different meanings depending on the culture and context in which they are administered. Additionally, evidence indicates that constructs such as dissociation might have different phenomenological presentations in different cultural groups (Krüger, 2020). Future research should go beyond providing internal consistency ratings but rather focus on validity, fully engaging in proper adaptation procedures such as in-depth qualitative work prior to administration (Bhui, Mohamud, Warfa, Craig, & Stansfeld, 2003).

The literature on the relationship between peritraumatic reactions and intrusive memories is even more limited by the above-mentioned issues as the majority of the evidence comes from studies among university students in the Global North (Marks et al., 2018). Some exceptions do exist (*e.g.* Holmes, Creswell, and O'Connor's 2007 study on peritraumatic reactions and intrusive imagery among children in London following the 9/11 attacks) but future research should explore more systematically the replicability of findings in a more ample array of sub-demographic groups. The work that will be undertaken by the author among Brazilian adolescents exposed to urban violence will build on the current findings and contribute in part to filling this research gap.

6.4.3 Measurement of peritraumatic reactions

The current study relied on self-administered peritraumatic questionnaires. This represents the most widely used approach to capture peritraumatic reactions in community samples. However self-administered peritraumatic questionnaires have a number of limitations that threaten their validity and accuracy such as social desirability and possible issues with memory recall (David et al., 2010; Ouimette et al., 2005; Zoellner et al., 2001). Experimental studies have used more sophisticated methods to capture peritraumatic reactions such as heart-rate measurements (Chou et al., 2014) but, as mentioned in Chapter 1, also have a number of limitations concerning their ecological validity.

More innovative methods to study peritraumatic reactions have been proposed to address these limitations. One possibility is that of measuring peritraumatic reactions using self-report measures immediately after a potentially distressing event. For example, one study assessed peritraumatic hyperarousal and dissociation among novice skydivers immediately after the jump (Sterlini & Bryant, 2002). Although this method is not devoid of limitations, *e.g.* people had wilfully chosen to engage in this activity and for some it would have been enjoyable, it does allow for a more immediate capture of peritraumatic phenomena. Additionally, while this study still relied on self-report, it could be ameliorated by having participants wear fitbits to measure heart rate throughout the event. This would allow a replication of Chapter 3 and 5 by assessing whether specific moments experienced as intrusive memories differ in terms of markers of physiological arousal from other moments of the same event.

Another possible way of capturing peritraumatic reactions more naturalistically is that of relying on behavioural observation. One possible way in which this has been achieved is by using CCTV recordings that captured the reaction of people during disasters. For example, one study using this method during the 2011 Christchurch earthquake in New Zealand reported how no individual performed all "drop, cover, hold" actions but most people held on to furniture, walls, and/or other people around them (26%) or looked around (30%) (Lambie et al., 2017). This method is however limited by its feasibility being circumscribed only to relatively high-income settings as well as by its inability to accurately capture thoughts and feelings which, as internal experiences, can only be elicited through self-report.

6.5 Concluding remarks

In conclusion, the current thesis holds a number of possible practical implications for the understanding of peritraumatic reactions and intrusive memories, for the prevention and treatment of PTSD symptoms, and for ensuring the wellbeing of disaster survivors. Additionally, it points to a number of possible future research avenues. Intrusive memories and peritraumatic reactions represent important elements of the traumatic experience. The current thesis, by shedding light on the phenomenology and relationship between peritraumatic reactions and intrusive memories, will inform future research on the topic and contribute to improving the mental health of people exposed to trauma.

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8 Appendices

8.1 Appendix A: Ethical approval from UCL Research Ethics Committee

UCL RESEARCH ETHICS COMMITTEE

UCL

Amending an Approved Application

Should you wish to make an amendment to an approved study, you will need to submit an 'amendment request' for the consideration of the Chair of the UCL Research Ethics Committee. Applications can only be amended **after** ethical approval has been granted.

You will need to apply for an amendment approval if you wish to:

1. Add a new participant group;
2. Add a new research method;
3. Ask for additional data from your existing participants;
4. Remove a group of participants or a research method from the project, and have not yet commenced that part of the project;
5. Apply for an extension to your current ethical approval.

If you need to apply for an amendment approval, please complete the Amendment Approval Request Form on the next page.

When completing the form, please ensure you do the following:

- Clearly explain what the amendment you wish to make is, and the justification for making the change.
- Insert details of any ethical issues raised by the proposed amendments.
- Include all relevant information regarding the change so that the Chair can make an informed decision, and submit a copy of the sections of your application that have changed with all changes highlighted/underlined for clarity.
- You do not need to submit your original application in full again. However, if the changes you wish to make alters several sections of your application form, you are advised to submit this.

Please email a signed electronic copy to the REC Administrator: ethics@ucl.ac.uk

Amendment requests are generally considered within 5-7 days of submission.

Amendment Approval Request Form

1	**Project ID Number: 10517/001**	**Name and Address of Principal Investigator: Prof. Helene Joffe, Department of Clinical, Educational and Health Psychology, UCL**
2	**Project Title: Representation of earthquake damage causation and psychopathology**	
3	**Type of Amendment/s (tick as appropriate)** Research procedure/protocol (including research instruments) ☒ Participant group ☐ Sponsorship/collaborators ☐ Extension to approval needed (extensions are given for one year) ☒ Information Sheet/s ☒ Consent form/s ☒ Other recruitment documents ☐ Principal researcher/medical supervisor* ☐ Other ☐ **Additions to the research team other than the principal researcher, student supervisor and medical supervisor do not need to be submitted as amendments but a complete list should be available upon request **	
4	**Justification** (give the reasons why the amendment/s are needed) The researcher is planning to conduct another wave of data collection as part of his PhD. The focus of the PhD research has however now shifted into investigating the relationship between participants' descriptions of what has happened to them during the 2016-2017 earthquakes in Central Italy and subsequent spontaneous memories of the event. In particular, we are interested in investigating how people respond to stressful events and in the frequency and characteristics of spontaneous memories of the earthquake that might have popped in the minds of participants following the event. To do so a series of amendments have been proposed as part of the research methods.	
5	**Details of Amendments** (provide full details of each amendment requested, state where the changes have been made and attach all amended and new documentation) - In the previous study the interview focused on what participants believed had caused the earthquake's damage. The topic of the interview will now change and participants will be asked to describe the characteristics of any spontaneous memories about the event that they might have experienced (30 min). The researcher will then investigate with the participant whether certain phenomena that can happen during stressful events have taken place in the experience of the participant (30 min) during the moments that are represented by the spontaneous memory. The interview schedule has been carefully constructed with the help of Prof. Chris Brewin, an academic and clinician expert in trauma and PTSD, and Prof. Helene Joffe, an expert in qualitative methods and earthquakes. The interview will also include some questions on notions of attachment to their homes and region and on perceived social support. - The second part of the research will consist in the completion of a series of commonly used questionnaires and should take approximately 30-45 min. The questionnaire will be given in paper form and the researcher will always be present in case any participant needs help with the completion. The questionnaires will include: the PTSD Checklist for DSM-5 (PCL-5), the Depression, Anxiety and Stress Scale-21 (DASS-21), a questionnaire investigating the level of exposure to the earthquakes, the Mental Defeat Questionnaire (MDF), the Somatoform Dissocation Questionnaire- Peritraumatic (SDQ-P), the Peritraumatic Dissociation Experiences Questionniare (PDEQ), the Peritraumatic Distress Inventory (PDI), the DSM Diagnostic Interview Schedule for panic, the Tonic Immobility Scale (TSI) the Data Driven Processing Questionnaire and a questionnaire investigating the presence and characteristics of spontaneous memories of	

	the earthquake. Besides the PCL-5, DASS-21 and the cause and blame questionnaires, all of the questionnaires used in the previous study are not going to be used in the current study. - The final part of the research will include the completion of a short diary for two weeks (daily amount of time spent on the diary will span from a minimum of 2 minutes to a maximum of 10 minutes per day). The diary will be given only to participants who report spontaneous memories of the event popping into their mind at the time of the interview. The diary will ask participants to report on whether they have experienced spontaneous memories of the earthquake popping into their minds three times a day: once in the morning, once at midday and once before going to bed. No diary method was used in the previous study. Both the questionnaires and the diary method for intrusive memories are very commonly used in trauma research and no novel or untested procedure is being proposed. - While most probably the sample will remain exactly the same as the one of last year (data were collected from 127 participants living in Amatrice and those same participants are going to be re-contacted) there is the possibility that the sample might be slightly expanded if some of the old participants are not willing to participate in the current follow-up. - The new data collection will take place in the months of May, June and July 2018. - The total sample that the researcher will aim at collecting will be of 100 participants living in Amatrice. Considering that last year the researcher conducted 72 interviews in 1 and a half months, the current sample size seems reasonable and doable. - No control group will be used. These amendments are necessary to answer the question of how spontaneous memories of a stressful event arise following the event.
6	**Ethical Considerations** (insert details of any ethical issues raised by the proposed amendment/s) Asking people to describe stressful events can sometimes elicit negative affect in some people. There is however little evidence that voluntarily choosing to describe a stressful event one and a half year following the event poses significant risks to research participants (Jaffe, DiLillo, Hoffman, Haikalis & Dykstra, 2015). The researcher's supervisor, Prof. Chris Brewin, a world leading expert on trauma and PTSD and a practicing clinical psychologist in the NHS, has closely followed the design of this research project and will work with the researcher throughout the data collection. It is unlikely that the researcher will be asking about things that the participant has not already discussed at length with friends, family members, journalists and other members of the community. Considering the salience of the topic for the participants it is very likely that individuals will have spontaneously created specific narratives of the event that they use when asked what happened to them during the earthquake and that they have rehearsed those several times when speaking with other people. In order to avoid the potential of disturbing the participant the information sheet and consent form will specify that the interview will involve discussing the events surrounding the earthquake and that participants should not participate in the study if they are not willing to provide details of their experience or if they believe that doing so might cause them significant distress. If a participant got distressed during the interview the researcher would stop the interview immediately and check with the participant if they thought they wanted a referral for professional psychological help. The researcher has worked extensively in the area last year and has strong ties with the local mental health response teams and health personnel in the town and region and details of such services will be provided on the information sheet. The researcher will immediately liaise with the mental health teams and with Prof. Chris Brewin in case of any worrisome reaction from the participants. Furthermore, the majority of the interviews will take place in an office at the local health centre where nurses and doctors will be immediately available 24/7 in the case of an emergency. It is also important to highlight how the process of going through the distressing event in detail over and over again is the National Institute for Clinical Excellence recommended procedure for one of the main evidence-based psychotherapies used to treat PTSD and trauma: exposure therapy. The participants might therefore perceive the discussion of the events surrounding the earthquakes as beneficial to his or her emotional wellbeing. The researcher interviewed 72 people for the previous research project and the majority of participants spontaneously often discussed at length their experience of the earthquake even though it was not asked from them at the time and no one displayed any worrisome reaction. On the contrary, many participants

	described how they believed that having someone listening to them represented a meaningful experience and that they cherished the possibility of talking about their thoughts and feelings around the earthquake. It is therefore likely that the participant will experience the interaction with the research as potentially liberating and positive. The researcher will however make it clear that he has not received any clinical training himself but that he would be able to refer the participants to someone with clinical qualifications if the participant felt the need for it. Considering the detailed discussions of their experience of the earthquake in the previous interviews the researcher believes that the current amendments do not significantly alter the ethical risk of the research from last year. Of course, all of the precautions that had been used for the previous research will be put in place for this piece of work in order to minimize risk for participants. Jaffe, A.E., DiLillo, D., Hoffman, L., Haikalis, M. & Dykstra, R.E. (2015). Does it Hurt to Ask? A Meta-Analysis of Participant Reactions to Trauma Research. *Clinical Psychology Review,* 40, 40-56
7	**Other Information** (provide any other information which you believe should be taken into account during ethical review of the proposed changes) The researcher has already worked with all the participants in the area last year for several months and is well known within the community. The researcher also has several well-established links with the local and national mental health units working in the area in the unlikely case of a referral and/or emergency. The researcher also has considerable experience in working in other similar disaster-hit and sensitive areas in Japan for two years (following the 2011 Great Eastern Japan Earthquake and the Fukushima Daiichi Nuclear Disaster) and among survivors of the 9/11 attacks. The researcher's supervisor Prof. Chris Brewin has decades of experience in working with survivors of severe trauma and will provide close supervision to the research in the unlikely case any participant displayed a worrisome reaction during the interview.

Declaration (to be signed by the Principal Researcher)

- I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.
- I consider that it would be reasonable for the proposed amendments to be implemented.
- For student projects, I confirm that my supervisor has approved my proposed modifications.

Signature: [redacted]

Date: 30/01/2017

FOR OFFICE USE ONLY:

Amendments to the proposed protocol have been APPROVED ..... by the Research Ethics Committee. WITH PROVISO.

Signature of the REC Chair: [redacted]

Date: 5/MAY/18

8.2 Appendix B: Approval from Comune di Amatrice

COMUNE DI AMATRICE
PROVINCIA DI RIETI
UFFICIO DEL SEGRETARIO COMUNALE

Uno dei Borghi più belli d'Italia

PROT. 4440

Amatrice, 20/2/2017

Ad Alessandro Masazza
Department of Clinical,
Educational and Health Psycology
University Ccollege of London
alessandro.massazza@gmail.com

OGGETTO: PROGETTO DI RICERCA

Con la presente si comunica che è stato positivamente valutato il progetto di Ricerca da Lei presentato ad oggetto "Psicopatologia e rappresentazione delle cause dei danni subiti in seguito a disastri".
Per lo stesso si è ricevuta anche disponibilità di massima da parte della ASL Rieti.
Pertanto il sottoscritto, in qualità di Responsabile dei Servizi sociali rilascia nulla osta per conto dell'Ente la realizzazione del progetto.
I dati andranno trattati secondo le previsioni del DLgs 196/2003. Le attività di ricerca andranno concordate con la ASL territoriale e con l'ufficio comunale dei Servizi Sociali. Copia del prodotto finale andrà consegnato al Comune.
Il suo riferimento per il Comune è questo ufficio e l'assistente sociale Gianna Petrocco giannapetrocco@virgilio.it .
Si resta a disposizione.
Cordiali saluti

IL SEGRETARIO COMUNALE
Dott. Simone Lodovisi
[redacted]

COMUNE DI AMATRICE - Prov. di RIETI

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8.3 Appendix C: Questionnaires in English

8.3.1. Peritraumatic Dissociative Experiences Questionnaire (PDEQ) (Marmar, Weiss, & Metzler, 1997)

Peritraumatic Dissociative Experiences Questionnaire (PDEQ)

Please complete the items below by circling the number that best describes the experiences you had had during and immediately after the critical incident. If an item does not apply to your experience, please circle "not at all true".

		Not at all true	Slightly true	Somewhat true	Very true	Extremely true
1	I had moments of losing track of what was going on. I "blanked out" or "spaced out" or in some way felt that I was not part of what was going on.	1	2	3	4	5
2	I found that I was on "automatic pilot". I ended up doing things that I later realized I hadn't actively decided to do.	1	2	3	4	5
3	My sense of time changed. Things seemed to be happening in slow motion.	1	2	3	4	5
4	What was happening seemed unreal to me, like I was in a dream, or watching a movie or play.	1	2	3	4	5
5	I felt as though I were spectator watching what was happening to me, as if I were floating above the scene or observing it as an outsider.	1	2	3	4	5
6	There were moments when my sense of my own body seemed distorted or changed. I felt disconnected from my own body, or it was unusually large or small.	1	2	3	4	5
7	I felt as though things that were actually happening to others were happening to me — like I was in danger when I really wasn't.	1	2	3	4	5
8	I was surprised to find afterwards that a lot of things happened at the time that I was not aware of,	1	2	3	4	5

	especially things I ordinarily would have noticed.					
9	I felt confused; That is, there were moments when I had difficulty making sense of what was happening.	1	2	3	4	5
10	I felt disoriented; that is, there were moments when I felt uncertain about where I was or what time it was.	1	2	3	4	5

8.3.2 Peritraumatic Distress Inventory (PDI) (Brunet et al., 2001)

Peritraumatic Distress Inventory (PDI)

Please complete the items below by circling the number that best describes the experiences you had had during and immediately following the critical accident. If an item does not apply to your experience, please circle "not at all true".

		Not at all true	Slightly true	Somewhat true	Very true	Extremely true
1	I felt helpless.	1	2	3	4	5
2	I felt sadness and grief.					
3	I felt frustrated or angry.					
4	I felt afraid for my own safety.					
5	I felt guilty					
6	I felt ashamed of my emotional reactions.					
7	I felt worried about the safety of others.					
8	I had the feeling I was about to loose control of my emotions.					
9	I had difficulty controlling my bowel and bladder.					
10	I was horrified by what I saw.					
11	I had physical reactions like sweating, shaking, and my heart pounding.					
12	I felt I might pass out.					
13	I thought I might die					

8.3.3 Somatoform Dissociation Questionnaire-Peritraumatic (SDQ-P) (Nijenhuis et al., 2001)

SDQ-P

Instructions: Please answer the questions in this list by circling the answer that best describes your experiences and reactions during and / or immediately after the major event. If a physical cause is known, you can indicate that by circling 'yes'. If not known then you circle 'no'.

The possible answers you can give are:
During (a part of) the major event and / or immediately after, this phenomenon occurred to me:

1 = not at all
2 = a little bit
3 = to a considerable extent
4 = a lot
5 = extremely

During (a part of) the major event and / or immediately after	This applied to me					Physical cause known?	
1. It felt as if my body, or parts of it, was paralyzed	1	2	3	4	5	Yes	No
2. My visual field was smaller than usual (it felt as if I was looking through a tunnel or could just see a section of an area)	1	2	3	4	5	Yes	No
3. It felt as if my body, or parts of it, disappeared	1	2	3	4	5	Yes	No
4. I felt temporarily paralyzed or stiff	1	2	3	4	5	Yes	No
5. It felt as if my body, or parts of it, were numb	1	2	3	4	5	Yes	No
6. My sense of taste diminished or was absent	1	2	3	4	5	Yes	No
7. I crouched and automatically did not move – it was involuntary and not because I was physically restrained	1	2	3	4	5	Yes	No
8. I felt like I had to vomit	1	2	3	4	5	Yes	No
9. I made goal directed movements that I did not control myself (*e.g.* trying to grab something)	1	2	3	4	5	Yes	No

10. I did not physically manage to eat and drink, although food and drinks were available and not forbidden	1	2	3	4	5	Yes	No
11. I completely lost my appetite and thirst while I was hungry or thirsty before	1	2	3	4	5	Yes	No

8.3.4 Mental Defeat Questionnaire (MDQ) (Dunmore et al., 1999).

Freely available at: https://oxcadatresources.com/questionnaires-ptsd/

Thoughts and Feelings During Trauma

In the following, you will find a number of statements that describe thoughts and feelings that people may experience during a trauma. Please rate the extent to which these statements apply to your experience DURING THE TRAUMA by circling the appropriate number. There are no right and no wrong answers to these questions. Please try to remember how you felt and thought AT THE TIME OF THE TRAUMA, not what you thought afterwards with the benefit of hindsight.

Please rate whether the following statements applied to you AT ANY TIME during the trauma.

AT SOME POINT DURING THE TRAUMA.....	**Thought or feeling applied to me**				
	Not at all/never	**Very little**	**Moderately**	**Strongly**	**Very Strongly**
1. I lost any will-power.	0	1	2	3	4
2. I didn't care what happened to me anymore.	0	1	2	3	4
3. I felt completely defeated.	0	1	2	3	4
4. I no longer felt like a human being.	0	1	2	3	4
5. In my mind, I gave up.	0	1	2	3	4
6. I felt destroyed as a person.	0	1	2	3	4
7. I wanted to die.	0	1	2	3	4
8. I lost any inner resistance.	0	1	2	3	4
9. I felt like an object.	0	1	2	3	4
10. I felt completely at the mercy of other people or the situation	0	1	2	3	4
11. I felt completely humiliated and lost any sense of inner dignity.	0	1	2	3	4

8.3.5 Data-Driven Processing Scale (DDPS) (Halligan et al., 2002)

Freely available at: https://oxcadatresources.com/questionnaires-ptsd/

DATA DRIVEN PROCESSING

In this questionnaire, we are interested in WHAT WENT THROUGH YOUR MIND during the traumatic event. Please indicate the extent to which the following statements applied to you DURING THE TRAUMATIC EVENT.

		This applied to me				
DURING THE TRAUMATIC EVENT...		**Not at all**	**A little**	**Moderately**	**Strongly**	**Very strongly**
1.	I couldn't really take it all in.	0	1	2	3	4
2.	I did not fully understand what was going on.	0	1	2	3	4
3.	It was just like a stream of unconnected impressions following each other.	0	1	2	3	4
4.	I could not think clearly.	0	1	2	3	4
5.	I was overwhelmed by sensations and couldn't put everything together.	0	1	2	3	4
6.	I was confused and could not fully make sense of what was happening.	0	1	2	3	4
7.	My mind was fully occupied with what I saw, heard, smelled, and felt.	0	1	2	3	4
8.	My mind was full of impressions and my reactions to them.	0	1	2	3	4

8.3.6 Tonic Immobility Scale (TIS) (Forsyth et al., 2000)

TONIC IMMOBILITY SCALE

Instructions: Please answer the questions in this list by circling the answer that best describes your experiences and reactions during and /or immediately after the major event from 0 (*not at all*) to 6 (*extremely*).

Experience	*Not at all* *Extremely*						
1. Rate the degree to which you froze or felt paralyzed during your most recent experience	0	1	2	3	4	5	6
2. Rate the degree to which you were unable to move even though not restrained	0	1	2	3	4	5	6
3. Rate the degree to which your body was trembling/ shaking during the event	0	1	2	3	4	5	6
4. Rate the degree to which you were unable to call out or scream during the event	0	1	2	3	4	5	6
5. Rate the degree to which you felt numb or no pain during the event	0	1	2	3	4	5	6
6. Rate the extent to which you felt cold during the event	0	1	2	3	4	5	6
7. Rate the extent to which you felt feelings of fear/panic during the event	0	1	2	3	4	5	6
8. Rate the extent to which you feared for your life or felt as though you were going to die	0	1	2	3	4	5	6
9. Rate the extent to which you felt detached from yourself during the event	0	1	2	3	4	5	6
10. Rate the extent to which you felt detached from what was going on around you	0	1	2	3	4	5	6

8.3.7 Intrusive Memory Questionnaire

Intrusive Memory Questionnaire

An intrusive memory is any memory of the event that suddenly pops into mind spontaneously when you don't want it to. It does not include times when you deliberately think about it or mull over it.

Please answer the questions below referring to the intrusive memory you have just described during the interview.

Q1. How did you experience this intrusive memory? *Tick all that apply*

- ☐ As thoughts
- ☐ As images
- ☐ All of the above
- ☐ As bodily sensations
- ☐ As feelings
- ☐ Other: _____

Q2. How vivid/detailed was this intrusive memory?

1	2	3	4	5	6	7	8	9	10
Not vivid at all									Extremely vivid

Q3. When you experienced this intrusive memory, how much did you feel like you were re-living the experience again in the present?

1	2	3	4	5	6	7	8	9	10
Not at all									Intensely

Q4. How well did this intrusive memory reflect what actually happened during the event?

1	2	3	4	5	6	7	8	9	10
Did not reflect at all									Reflected extremely well

Q5. From 1 (not prevalent at all) to 10 (very prevalent) which of these senses were more prevalent in this intrusive memory?

Sight

1	2	3	4	5	6	7	8	9	10

Sound

1	2	3	4	5	6	7	8	9	10

Smell

1	2	3	4	5	6	7	8	9	10

Taste

1	2	3	4	5	6	7	8	9	10

Touch

1	2	3	4	5	6	7	8	9	10

Q6. If you experienced this intrusive memory as images, did you experience these images as: *Tick as many as apply*

- ☐ A single image
- ☐ A series of unconnected images
- ☐ A video-clip
- ☐ Other, specify: _____

Q7. How distressing was this intrusive memory for you?

1	2	3	4	5	6	7	8	9	10
Not distressing at all									Extremely distressing

Q8. How much did you try and suppress this intrusive memory when it appeared?

1	2	3	4	5	6	7	8	9	10
Not at all									A lot

Q9. From which perspective did you see what was happening in the intrusive memory?

- ☐ As if I was seeing the scene through my eyes (like I see the world normally)
- ☐ As if I was seeing the scene from the outside (*e.g.* as a third person, from above)

Q10. Has this intrusive memory changed in content throughout time?

- ☐ No, it has always remained stable
- ☐ Yes, it has changed throughout time

If it has changed please provide some details on what has changed:

Q11. In the previous month, how frequently did this intrusive memory pop into your mind?

- ☐ Several times a day
- ☐ A few times day
- ☐ Several times a week
- ☐ A few times a week
- ☐ Several times a month
- ☐ A few times a month
- ☐ Less than once a month
- ☐ Never

Q12. How long do you think this intrusive memory generally lasted for?

- ☐ 1-10 seconds
- ☐ 10-60 seconds
- ☐ 1-5 minutes
- ☐ 5-15 minutes
- ☐ 15-60 minutes
- ☐ 1-2 hours
- ☐ More than 2 hours

Q13. From 0 (not at all) to 10 (extremely) how much each of the following emotions accompanied the occurrence of the intrusive memory?

Anxiety

0	1	2	3	4	5	6	7	8	9	10

Anger

0	1	2	3	4	5	6	7	8	9	10

Sadness

0	1	2	3	4	5	6	7	8	9	10

Guilt

0	1	2	3	4	5	6	7	8	9	10

Shame

0	1	2	3	4	5	6	7	8	9	10

Helplessness

0	1	2	3	4	5	6	7	8	9	10

Numbness

0	1	2	3	4	5	6	7	8	9	10

Fear

0	1	2	3	4	5	6	7	8	9	10

Horror

0	1	2	3	4	5	6	7	8	9	10

Disgust

0	1	2	3	4	5	6	7	8	9	10

Q14. Did you experience any of the following during the moments that feature in your intrusive memory (not during the event as a whole but ONLY in the moments that are part of the intrusive memory)?
Please try to remember how you felt, behaved and thought DURING THOSE MOMENTS.
EXAMPLE: You might have an intrusive memory of when you saw your collapsed house for the first time. We want you to think back to those moments when you actually saw your collapsed house and report how much you experienced the following*:*

	Not at all					*Extremely*
1. Like you were having a panic attack	0	1	2	3	4	5
2. A physical reaction like sweating, shaking and your heart pounding	0	1	2	3	4	5
3. You felt like what was happening was unreal, like you were in a dream or watching a movie or a play	0	1	2	3	4	5
4. Your sense of time changed. Things seemed to be happening in slow motion	0	1	2	3	4	5
5. You felt as though you were a spectator watching what was happening to you, as if you were floating above the scene or observing it as an outsider	0	1	2	3	4	5
6. You had moments of losing track of what was going on. You "blanked out" or "spaced out" or in some way felt that you were not part of what was going on	0	1	2	3	4	5
7. You found that you were on "automatic pilot". You ended up doing things that you later realized you hadn't actively decided to do	0	1	2	3	4	5
8. You felt confused. That is, there were moments when you had difficulty making sense of what was happening	0	1	2	3	4	5
9. You felt disoriented. That is, there were moments when you felt uncertain about where you were or what time it was	0	1	2	3	4	5
10. Your sense of body seemed distorted or changed. You felt disconnected from your own body or it was unusually large or small	0	1	2	3	4	5
11. You felt numb or no pain	0	1	2	3	4	5
12. You froze or felt paralyzed	0	1	2	3	4	5
13. You felt cold	0	1	2	3	4	5
14. Your visual field was smaller than usual (it felt as if you were looking through a tunnel or could just see a section of an area)	0	1	2	3	4	5
15. It felt as if your body, or parts of it, disappeared	0	1	2	3	4	5

16. You felt like you had to vomit	0	1	2	3	4	5
17. You were unable to move even though not restrained	0	1	2	3	4	5
18. Your body was trembling/shaking	0	1	2	3	4	5
19. You were unable to call out or scream	0	1	2	3	4	5
20. You thought you might die	0	1	2	3	4	5
21. You felt you might pass out	0	1	2	3	4	5
22. You had the feeling you were about to lose control of your emotions	0	1	2	3	4	5
23. You had difficulty controlling your bowel and bladder	0	1	2	3	4	5
24. You were horrified by what you saw	0	1	2	3	4	5
25. You felt completely defeated	0	1	2	3	4	5
26. You lost any will-power	0	1	2	3	4	5
27. You didn't care what happened to you anymore	0	1	2	3	4	5
28. In your mind, you gave up	0	1	2	3	4	5
29. You wanted to die	0	1	2	3	4	5
30. You felt like you couldn't really take it all in	0	1	2	3	4	5
31. You felt as if it was just like a stream of unconnected impressions following each other	0	1	2	3	4	5
32. Your mind was fully occupied with what you saw, heard, smelled and felt	0	1	2	3	4	5
33. You felt overwhelmed by sensations and couldn't put everything together	0	1	2	3	4	5
34.You prayed to God	0	1	2	3	4	5
35. You felt worried about the safety of others	0	1	2	3	4	5
36.You felt fearless, exited and invulnerable	0	1	2	3	4	5

8.3.8 Level of exposure questionnaire

LEVEL OF EXPOSURE QUESTIONNAIRE

1. How strongly did you feel the shaking of the earthquake?

1	2	3	4	5	6	7	8	9	10
Very weak									Very strong

2. How has your house been classified?

   ☐ A
   ☐ B
   ☐ C
   ☐ D
   ☐ E
   ☐ F

3. Have you lost any close person?

   ☐ Parent(s)/ No. ____
   ☐ Brother(s) or sister(s)/ No. ___
   ☐ Spouse
   ☐ Aunt(s) or uncle(s)/ No. ___
   ☐ Cousin(s)/ No. ___
   ☐ Close friend(s)/ No. ___

4. Where you trapped under the debris?

   ☐ Yes, *please specify for how long*: _____
   ☐ No
   ☐ I don't remember

5. Did you witness any grotesque scenes? (*e.g.* body parts or dead bodies)

   ☐ Yes
   ☐ No
   ☐ I don't remember

6. Did you hear the voices of people under the debris?

   ☐ Yes
   ☐ No
   ☐ I don't remember

7. Did you witness the death of anyone?

   ☐ Yes

- ☐ No
- ☐ I don't remember

8. Where you physically injured during the earthquake?

   - ☐ Yes
   - ☐ No
   - ☐ I don't remember

9. Did you participate in the rescue efforts in the hours following the earthquake?

   - ☐ Yes
   - ☐ No

10. Where were you at the time of the earthquake of the 24th of August? *Please specify*

_____

11. Which of the following earthquakes did you experience personally?

    - ☐ 24th of August
    - ☐ 26th of October
    - ☐ 30h of October
    - ☐ 18th of January

8.4 Appendix D: Questionnaires in Italian

8.4.1. Peritraumatic Dissociative Experiences Questionnaire (PDEQ) (Marmar, Weiss, & Metzler, 1997)

Emozioni e pensieri durante o immediatamente dopo il trauma

Per favore compila tutti i campi qui sotto cerchiando il numero che meglio descrive l'esperienza che hai avuto durante o immediatamente dopo l'incidente critico. Se non hai fatto esperienza di alcuni di questi stati, semplicemente cerchia "per nulla".

	Per nulla	**Un pochino**	**Moderatamente**	**Molto**	**Moltissimo**
1. Ho avuto dei momenti in cui ho perso la cognizione di quello che stava succedendo. Ho avuto un vuoto o mi sono sentito/a assente o in qualche modo non mi sembrava di essere parte di quello che stava accadendo	1	2	3	4	5
2. Mi è sembrato come di aver attivato una mia modalità di "pilota automatico". Ho fatto cose che ho poi realizzato non avevo consapevolmente deciso di fare	1	2	3	4	5
3. La mia percezione del tempo è cambiata. Le cose sembravano essere al rallentatore	1	2	3	4	5
4. Mi è sembrato che quello che stava accadendo non fosse reale, come se fossi in un sogno o guardando un film o a teatro	1	2	3	4	5
5. Mi sono sentito/a come se fossi uno spettatore che guardava quello	1	2	3	4	5

che mi stava succedendo, come se stessi fluttuando sopra la scena o la osservassi da persona esterna					
6. C'erano dei momenti quando la mia percezione del mio corpo sembrava distorta o cambiata. Mi sono sentito/a distaccato/a dal mio corpo o come se fosse insolitamente grande o piccolo	1	2	3	4	5
7. Mi sono sentito/a come se cose che stavano in realtà accadendo ad altre persone stessero accadendo a me: come se fossi in pericolo quando in realtà non lo ero	1	2	3	4	5
8. Ero sorpreso/a di scoprire dopo che erano accadute molte cose di cui non ero consapevole, specialmente cose che normalmente avrei notato	1	2	3	4	5
9. Mi sono sentito/a confuso/a. Ovvero, c'erano dei momenti in cui avevo difficoltà a dare un senso a quello che stava accadendo	1	2	3	4	5
10. Mi sono sentito/a disorientato. Ovvero, c'erano dei momenti in cui non ero sicuro di dove fossi o di che ora fosse	1	2	3	4	5

8.4.2 Peritraumatic Distress Inventory (PDI) (Brunet et al., 2001)

Emozioni e pensieri durante o immediatamente dopo il trauma

Per favore compila i campi qui sotto cerchiando il numero che meglio descrive l'esperienza che hai avuto durante o immediatamente dopo l'incidente critico. Se non hai fatto esperienza di alcuni di questi stati, semplicemente cerchia "per nulla".

		Per nulla	**Un pochino**	**Moderatamente**	**Molto**	**Moltissimo**
1	Mi sono sentito/a impotente	1	2	3	4	5
2	Mi sono sentito/a triste e in pena	1	2	3	4	5
3	Mi sono sentito/a frustrato/a o arrabbiato/a	1	2	3	4	5
4	Ho avuto paura per la mia incolumità	1	2	3	4	5
5	Mi sono sentito/a in colpa	1	2	3	4	5
6	Mi sono vergognato delle mie reazioni emotive	1	2	3	4	5
7	Ero preoccupato per l'incolumità di altre persone	1	2	3	4	5
8	Ho sentito che stavo per perdere il controllo delle mie emozioni	1	2	3	4	5
9	Ho avuto difficoltà a contenere i miei bisogni fisici (escrezioni fisiologiche)	1	2	3	4	5
10	Ho provato orrore per quello che ho visto	1	2	3	4	5
11	Ho avuto una reazione fisica come sudare, tremare o avere il batticuore	1	2	3	4	5

12	Mi sono sentito svenire	1	2	3	4	5
13	Ho pensato che sarei morto/a	1	2	3	4	5

8.4.3 Somatoform Dissociation Questionnaire-Peritraumatic (SDQ-P) (Nijenhuis et al., 2001)

Emozioni e pensieri durante o immediatamente dopo il trauma

Istruzioni: Per favore rispondi alle domande in questa lista cerchiando la risposta che meglio descrive le tue esperienze e le tue reazioni durante o immediatamente dopo l'incidente critico.

Se c'è una causa fisica per questo sintomo che conosci, puoi indicarlo cerchiando "si". Se non c'è una causa fisica puoi cerchiare "no".

Le risposte possibili che puoi dare sono:

Durante (una parte del) evento critico o immediatamente dopo, questa cosa mi è successa:
1 = Per nulla
2 = Un pochino
3 = Moderatamente
4 = Molto
5 = Moltissimo

Durante (una parte del) evento critico o immediatamente dopo:							
	Mi è successo:					**Causa fisica?**	
1. Sentivo come se il mio corpo, o parte di esso, fosse paralizzato	1	2	3	4	5	Si	No
2. Il mio campo visivo era più piccolo del normale (mi è sembrato di vedere attraverso un tunnel o solo parte di un'area)	1	2	3	4	5	Si	No
3. Sentivo come se il mio corpo, o parte di esso, fosse scomparso	1	2	3	4	5	Si	No
4. Mi sono sentito temporaneamente paralizzato o rigido	1	2	3	4	5	Si	No
5. Mi è sembrato che il mio corpo, o parte di esso, fosse insensibile	1	2	3	4	5	Si	No
6. Il mio senso del gusto è diminuito o scomparso	1	2	3	4	5	Si	No
7. Mi sono accucciato e automaticamente non mi sono mosso, è successo in modo involontario e non perché ero fisicamente bloccato da qualcosa	1	2	3	4	5	Si	No

8. Mi è venuto da vomitare	1	2	3	4	5	Si	No
10. Ho fatto movimenti finalizzati a qualcosa senza che lo decidessi/percepiti come fuori dal mio controllo (per esempio cercare di afferrare qualcosa)	1	2	3	4	5	Si	No
11. Non sono fisicamente riuscito a mangiare o a bere, nonostante ci fossero cibo e bevande e non fosse vietato farne uso	1	2	3	4	5	Si	No
12. Ho completamente perso la mia fame e sete anche se avevo fame e sete prima	1	2	3	4	5	Si	No

8.4.4 Mental Defeat Questionnaire (MDQ) (Dunmore et al., 1999)

Emozioni e pensieri durante o immediatamente dopo il trauma

Nel seguente questionario, troverete una serie di affermazioni che descrivono pensieri ed emozioni che alcune persone possono avere durante un trauma. Per favore valuta in che misura hai fatto le seguenti esperienze DURANTE IL TRAUMA facendo un cerchio attorno al numero adatto. Non ci sono risposte giuste o sbagliate per queste domande. Per favore cerca di ricordare cosa hai sentito e pensato NEI MOMENTI DEL TRAUMA, non a quello che hai pensato dopo con il senno di poi.
Per favore valuta se hai vissuto le seguenti esperienze IN QUALSIASI MOMENTO durante il trauma.

Durante l'evento traumatico…					
	Per nulla	**Un pochino**	**Moderatamente**	**Molto**	**Moltissimo**
1. Ho perso tutta la forza di volontà	0	1	2	3	4
2. Non mi importava più nulla di quello che mi sarebbe accaduto	0	1	2	3	4
3. Mi sono sentito/a completamente sconfitto	0	1	2	3	4
4. Non mi sono più sentito/a un essere umano	0	1	2	3	4
5. Nella mia mente, mi sono arreso/a	0	1	2	3	4
6. Mi sono sentito/a distrutto/a come persona	0	1	2	3	4
7. Volevo morire	0	1	2	3	4
8. Ho perso qualsiasi tipo di resistenza interiore	0	1	2	3	4
9. Mi sono sentito/a come un oggetto	0	1	2	3	4
10. Mi sono sentito/a completamente alla mercé di altre persone o della situazione	0	1	2	3	4
11. Mi sono sentito/a completamente umiliato/a e ho perso qualsiasi forma di dignità interna	0	1	2	3	4

8.4.5 Data-Driven Processing Questionnaire (DDPS) (Halligan et al., 2002)

Emozioni e pensieri durante o immediatamente dopo il trauma

In questo questionario siamo interessati a QUELLO CHE TI È PASSATO PER LA MENTE durante l'evento traumatico. Gentilmente indica quanto hai fatto esperienza dei seguenti stati DURANTE L'EVENTO TRAUMATICO.

Durante l'evento traumatico…					
	Per nulla	**Un pochino**	**Moderatamente**	**Molto**	**Moltissimo**
1. Non riuscivo a processare tutto	0	1	2	3	4
2. Non capivo appieno quello che stava succedendo	0	1	2	3	4
3. Tutto era come un flusso di sensazioni sconnesse che si susseguivano	0	1	2	3	4
4. Non riuscivo a pensare lucidamente	0	1	2	3	4
5. Ero sopraffatta/o dalle mie sensazioni e non riuscivo a dar loro un senso	0	1	2	3	4
6. Ero confusa/o e non riuscivo a dare un senso a quello che stava accadendo	0	1	2	3	4
7. La mia mente era completamente occupata da quello che vedevo, udivo, odoravo e sentivo.	0	1	2	3	4
8. La mia mente era piena di sensazioni e delle mie reazioni a queste sensazioni	0	1	2	3	4

8.4.6 Tonic Immobility Scale (TIS) (Forsyth et al., 2000)

Emozioni e pensieri durante o immediatamente dopo il trauma

Istruzioni: Per favore rispondi alle domande in questa lista cerchiando la risposta che meglio descrive le tue esperienze e reazioni durante e/o immediatamente dopo l'incidente critico da 0 (*per nulla)* a 6 (*estremamente).*

Esperienza	*Per nulla* *Estremamente*						
1. Valuta in che misura ti sei pietrificato o ti sei sentito paralizzato durante l'evento	0	1	2	3	4	5	6
2. Valuta in che misura ti sei sentito incapace di muoverti nonostante non fossi fisicamente bloccato da nulla	0	1	2	3	4	5	6
3. Valuta in che misura il tuo corpo tremava durante l'evento	0	1	2	3	4	5	6
4. Valuta in che misura eri incapace di chiamare o gridare durante l'evento	0	1	2	3	4	5	6
5. Valuta in che misura il tuo corpo era insensibile e non provava dolore fisico durante l'evento	0	1	2	3	4	5	6
6. Valuta in che misura hai sentito freddo durante l'evento	0	1	2	3	4	5	6
7. Valuta in che misura hai avuto emozioni di paura/ panico durante l'evento	0	1	2	3	4	5	6
8. Valuta in che misura hai avuto paura per la tua vita o ti è sembrato che stessi per morire	0	1	2	3	4	5	6
9. Valuta in che misura ti sei sentito distaccato da te stesso durante l'evento	0	1	2	3	4	5	6
10. Valuta in che misura ti sei sentito distaccato da quello che ti stava accadendo attorno	0	1	2	3	4	5	6

8.4.7 Intrusive Memory Questionnaire

Questionario memorie intrusive

Una memoria intrusiva è una qualsiasi memoria riguardante gli eventi del terremoto che ti viene in mente in modo improvviso e contro il tuo volere. Non conta quando pensi deliberatamente agli eventi del terremoto o quando ci rimugini sopra.

Gentilmente rispondi alle domande qui sotto in relazione alla memoria intrusiva che hai descritto durante il colloquio.

Q1. In che modo hai vissuto la memoria intrusiva? *Segna tutte le voci pertinenti*

- ☐ Come pensiero
- ☐ Come immagine
- ☐ Tutte le precedenti
- ☐ Come sensazione fisica
- ☐ Come emozione
- ☐ Altro: _____

Q2. Quanto vivida/dettagliata era questa memoria intrusiva?

0	1	2	3	4	5	6	7	8	9	10
Per nulla vivida										Estremamente vivida

Q3. Quando hai vissuto questa memoria intrusiva, quanto ti è sembrato di rivivere l'esperienza ancora una volta nel presente?

0	1	2	3	4	5	6	7	8	9	10
Per nulla										Intensamente

Q4. In che misura questa memoria intrusiva ha rappresentato fedelmente quello che è accaduto nella realtà durante l'evento?

0	1	2	3	4	5	6	7	8	9	10
Per nulla fedelmente										Molto fedelmente

Q5. Da 0 (per nulla predominante) a 10 (molto predominante) quanto i seguenti sensi erano presenti nella memoria intrusiva?

Vista

0	1	2	3	4	5	6	7	8	9	10

Udito

0	1	2	3	4	5	6	7	8	9	10

Odorato

0	1	2	3	4	5	6	7	8	9	10

Gusto

0	1	2	3	4	5	6	7	8	9	10

Tatto

0	1	2	3	4	5	6	7	8	9	10

Q6. Se hai vissuto questa memoria intrusiva come un'immagine, hai vissuto questa immagine come: *Segna tutte le voci pertinenti*

- ☐ Una singola immagine
- ☐ Una serie di immagini sconnesse
- ☐ Un breve film
- ☐ Altro, specifica: _____

Q7. Quanto ti ha turbato questa memoria intrusiva?

0	1	2	3	4	5	6	7	8	9	10
Per nulla										Moltissimo

Q8. Quanto hai provato a reprimere questa memoria intrusiva quando è apparsa?

0	1	2	3	4	5	6	7	8	9	10
Per nulla										Moltissimo

Q9. Da che prospettiva hai osservato ciò che accadeva nella memoria intrusiva?

- ☐ Come se stessi vedendo la scena con i miei occhi (come vedi il mondo normalmente)
- ☐ Come se stessi vedendo la scena dall'esterno (per esempio come dalla prospettiva di una terza persona o come dall'alto)

Q10. Il contenuto di questa memoria intrusiva è cambiato nel tempo?

- ☐ No, è sempre rimasto lo stesso
- ☐ Si, è cambiato nel tempo

Se è cambiato, per favore scrivi in breve in che modo il contenuto è cambiato nel tempo:

Q11. Nell'ultimo mese, quanto di frequente questa memoria intrusiva ti è venuta in mente all'improvviso senza che tu lo volessi?

- ☐ Più volte al giorno
- ☐ Un paio di volte al giorno
- ☐ Più volte alla settimana
- ☐ Un paio di volte alla settimana
- ☐ Più volte al mese
- ☐ Un paio di volte al mese
- ☐ Meno di una volta al mese
- ☐ Mai

Q12. Approssimativamente quanto dura questa memoria intrusiva quando accade?

- ☐ 1-10 secondi
- ☐ 10-60 secondi
- ☐ 1-5 minuti
- ☐ 5-15 minuti
- ☐ 15-60 minuti
- ☐ 1-2 ore
- ☐ Più di due ore

Q13. Da 0 (per nulla) a 10 (estremamente) quanto ognuna delle seguenti emozioni ha accompagnato la memoria intrusiva?

Ansia

0	1	2	3	4	5	6	7	8	9	10

Rabbia

0	1	2	3	4	5	6	7	8	9	10

Tristezza

0	1	2	3	4	5	6	7	8	9	10

Senso di colpa

0	1	2	3	4	5	6	7	8	9	10

Vergogna

0	1	2	3	4	5	6	7	8	9	10

Impotenza

0	1	2	3	4	5	6	7	8	9	10

Apatia

0	1	2	3	4	5	6	7	8	9	10

Paura

0	1	2	3	4	5	6	7	8	9	10

Orrore

0	1	2	3	4	5	6	7	8	9	10

Disgusto

0	1	2	3	4	5	6	7	8	9	10

Q14. **Nella realtà**, **durante gli effettivi momenti del trauma** che vedi nella tua memoria intrusiva, hai fatto esperienza dei seguenti stati? Non pensare a tutto l'evento ma SOLO a quei momenti che sono contenuti nella tua memoria intrusiva.
Cerca di ricordare cosa hai provato, pensato e fatto DURANTE QUEI MOMENTI:

	Per nulla					*Estremamente*
1. Un attacco di panico	0	1	2	3	4	5
2. Una reazione fisica come sudare, tremare o avere il batticuore	0	1	2	3	4	5
3. Ti è sembrato che quello che stava accadendo non fosse reale, come se fossi in un sogno o guardando un film o a teatro	0	1	2	3	4	5
4. La tua percezione del tempo è cambiata. Le cose sembravano essere al rallentatore	0	1	2	3	4	5
5. Ti sei sentito/a come se fossi uno spettatore che guardava quello che ti stava succedendo, come se stessi fluttuando sopra la scena o la osservassi da persona esterna	0	1	2	3	4	5
6. Hai avuto dei momenti in cui hai perso la cognizione di quello che stava succedendo. Hai avuto un vuoto o ti sei sentito/a assente o in qualche modo non ti sembrava di essere parte di quello che stava accadendo	0	1	2	3	4	5
7. Ti è sembrato come di aver attivato una tua modalità di "pilota automatico". Hai fatto cose che hai poi realizzato non avevi consapevolmente deciso di fare	0	1	2	3	4	5
8. Ti sei sentito/a confuso/a. Ovvero c'erano dei momenti in cui hai avuto difficoltà a dare un senso a quello che stava accadendo	0	1	2	3	4	5
9. Ti sei sentito/a disorientato/a. Ovvero c'erano dei momenti in cui non eri sicuro di dove fossi o di che ora fosse	0	1	2	3	4	5
10. C'erano dei momenti quando la tua percezione del tuo corpo sembrava distorta o cambiata. Ti sei sentito/a distaccato/a dal tuo corpo o come se fosse insolitamente grande o piccolo	0	1	2	3	4	5
11. Il tuo corpo era insensibile e non provava dolore fisico	0	1	2	3	4	5
12. Ti sei pietrificato/a o paralizzato /a	0	1	2	3	4	5
13. Hai sentito freddo	0	1	2	3	4	5
14. Il tuo campo visivo era più piccolo del normale (ti è sembrato di vedere attraverso un tunnel o solo parte di un'area)	0	1	2	3	4	5

15. Ti è sembrato che il tuo corpo, o parti di esso, fosse scomparso	0	1	2	3	4	5
16. Ti è venuto da vomitare	0	1	2	3	4	5
17. Ti sei sentito incapace di muoverti nonostante non fossi fisicamente bloccato da nulla	0	1	2	3	4	5
18. Il tuo corpo tremava	0	1	2	3	4	5
19. Eri incapace di chiamare o gridare	0	1	2	3	4	5
20. Hai pensato che saresti morto/a	0	1	2	3	4	5
21. Ti sei sentito/a svenire	0	1	2	3	4	5
22. Hai sentito che stavi per perdere il controllo delle tue emozioni	0	1	2	3	4	5
23. Hai avuto difficoltà a contenere i bisogni fisici (escrezioni fisiologiche)	0	1	2	3	4	5
24. Hai provato orrore per quello che hai visto	0	1	2	3	4	5
25. Ti sei sentito/a totalmente sconfitto/a	0	1	2	3	4	5
26. Hai perso tutta la forza di volontà	0	1	2	3	4	5
27. Non ti importava più nulla di ciò che ti sarebbe accaduto	0	1	2	3	4	5
28. Nella tua mente, ti sei arreso/a	0	1	2	3	4	5
29. Volevi morire	0	1	2	3	4	5
30. Non riuscivi a processare tutto	0	1	2	3	4	5
31 Tutto ti sembrava un flusso di sensazioni sconnesse che si susseguivano	0	1	2	3	4	5
32. La tua mente era completamente occupata da quello che vedevi, udivi, odoravi e sentivi	0	1	2	3	4	5
33. Eri sopraffatto/a dalle tue sensazioni e non riuscivi a dar loro un senso	0	1	2	3	4	5
34. Hai pregato Dio	0	1	2	3	4	5
35. Eri preoccupato per l'incolumità di altre persone	0	1	2	3	4	5
36. Ti sentivi senza paura e invulnerabile, come se nulla potesse farti del male	0	1	2	3	4	5

8.4.8 Non-Intrusive Memory Questionnaire

Questionario memoria volontaria

Durante il colloquio hai descritto una memoria riguardante gli eventi del terremoto che ti turba molto ma che tuttavia **non ti è mai venuta alla memoria di colpo senza che tu lo volessi**. Questa è una memoria a cui talvolta pensi volontariamente.

Gentilmente rispondi alle domande qui sotto in relazione alla memoria volontaria che hai descritto durante il colloquio.

Q1. In che modo hai vissuto la memoria volontaria? *Segna tutte le voci pertinenti*

- ☐ Come pensiero
- ☐ Come immagine
- ☐ Tutte le precedenti
- ☐ Come sensazione fisica
- ☐ Come emozione
- ☐ Altro: _____

Q2. Quanto vivida/dettagliata era questa memoria volontaria?

0	1	2	3	4	5	6	7	8	9	10
Per nulla vivida										Estremamente vivida

Q3. Quando hai pensato a questa memoria volontaria, quanto ti è sembrato di rivivere l'esperienza ancora una volta nel presente?

0	1	2	3	4	5	6	7	8	9	10
Per nulla										Intensamente

Q4. In che misura questa memoria volontaria ha rappresentato fedelmente quello che è accaduto nella realtà durante l'evento?

0	1	2	3	4	5	6	7	8	9	10
Per nulla fedelmente										Molto fedelmente

Q5. Da 0 (per nulla predominante) a 10 (molto predominante) quanto i seguenti sensi erano presenti nella memoria volontaria?

Vista

0	1	2	3	4	5	6	7	8	9	10

Udito

0	1	2	3	4	5	6	7	8	9	10

Odorato

0	1	2	3	4	5	6	7	8	9	10

Gusto

0	1	2	3	4	5	6	7	8	9	10

Tatto

0	1	2	3	4	5	6	7	8	9	10

Q6. Se hai vissuto questa memoria volontaria come un'immagine, hai vissuto questa immagine come: *Segna tutte le voci pertinenti*

- ☐ Una singola immagine
- ☐ Una serie di immagini sconnesse
- ☐ Un breve film
- ☐ Altro, specifica: _____

Q7. Quanto ti ha turbato questa memoria volontaria?

0	1	2	3	4	5	6	7	8	9	10
Per nulla										Moltissimo

Q8. Quanto hai provato a reprimere questa memoria volontaria quando ci hai pensato?

0	1	2	3	4	5	6	7	8	9	10
Per nulla										Moltissimo

Q9. Da che prospettiva hai osservato ciò che accadeva nella memoria volontaria?

- ☐ Come se stessi vedendo la scena con i miei occhi (come vedi il mondo normalmente)
- ☐ Come se stessi vedendo la scena dall'esterno (per esempio come dalla prospettiva di una terza persona o come dall'alto)

Q10. Il contenuto di questa memoria volontaria è cambiato nel tempo?

- ☐ No, è sempre rimasto lo stesso
- ☐ Si, è cambiato nel tempo

Se è cambiato, per favore scrivi in breve in che modo il contenuto è cambiato nel tempo:

Q11. Nell'ultimo mese, quanto di frequente hai pensato a questa memoria volontaria?

- ☐ Più volte al giorno
- ☐ Un paio di volte al giorno
- ☐ Più volte alla settimana
- ☐ Un paio di volte alla settimana
- ☐ Più volte al mese
- ☐ Un paio di volte al mese
- ☐ Meno di una volta al mese
- ☐ Mai

Q12. Approssimativamente quanto dura questa memoria volontaria quando ci pensi?

- ☐ 1-10 secondi
- ☐ 10-60 secondi
- ☐ 1-5 minuti
- ☐ 5-15 minuti
- ☐ 15-60 minuti
- ☐ 1-2 ore
- ☐ Più di due ore

Q13. Da 0 (per nulla) a 10 (estremamente) quanto ognuna delle seguenti emozioni ha accompagnato la memoria volontaria?

Ansia

0	1	2	3	4	5	6	7	8	9	10

Rabbia

0	1	2	3	4	5	6	7	8	9	10

Tristezza

0	1	2	3	4	5	6	7	8	9	10

Senso di colpa

0	1	2	3	4	5	6	7	8	9	10

Vergogna

0	1	2	3	4	5	6	7	8	9	10

Impotenza

0	1	2	3	4	5	6	7	8	9	10

Apatia

0	1	2	3	4	5	6	7	8	9	10

Paura

0	1	2	3	4	5	6	7	8	9	10

Orrore

0	1	2	3	4	5	6	7	8	9	10

Disgusto

0	1	2	3	4	5	6	7	8	9	10

Q14. **Nella realtà**, **durante gli effettivi momenti del trauma** che vedi nella tua memoria volontaria, hai fatto esperienza dei seguenti stati? Non pensare a tutto l'evento ma SOLO a quei momenti che sono contenuti nella tua memoria volontaria.
Cerca di ricordare cosa hai provato, pensato e fatto DURANTE QUEI MOMENTI:

	Per nulla					*Estremamente*
1. Un attacco di panico	0	1	2	3	4	5
2. Una reazione fisica come sudare, tremare o avere il batticuore	0	1	2	3	4	5
3. Ti è sembrato che quello che stava accadendo non fosse reale, come se fossi in un sogno o guardando un film o a teatro	0	1	2	3	4	5
4. La tua percezione del tempo è cambiata. Le cose sembravano essere al rallentatore	0	1	2	3	4	5
5. Ti sei sentito/a come se fossi uno spettatore che guardava quello che ti stava succedendo, come se stessi fluttuando sopra la scena o la osservassi da persona esterna	0	1	2	3	4	5
6. Hai avuto dei momenti in cui hai perso la cognizione di quello che stava succedendo. Hai avuto un vuoto o ti sei sentito/a assente o in qualche modo non ti sembrava di essere parte di quello che stava accadendo	0	1	2	3	4	5
7. Ti è sembrato come di aver attivato una tua modalità di "pilota automatico". Hai fatto cose che hai poi realizzato non avevi consapevolmente deciso di fare	0	1	2	3	4	5
8. Ti sei sentito/a confuso/a. Ovvero c'erano dei momenti in cui hai avuto difficoltà a dare un senso a quello che stava accadendo	0	1	2	3	4	5
9. Ti sei sentito/a disorientato/a. Ovvero c'erano dei momenti in cui non eri sicuro di dove fossi o di che ora fosse	0	1	2	3	4	5
10. C'erano dei momenti quando la tua percezione del tuo corpo sembrava distorta o cambiata. Ti sei sentito/a distaccato/a dal tuo corpo o come se fosse insolitamente grande o piccolo	0	1	2	3	4	5
11. Il tuo corpo era insensibile e non provava dolore fisico	0	1	2	3	4	5
12. Ti sei pietrificato/a o paralizzato /a	0	1	2	3	4	5
13. Hai sentito freddo	0	1	2	3	4	5
14. Il tuo campo visivo era più piccolo del normale (ti è sembrato di vedere attraverso un tunnel o solo parte di un'area)	0	1	2	3	4	5

15. Ti è sembrato che il tuo corpo, o parti di esso, fosse scomparso	0	1	2	3	4	5
16. Ti è venuto da vomitare	0	1	2	3	4	5
17. Ti sei sentito incapace di muoverti nonostante non fossi fisicamente bloccato da nulla	0	1	2	3	4	5
18. Il tuo corpo tremava	0	1	2	3	4	5
19. Eri incapace di chiamare o gridare	0	1	2	3	4	5
20. Hai pensato che saresti morto/a	0	1	2	3	4	5
21. Ti sei sentito/a svenire	0	1	2	3	4	5
22. Hai sentito che stavi per perdere il controllo delle tue emozioni	0	1	2	3	4	5
23. Hai avuto difficoltà a contenere i bisogni fisici (escrezioni fisiologiche)	0	1	2	3	4	5
24. Hai provato orrore per quello che hai visto	0	1	2	3	4	5
25. Ti sei sentito/a totalmente sconfitto/a	0	1	2	3	4	5
26. Hai perso tutta la forza di volontà	0	1	2	3	4	5
27. Non ti importava più nulla di ciò che ti sarebbe accaduto	0	1	2	3	4	5
28. Nella tua mente, ti sei arreso/a	0	1	2	3	4	5
29. Volevi morire	0	1	2	3	4	5
30. Non riuscivi a processare tutto	0	1	2	3	4	5
31 Tutto ti sembrava un flusso di sensazioni sconnesse che si susseguivano	0	1	2	3	4	5
32. La tua mente era completamente occupata da quello che vedevi, udivi, odoravi e sentivi	0	1	2	3	4	5
33. Eri sopraffatto/a dalle tue sensazioni e non riuscivi a dar loro un senso	0	1	2	3	4	5
34. Hai pregato Dio	0	1	2	3	4	5
35. Eri preoccupato per l'incolumità di altre persone	0	1	2	3	4	5
36. Ti sentivi senza paura e invulnerabile, come se nulla potesse farti del male	0	1	2	3	4	5

8.4.9 Level of exposure questionnaire

Questionario livello di esposizione

12. Con che intensità hai sentito il tremore del terremoto?

1	2	3	4	5	6	7	8	9	10
Debolmente									Molto intensamente

13. Come è stata classificata la tua abitazione?

- ☐ A
- ☐ AF
- ☐ B
- ☐ BF
- ☐ C
- ☐ CF
- ☐ D
- ☐ DF
- ☐ E
- ☐ EF

14. Hai perso persone a te vicine a causa del terremoto?

- ☐ Genitore/ n° ____
- ☐ Figlio o figlia/ n° ___
- ☐ Fratello o sorella/ n° ___
- ☐ Partner
- ☐ Zio o zia/ n° ___
- ☐ Cugino o cugina/ n° ___
- ☐ Amico o amica molto stretti/ n° ___

15. Sei rimasto intrappolato/a sotto le macerie?

- ☐ Si, *per favore specifica approssimativamente per quanto*:
  _____
- ☐ No
- ☐ Non mi ricordo

16. Sei stato testimone di scene agghiaccianti? (per esempio parti del corpo o cadaveri)

- ☐ Si
- ☐ No
- ☐ Non mi ricordo

17. Hai sentito le voci di persone da sotto le macerie?

- ☐ Si
- ☐ No
- ☐ Non mi ricordo

18. Sei stato/a testimone della morte di qualcuno?

- ☐ Si
- ☐ No
- ☐ Non mi ricordo

19. Sei stato ferito/a fisicamente durante il terremoto?

- ☐ Si
- ☐ No
- ☐ Non mi ricordo

20. Hai partecipato alle attività di primo soccorso nelle ore dopo il sisma?

- ☐ Si
- ☐ No

21. Dove ti trovavi durante la scossa del 24 agosto? *Specifica per favore* (per esempio: *casa mia, Poggio Castellano)*

_____

22. Quali dei seguenti terremoti hai vissuto in prima persona?

- ☐ 24 agosto
- ☐ 26 ottobre
- ☐ 30 ottobre
- ☐ 18 gennaio

23. Hai perso il lavoro a causa del terremoto?

- ☐ Si
- ☐ No
- ☐ Non applicabile (in pensione, disoccupato già da prima, studente)

Se si, gentilmente specifica per quanto sei stato/a disoccupato/a:

_____

8.4.10 PTSD Checklist for DSM-5 (PCL-5) (Weathers et al. 2013)

Emozioni riguardanti il trauma nell'ultimo mese

Istruzioni: Qua sotto trovi una lista di problemi che talvolta le persone possono riscontrare in risposta a esperienze particolarmente stressanti. Leggi gentilmente ciascuno dei problemi attentamente e cerchia uno dei numeri sulla destra per indicare quanto sei stato/a disturbato/a da quel problema nell'ultimo mese.

0 = Per nulla
1 = Un pochino
2 = Moderatamente
3 = Un bel po'
4 = Estremamente

Nell'ultimo mese, quanto sei stato/a disturbato/a da:					
1. Ricordi ricorrenti, inquietanti e indesiderati sull'esperienza stressante	0	1	2	3	4
2. Sogni ricorrenti e inquietanti sull'esperienza stressante	0	1	2	3	4
3. Improvvisamente sentirsi o comportarsi come se l'esperienza stressante stesse accadendo di nuovo (come se tu fossi di nuovo lì a rivivere quella situazione)	0	1	2	3	4
4. Sentirsi molto turbati quando qualcosa ti ricorda l'esperienza stressante	0	1	2	3	4
5. Avere forti reazioni fisiche quando qualcosa ti ricorda l'esperienza stressante (per esempio, cuore che batte forte, fatica a respirare, sudare)	0	1	2	3	4
6. Evitare ricordi, pensieri o emozioni collegate all'esperienza stressante	0	1	2	3	4
7. Evitare ricordi esterni dell'esperienze stressante (per esempio, persone, luoghi, conversazioni, attività, oggetti o situazioni)	0	1	2	3	4
8. Difficoltà nel ricordarsi parti importanti dell'esperienza stressante	0	1	2	3	4
9. Avere forti convinzioni negative su te stesso/a, altre persone, o il mondo (per esempio, avere pensieri tipo: non sono una bella persona, c'è qualcosa di veramente sbagliato in me, non ci si può fidare di nessuno, il mondo è assolutamente pericoloso)	0	1	2	3	4
10. Incolpare se stessi o altri per l'esperienza stressante o per ciò che è accaduto dopo	0	1	2	3	4
11. Avere forti emozioni negative come paura, orrore, rabbia, senso di colpa o vergogna	0	1	2	3	4
12. Perdita di interesse nelle attività che ti piacevano	0	1	2	3	4
13. Sentirsi distante o tagliato fuori dalle altre persone	0	1	2	3	4
14. Difficoltà a provare emozioni positive (per esempio, essere incapace di sentirsi felici o di avere sentimenti affettuosi nei confronti delle persone a te vicine)	0	1	2	3	4
15. Comportamento irritabile, eccessi di rabbia, o atteggiamenti aggressivi	0	1	2	3	4
16. Correre troppi rischi o fare cose che potrebbero nuocerti	0	1	2	3	4
17. Essere oltremodo attento/a, vigile o sul chi va là	0	1	2	3	4
18. Sentirsi tesi o trasalire facilmente	0	1	2	3	4
19. Avere difficoltà nel concentrarsi	0	1	2	3	4

20. Difficoltà nell'addormentarsi o nel rimanere addormentati	0	1	2	3	4

8.4.11 Demographic information questionnaire

Informazioni socio-demografiche

Genere

☐Maschio ☐Femmina ☐Preferisco non dire

Età

…… anni

Religione

☐Cattolica ☐Cristiana (altro) ☐Ateo/a ☐Agnostico/a
☐Altro (specificare _____)

Reddito annuo

☐Meno di 10.000 euro ☐Tra 10.000 e 20.000 ☐Tra 20.000 e 40.000
☐Più di 40.000 ☐Non applicabile

Etnia

☐Caucasico/a
☐Altro (specificare _____)

Stato civile

☐Sposato/a ☐Celibe/Nubile ☐Altro (specificare _____)

Professione

☐Impiegato ☐Operaio ☐Dirigente ☐Commerciante ☐Artigiano ☐Contadino
☐Libero professionista ☐Imprenditore ☐Insegnante ☐Pensionato ☐Studente
☐Casalinga ☐Disoccupato ☐Medico ☐Altro (specificare _____)

Titolo di studio

☐Licenza elementare ☐Diploma di scuola media
☐Diploma di scuola secondaria (liceo, istituto, diploma) ☐Laurea
☐Post-laurea

Residenza ad _____ nella frazione di _____

8.5 Appendix E: Interview schedule

INTERVIEW SCHEDULE – Intrusive Memories

Section	Script
1. Introduce project and get informed consent	Read information sheet and consent form.
2. Check for the presence of intrusive memories. If YES go to 3. If NO go to 7b.	"*People who have gone through a distressing event can remember the event in different ways. Some people have memories of part of the earthquake that pop into their mind when they do not want them to. These are usually from particular moments from before, during or after the event that somehow "got stuck" in memory and keep coming back. These memories consist of part of what actually happened at the time. Do you sometimes get or have got in the past such unwanted recollections of the earthquake?".* (Adapted from Evans, Mezey, Ehlers & Clark, 2007).
3. Check if they still experience these intrusive memories or if they have experienced them in the past. Record response.	*"Do you still experience these unwanted recollections of the earthquake or did you only experience these in the past and do not experience them anymore?"* If they experienced them in the past but not anymore inquire on when approximately they stopped experiencing them.
4. Check how many different intrusive memories the participant has/ is experiencing. Record response.	"*Do you have only one unwanted recollection or more than one (i.e. intrusive memories of different scenes)?"*
5. Detailed description of the intrusive memory. Focus only on one memory.	"*I would like you to try and describe in as much detail as you can the characteristics and content or such unwanted recollection. If you have experienced more than one unwanted recollection please just describe the one that was most upsetting or distressing to you."* Give additional prompt in the end "*Is there anything else you would like to add?".*
6. Detailed description of what happened in the moments described by the intrusive memory.	"*I would now like you to try and go back in memory to the moments of the event that correspond to the unwanted recollection you have just described* [refer to the moments described in the memory they have

	described in 5.] *and try and describe in as much detail as you can what you felt, thought and did in those moments. It is important that you think back at what happened in the exact moments described by the unwanted recollection not at the moments when you experienced the unwanted recollection. For example, you might have an unwanted memory of when you saw your collapsed house for the first time. We want you to think back at those moments when you actually saw your collapsed house and describe in as much detail as you can what you felt, did or thought in these moments.* Give additional prompt in the end "*Is there anything else you did, thought or felt?".*
7a. Detailed description of distressing BUT NOT INTRUSIVE memory. IF participant experienced intrusive memories.	"*I would now like you to identity another memory concerning the earthquake events that is just as distressing as the unwanted recollection you have just described but that never spontaneously popped into your mind without you wanting it. This should be a memory that you sometimes might consciously and voluntarily think about. It's important that you try and identify a memory that is just as distressing and upsetting as the unwanted recollections you have just described but that does not pop into your mind involuntarily."* Give additional prompt in the end "*Is there anything else you would like to add?".*
7b. Detailed description of distressing BUT NOT INTRUSIVE memory. IF participant DID NOT experience intrusive memories.	"*I would like you to identify the most distressing memory you have of the earthquake and describe its content and characteristics in as much detail as you can. It is important that this memory has never spontaneously popped into your mind without you wanting it and that you have always brought it to mind consciously and voluntarily."* Give additional prompt in the end "*Is there anything else you would like to add?".*
8. Detailed description of what happened in the moments described by the voluntary memory.	"*I would now like you to try and go back in memory to the moments of the events that correspond to the memory you have just described* [refer to the moments described in the memory they have described in 7.] *and*

	try and describe in as much detail as you can what you felt, thought and did in those moments. It is important that you think back at what happened in the exact moments described by the memory." Give additional prompt in the end "*Is there anything else you did, thought or felt?".*

Throughout interview do not ask any more additional direct question but simply add prompts at the end of the description and throughout their description take note of peritraumatic phenomena and at the end of each section ask participants to elaborate more on these part (e.g. "*You said everything felt unreal, could you elaborate more on that*?").

8.6 Appendix F: Information sheet and consent form

8.6.1 Information sheet (participation in all components of study)

SCHEDA INFORMATIVA

Ti verrà data una copia di questo documento prima di iniziare la ricerca.

Titolo del progetto: **Terremoti e psicopatologia**

Questo studio è stato approvato dal Comitato Etico di Ricerca della University College London con il seguente numero identificativo: 10517/001, dal Comune di Amatrice e dalla ASL di Rieti.
Nome del ricercatore: Alessandro Massazza
Indirizzo lavorativo: Department of Clinical, Educational and Health Psychology, Gower Street, London
E-mail: alessandro.massazza.13@ucl.ac.uk

Grazie per il tuo interesse nella nostra ricerca. Prima che tu decida se vuoi partecipare o meno, è importante che tu comprenda in cosa consiste questo progetto. Per favore leggi le seguenti informazioni attentamente. Non esitare a farmi delle domande se c'è qualcosa che non ti risulta chiaro o semplicemente se volessi più informazioni su qualcosa. Prenditi del tempo per decidere se desideri partecipare o meno.

In questo studio siamo interessati a comprendere quali sono le conseguenze dei disastri sul benessere emotivo delle popolazioni esposte a disastri. In questo studio ci stiamo concentrando in particolare sulle persone di che sono state colpite dai terremoti del 2016-17.

Il presente studio è composto da tre parti:

1. Un **colloquio** (durata di 1 ora e mezza massimo) in cui ti verranno chieste varie domande sul modo in cui ricordi gli eventi riguardanti i terremoti e su come questo ti fa sentire. Ti verranno poi chieste delle domande su cosa hai fatto, pensato e provato durante quei momenti.
2. Dei **questionari** (durata di 1 ora massimo**)** in cui ti verranno fatte delle domande sulle tue emozioni e pensieri durante e dopo il sisma e su come ti ricordi degli eventi relativi ai terremoti.
3. Se stai facendo esperienza di memorie riguardanti gli eventi del terremoto che ti sorgono alla mente in modo improvviso senza che tu lo voglia ti verrà chiesto di completare **un diario** (durata media di 10 minuti al giorno per sette giorni) nel quale prendere nota della presenza di queste memorie.

Ti verranno dati 40 euro come ringraziamento per il tuo tempo.

Ricordati che prima di iniziare la ricerca dovrai compilare la **dichiarazione di consenso** che ti è stata data assieme a questa scheda informativa.

Mi rendo conto che talvolta potrebbe essere difficile riportare alla memoria dei momenti stressanti. Se per caso senti che alcuni degli argomenti che stiamo discutendo ti stanno facendo sentire turbato/a o oltremodo triste e/o agitato/a, **fermati per favore**. Ricordati durante tutta la ricerca che il tuo benessere è l'aspetto più importante della ricerca sia per te che per me. Se in un qualsiasi momento senti che questo processo ti sta disturbando non esitare a farmelo sapere e avrai il diritto di ritirarti dallo studio senza incorrere in alcuna conseguenza e senza spiegazione alcuna. Riceverai comunque il pagamento. Se senti il bisogno di un supporto professionale non esitare a farmelo sapere. Sarò in grado di indirizzarti verso delle persone che possono darti una mano a superare questi momenti difficili.

Se volessi essere informato/a dei risultati dello studio non esitare a farmelo sapere ora così che io possa prendere i tuoi recapiti in modo tale da fornirti i risultati dello studio.

Per mantenere l'anonimità e la confidenzialità dei tuoi dati, tutti i questionari saranno anonimi. Nelle interviste ti sarà assegnato uno pseudonimo che ti renderà non identificabile. La tua intervista sarà registrata e le registrazioni saranno trascritte e poi distrutte. Le trascrizioni delle interviste e i dati dei questionari saranno tenuti su un computer protetto da password.

Hai il diritto di ritirare le trascrizioni delle tue interviste fino alla conclusione della raccolta dati (30 luglio 2018).

I colloqui e la compilazione dei questionari avranno luogo al PASS di Amatrice.

Sentiti libero di discutere queste informazioni con altre persone o di farmi qualsiasi domanda se c'è qualcosa che non ti è chiaro o se volessi più informazioni su qualcosa di specifico.

Sta a te decidere se vuoi partecipare o no, la decisione di non partecipare non ti arrecherà nessuno svantaggio. Se decidessi di prendere parte allo studio, sarai ancora libero/o di ritirarti dallo studio in qualsiasi momento senza dover dare una ragione.

Tutti i dati saranno collezionati e mantenuti secondo le normative del Data Protection Act 1998.

Grazie mille per aver letto questa scheda informativa e per aver considerato di partecipare in questa ricerca.

Se questo studio ti ha danneggiato/a in qualsiasi maniera o se volessi sporgere una lamentela riguardo al modo in cui questo studio è stato condotto puoi contattare i ricercatori utilizzando i seguenti contatti:

- UCL Comitato Etico di Ricerca: ethics@ucl.ac.uk
- Prof. Helene Joffe: h.joffe@ucl.ac.uk
- Prof. Chris Brewin: c.brewin@ucl.ac.uk

Se invece pensi di aver bisogno di un supporto clinico puoi contattare i seguenti servizi:

- Dipartimento di Salute Mentale- Servizio Psichiatrico Territoriale. Via Salaria per Roma 34/36, 02100 Rieti. Tel: 0746/278901

- Servizio per le Dipendenze Patologiche: UOSD Dipendenze e Patologie d'Abuso. Via Salaria per Roma 34/36, 02100 Rieti. Tel: 0746/278935
- Se siete in pensiero per i vostri figli o per minori il servizio di riferimento è il Dipartimento di Salute Mentale- TSMREE Via del Terminillo 42, Rieti.

8.6.2 Information sheet (only peritraumatic questionnaires)

SCHEDA INFORMATIVA

Ti verrà data una copia di questo documento prima di iniziare la ricerca.

Titolo del progetto: **Terremoti e psicopatologia**

Questo studio è stato approvato dal Comitato Etico di Ricerca della University College London con il seguente numero identificativo: 10517/001, dal Comune di Amatrice e dalla ASL di Rieti.
Nome del ricercatore: Alessandro Massazza
Indirizzo lavorativo: Department of Clinical, Educational and Health Psychology, Gower Street, London
E-mail: alessandro.massazza.13@ucl.ac.uk

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In questo studio siamo interessati a comprendere quali sono le conseguenze dei disastri sul benessere emotivo delle popolazioni esposte a disastri. In questo studio ci stiamo concentrando in particolare sulle persone di che sono state colpite dai terremoti del 2016-17.

Il presente studio è composto da:

4. Dei **questionari** (durata di 1 ora massimo**)** in cui ti verranno fatte delle domande sulle tue emozioni e pensieri durante e dopo il sisma e su come ti ricordi degli eventi relativi ai terremoti.

Ti verranno dati 10 euro come ringraziamento per il tuo tempo.

Ricordati che prima di iniziare la ricerca dovrai compilare la **dichiarazione di consenso** che ti è stata data assieme a questa scheda informativa.

Mi rendo conto che talvolta potrebbe essere difficile riportare alla memoria dei momenti stressanti. Se per caso senti che alcuni degli argomenti che stiamo discutendo ti stanno facendo sentire turbato/a o oltremodo triste e/o agitato/a, **fermati per favore**. Ricordati durante tutta la ricerca che il tuo benessere è l'aspetto più importante della ricerca sia per te che per me. Se in un qualsiasi momento senti che questo processo ti sta disturbando non esitare a farmelo sapere e avrai il diritto di ritirarti dallo studio senza incorrere in alcuna conseguenza e senza spiegazione alcuna. Riceverai comunque il pagamento. Se senti il bisogno di un supporto professionale non esitare a farmelo sapere. Sarò in grado di indirizzarti verso delle persone che possono darti una mano a superare questi momenti difficili.

Se volessi essere informato/a dei risultati dello studio non esitare a farmelo sapere ora così che io possa prendere i tuoi recapiti in modo tale da fornirti i risultati dello studio.

Per mantenere l'anonimità e la confidenzialità dei tuoi dati, tutti i questionari saranno anonimi. I dati dei questionari saranno tenuti su un computer protetto da password.

Hai il diritto di ritirare i tuoi dati fino alla conclusione della raccolta dati (30 luglio 2018).

La compilazione dei questionari avranno luogo al PASS di Amatrice.

Sentiti libero di discutere queste informazioni con altre persone o di farmi qualsiasi domanda se c'è qualcosa che non ti è chiaro o se volessi più informazioni su qualcosa di specifico.

Sta a te decidere se vuoi partecipare o no, la decisione di non partecipare non ti arrecherà nessuno svantaggio. Se decidessi di prendere parte allo studio, sarai ancora libero/o di ritirarti dallo studio in qualsiasi momento senza dover dare una ragione.

Tutti i dati saranno collezionati e mantenuti secondo le normative del Data Protection Act 1998.

Grazie mille per aver letto questa scheda informativa e per aver considerato di partecipare in questa ricerca.

Se questo studio ti ha danneggiato/a in qualsiasi maniera o se volessi sporgere una lamentela riguardo al modo in cui questo studio è stato condotto puoi contattare i ricercatori utilizzando i seguenti contatti:

- UCL Comitato Etico di Ricerca: ethics@ucl.ac.uk
- Prof. Helene Joffe: h.joffe@ucl.ac.uk
- Prof. Chris Brewin: c.brewin@ucl.ac.uk

Se invece pensi di aver bisogno di un supporto clinico puoi contattare i seguenti servizi:

- Dipartimento di Salute Mentale- Servizio Psichiatrico Territoriale. Via Salaria per Roma 34/36, 02100 Rieti. Tel: 0746/278901
- Servizio per le Dipendenze Patologiche: UOSD Dipendenze e Patologie d'Abuso. Via Salaria per Roma 34/36, 02100 Rieti. Tel: 0746/278935
- Se siete in pensiero per i vostri figli o per minori il servizio di riferimento è il Dipartimento di Salute Mentale- TSMREE Via del Terminillo 42, Rieti.

8.6.3 Consent form (participation in all components of study)

DICHIARAZIONE DI CONSENSO

Completa questa dichiarazione solo dopo aver letto attentamente la scheda informativa.

Titolo del progetto: **Terremoti e psicopatologia**

Questo studio è stato approvato dal Comitato Etico di Ricerca della University College London con il seguente numero identificativo: 10517/001, dal Comune di Amatrice e dalla ASL di Rieti.

Grazie per il tuo interesse nel partecipare in questa ricerca. Prima che tu accetti di partecipare devi aver compreso in cosa consiste la ricerca.

Se hai delle domande riguardanti la scheda informativa, ponile al ricercatore prima di decidere se vuoi partecipare o meno. Ti sarà data una copia di questa dichiarazione di consenso che potrai tenere con te.

Statuto del partecipante: *Metti per favore una crocetta su ogni affermazione*

Io _____

- ☐ Ho letto le informazioni qua sopra e la scheda informativa e sono consapevole della natura dello studio
- ☐ Capisco che se in qualsiasi momento decidessi che non voglio più far parte di questo progetto posso comunicarlo al ricercatore e ritirarmi immediatamente senza dover dare spiegazioni
- ☐ Consento all'utilizzo di informazioni che mi riguardano personalmente per questa ricerca
- ☐ Comprendo che queste informazioni saranno trattate in modo strettamente confidenziale e saranno mantenute seguendo le normative del Data Protection Act 1998 (UK)
- ☐ Confermo che il progetto di ricerca per cui sto dando consenso mi è stato spiegato in modo sufficiente e che desidero partecipare a questo studio
- ☐ Consento che i miei dati, dopo essere stati resi anonimi, siano condivisi con altri ricercatori
- ☐ Sono a conoscenza del fatto che le mie interviste saranno registrate e consento all'utilizzo di questo materiale come parte del progetto
- ☐ Sono a conoscenza della possibilità di essere contatto in futuro dal ricercatore per scopi di ricerca
- ☐ **Comprendo di non dover partecipare in questo progetto se penso possa essere dannoso per il mio benessere emotivo**

Firmato Il giorno

8.6.4 Consent form (only peritraumatic questionnaire)

DICHIARAZIONE DI CONSENSO

Completa questa dichiarazione solo dopo aver letto attentamente la scheda informativa.

Titolo del progetto: **Terremoti e psicopatologia**

Questo studio è stato approvato dal Comitato Etico di Ricerca della University College London con il seguente numero identificativo: 10517/001, dal Comune di Amatrice e dalla ASL di Rieti.

Grazie per il tuo interesse nel partecipare in questa ricerca. Prima che tu accetti di partecipare devi aver compreso in cosa consiste la ricerca.

Se hai delle domande riguardanti la scheda informativa, ponile al ricercatore prima di decidere se vuoi partecipare o meno. Ti sarà data una copia di questa dichiarazione di consenso che potrai tenere con te.

Statuto del partecipante: *Metti per favore una crocetta su ogni affermazione*

Io _____

- ☐ Ho letto le informazioni qua sopra e la scheda informativa e sono consapevole della natura dello studio
- ☐ Capisco che se in qualsiasi momento decidessi che non voglio più far parte di questo progetto posso comunicarlo al ricercatore e ritirarmi immediatamente senza dover dare spiegazioni
- ☐ Consento all'utilizzo di informazioni che mi riguardano personalmente per questa ricerca
- ☐ Comprendo che queste informazioni saranno trattate in modo strettamente confidenziale e saranno mantenute seguendo le normative del Data Protection Act 1998 (UK)
- ☐ Confermo che il progetto di ricerca per cui sto dando consenso mi è stato spiegato in modo sufficiente e che desidero partecipare a questo studio
- ☐ Consento che i miei dati, dopo essere stati resi anonimi, siano condivisi con altri ricercatori
- ☐ Sono a conoscenza della possibilità di essere contatto in futuro dal ricercatore per scopi di ricerca
- ☐ **Comprendo di non dover partecipare in questo progetto se penso possa essere dannoso per il mio benessere emotivo**

Firmato Io giorno

8.7 Appendix G: Coding framework

THEME-FAMILY SUMMARY

1. NEGATIVE PERITRAUMATIC REACTIONS
2. NEUTRAL OR POSITIVE PERITRAUMATIC REACTIONS
3. MEMORY CHARACTERISTIC
4. RECURRING MAIN MEMORY THEMES
5. VARIOUS

CODING FRAME

CODE	DEFINITION
1. NEGATIVE PERITRAUMATIC REACTIONS	
1.1 NUMBNESS	Participant reports feeling no emotions or not being able to feel emotion, often reported as "feeling nothing"
1.2. DEREALISATION (feeling like in a dream, movie etc.)	Participant reports feeling as if the situation was unreal (as if they were in a movie or in a dream)
1.3. UNBELIVABILITY	Participant reports not being able to believe that the situation was actually happening or refusing to believe what was happening
1.4. CONFUSION	Participant reports not understanding what was happening around them, reporting they felt it was chaos etc.
1.5. RACING THOUGHTS	Participant reports having racing thoughts
1.6. DISORGANISED THOUGHTS/ THOUGHT SALAD	Participant reports having disordered thoughts, disconnected thoughts, or thought salad
1.7 OVERWHELMED/ SHOCKED	Participants reports feeling overwhelmed by thoughts, feelings and sensations or by the situation overall. Participant reports being "sconvolto" or in shock, perception of the end of the world, "caduto il mondo addosso"
1.8 ATTENTION BLINDNESS	Participant reports not noticing things that were obvious (e.g. not noticing entire buildings collapsed in front of them)
1.9. HELPLESSNESS	Participant reports feeling helpless
1.10. FEELING USELESS/INSIGNIFICANT/ OR SMALL	Participant reports feeling useless, insignificant, or small in front of the earthquake, the situation
1.12. AUTOMATIC PILOT	Participant reports acting without thinking or feeling as if they were on an "automatic pilot"
1.13. DEPERSONALISATION	Participant reports not feeling like themselves or feeling as if they were someone else or reports "spacing out", "sentirsi imbambolato" "sentirsi assente"
1.14. FEELING LIKE A SPECTATOR	Participant reports feeling like a spectator/ witnessing the scene from outside
1.15. FEAR	Participant reports being afraid/terrified etc.
1.16. LACK OF CONTROL	Participant refers to a feeling of not having control over the situation

1.17. ANAESTHESIA	Participant reports feeling no pain despite wounds
1.19. ANXIETY ABOUT FUTURE/ EXISTENTIAL ANXIETIES	Participant reports higher-level fears/anxieties about what their life was going to look like in the future (e.g. job, work etc.)
1.20. GUILT/SHAME/COWARDICE	Participant reports feelings of guilt, shame or feeling like a coward (e.g. for having escaped while people were begging for help)
1.21. SURVIVOR'S GUILT	Participant reports feeling guilty for having survived while others had died
1.22 AROUSAL/ BODILY SENSATIONS	Participants reports strong bodily reactions such as heart pounding or hyperventilating or reports mentions of "adrenaline"
1.23. SHAKING	Participant reports strong shaking
1.24. TONIC IMMOBILTIY	Participant reports freezing and not being able to do anything at all. Also this notion of feeling "blocked" although might not necessarily be connected to physical immobility.
1.25. FEELING LIKE THROWING UP/THROWING UP	Participant describes feelings of nausea and/or vomiting
1.26. GEOGRAPHICAL DISORIENTATION	Participant reports feeling lost, not being able to recognise where they were
1.27. FEARING FOR OTHERS	Participant reports being concerned, afraid for the safety of family members, friends
1.29. ANGER	Participant reports feeling angry, irritated
1.30. SADNESS/ EMOTIONAL PAIN/ EMOTIONAL SUFFERING	Participants reports feeling sad or feeling "sofferenza" o "dolore" but in the emotional sense
1.31. CRYING	Participant reports crying or weeping
1.32. WHY QUESTIONS	Participants reports having existential questions about why the disaster had happened to them
1.33. SMOKING	Participant reports smoking cigarettes/tobacco
1.34. FLIGHT RESPONSE	Participant reports having had the urge to escape/flee (e.g. from house during earthquake, while witnessing gruesome scenes)
1.35. FEELING OF VOID	Participant reports feeling a void inside, feeling empty
1.36. "HYSTERICAL" REACTION	Participant reports having an hysterical reaction, *i.e.* loosing control of emotions
1.37. SUDDENNESS OF CHANGE	Participant reports struggling to understand what was happening because of the suddenness of the change
1.38. OVER-IDENTIFICATION	Participant reports thinking that what had happened to certain people (*e.g.* dying) could have happened to them
1.39. THOUGHT OF DEATH	Participant reports thinking they were going to die
1.40 DISTORTIONS IN SENSE OF TIME	Participant reports distortions in sense of time (e.g. time moving slower or faster than usual)
1.41. COLD	Participant reports feeling unusually cold

1.42. LOSS OF APPETITE AND THIRST	Participant reports not eating/not feeling hungry/not drinking/not feeling thirsty
1.43. LOSING CONTROL OF BOWEL OR BLADDER	Participant reports soiling or wetting themselves
1.44. FEELING TRAPPED	Participant reports feeling trapped inside building/ house etc.
1.45 PANIC	Participants reports feeling panicked or having a panic attack
1.46 SCREAMING	Participants reports screaming
1.47 FAINTING	Participant reports feeling like they had to faint or fainting
1.48 UNUSUAL BODY EXPERIENCES	Participant reports strange perceptions of the body, e.g. not feeling certain parts of the body, restrictions in visual field etc.
1.50 STRANGE	Participants reports that the whole situation felt "strange"
1.51 ANXIETY/ANGST	Participants reports feeling anxiety/angst
1.52 MATERIAL LOSS	Participant reports sadness/frustration for having lost work/home, "the work of a lifetime" etc
1.53 FEELING LOST/ NOT KNOWING WHAT TO DO	Participant reports feeling "lost"
2. NEUTRAL OR POSITIVE PERITRAUMATIC REACTIONS	
2.1. JOY	Participant reports feelings of joy, happiness (e.g. after someone was found alive)
2.2. HOPE	Participant reports feelings of hope (e.g. while waiting for someone to be fetched out from debris)
2.3. FEELING PREPARED	Participant reports feeling prepared to handle such circumstances (e.g. because of past experience with disasters or because they were a soldier, fire fighter etc.)
2.4. HAPPY WITH THEIR REACTION	Participant reports feeling happy/satisfied with the way they reacted and what they did
2.5. SENSE OF INVINCIBLITY/ EXHALTATION/ HEIGHTENED PHYSICAL CAPACITIES	Participant reports feeling invincible, having super powers (e.g. extra strength) or feeling very hyper
2.6. AWE	Participant reports feeling of awe at the strength of the earthquake
2.7. STAYING CALM	Participants reports purposefully trying or managing to staying calm
2.8. URGE TO ACT/ BEING REACTIVE	Participant reports on thinking they had to act/do something or that they were reactive and focused on acting and doing stuff
2.9. COMMUNITY COHESION	Participant reports feeling like the community came together, engaged in acts of mutual aid etc.
2.10. GOD/ RELIGIOUS COPING	Participant reports thinking about God or engaging in religious activities (e.g. praying)
2.11. GOAL-ORIENTED ACTIONS	Participant reports engaging in goal-oriented actions (e.g. bringing clothes to people, saving people from debris, doing stuff etc.)
2.12 GAINING AWARENESS	Participants reports finally gaining awareness and fully understand what had happened

2.13 BEING STRONG FOR OTHER PEOPLE	Participant reports the need to being strong for other people around them, e.g. children or for having to take care of them
2.14 DETACHMENT	Participant reports voluntarily forcing themselves to be detached from the scene (e.g. when recognising corpses)
2.15 TRYING TO BE USEFUL/ HELPING OTHER PEOPLE	Participants reports intentionally trying to be useful or trying to help other people
2.16 MAINTAINING CLARITY OF THOUGHT/ RATIONALITY	Participant reports how they always managed/or tried to maintain clarity of thought/ lucidity
2.17 BEING POSITIVELY SURPRISED WITH REACTION	Participant reports how they were positively surprised with how they reacted
2.18 INSTINCT BEHAVIORS	Participant reporting acting very instinctually or based on a "survival instinct"
2.19 CONCENTRATION/ FOCUS	Participant reports being concentrated on certain things or being focused
2.20 THOUGHT VACUUM/ HAVING NO THOUGHTS	Participant reports not having any thoughts and just being completely focused on action or on something else like "guardavo soltanto"
2.21 MIX OF THOUGHTS/EMOTIONS/FEELINGS	Participants reports that they had mixed feelings, a variety of different feelings, emotions all together
2.23 TAKING LEADERSHIP ROLES/ TAKING INITIATIES	Participant reports taking initiatives on things to do, behaving like a leader, giving orders to others etc.
2.24 SURPRISED	Participant reports being surprised at what had happened, not thinking that such a big thing had happened
3. MEMORY CHARACTERISTICS	
3.1. FALSE MEMORY	Participant report thinking something had happened while other people had told them it actually had not happened or vice-versa
3.2. DISORGANISED MEMORY	Participant reporting they felt their memory was disorganised, fragmented, or uncoherent
3.3. STRUGGLING TO REMEMBER	Participant reports finding it hard to remember certain parts/details
3.4. TRIGGERS	Participant describes what the trigger of intrusive memories usually is
3.5. TEMPORAL DETAILS	Participant reports the timing at which the intrusive memories usually happen (e.g. usually before I am falling asleep)
3.6. PRESENT TENSE	Participant shifts from using past tense to using present tense while describing memory
3.7. POSITIVE INTRUSIONS	Participant mentions positive intrusions, such as vivid images of how the town used to look before earthquake, of their house etc.
3.8. ENHAHNCED MEMORY OF MOMENTS BEFORE TRAUMA	Participants reports having enhanced/vivid memories of things that happened before trauma (e.g. moments, hours before, the last time they met a person etc.)
3.9. RECALLING NEW MEMORY AFTER A WHILE	Participant reports they had not remembered certain details or entire memory in a while until probed during interview

3.10. QUALITY OF MEMORY	Participant gives details on quality/phenomenology of memory (e.g. memory is like a photograph, memory is like a movie, I see myself like from the outside etc.)
3.12. "WHAT IF" INTRUSIVE MEMORIES	Participant describes an intrusive memory concerned with how things might have happened (e.g. thinking how one's family members might have died despite not having witnessed the scene)
3.13. STRUGGLING TO DESCRIBE PHENOMENON	Participant reports struggling to describe a specific emotions or feeling
3.14. NIGHTMARES OR DREAMS	Participant reports experiencing nightmares or dreams of trauma-related content
3.15. TYPE OF MEMORY	Highlight whether a person is describing an intrusive memory or a non-intrusive memory
3.16. RE-EXPERIENCING	Participant provides details on whether they feel like they are re-experiencing the memory when they have it
3.17. MANAGEMENT OF MEMORY	Participant describes ways in which they cope with the memory (repressing it, accepting it etc.)
3.18. SMELL	Participant reports strongly remembering smells (e.g. usually smell of gas, dust, corpses)
3.19. SIGHT	Participant repots strongly remembering sights (e.g. remembering very clearly the darkness, the full moon etc.)
3.20. SOUND	Participant reports strongly remembering sounds (e.g. usually sound of helicopters, people begging for help, rumble of earthquake)
3.21. TOUCH	Participant reports strongly remembering touch (e.g. debris, corpses etc.)
3.22. BODILY SENSATIONS	Participant reports strongly remembering certain bodily sensations/movements (e.g. their body being shook by the earthquake)
3.23. TASTE	Participant reports strongly remembering tastes (e.g. usually dust in mouth)
3.24. 24th OF AUGUST	Memory is of the 24th of August earthquake
3.25. 30th OF OCTOBER	Memory is of the 30th of October earthquake
3.26. 18th OF JANUARY	Memory is of the 18th of January earthquakes
3.27. MEMORY GAPS	Participant reports that they have gaps in the memory or parts of the event that they cannot remember at all
4. RECURRING MAIN MEMORY THEMES	
4.1. DEAD PEOPLE	Participant describes witnessing corpse or body parts
4.2. CORPSE RECOGNITION	Participant describes being called to recognise corpses
4.3. DESTROYED CORSO	Participant describes seeing the main street in town destroyed after earthquake
4.4. GREEN VILLA	Participant describes seeing a specific building collapsed

4.5. MOON	Participant describes seeing a full moon
4.6. SOUND OF HELICOPTERS	Participants describes hearing sound of helicopters
4.7. EARTHQUAKE RUMBLE	Participant describes hearing sound of earthquake
4.8. PEOPLE ASKING FOR HELP	Participant describes hearing sound of people begging for help from under debris
4.9. SMELL OF GAS	Participants describes the smell of gas
4.10. DUST	Participant describes the sight of the dust
4.11. DARKNESS	Participant describes the sight of darkness
4.12. LIVING IN TENTS	Participant describes period when living in tents
4.13. STATE FUNERALS AND OTHER FUNERALS	Participant describes moments of State funerals or other private funerals
4.14 PEOPLE EXITING DEBRIS	Participant reports remembering well sight of people getting out from the debris full of dust and wounded
4.15 MOMENTS OF THE SHOCK	Participant describe the moments when they felt the earthquake shock
4.16 WAR METAPHOR	Participants uses war metaphor (saying that it looked like a bombing, like Syria, like a war)
5. VARIOUS	
5.1. DESCRIPTION OF OTHER PEOPLE REACTIONS	Participant reports thoughts, feelings and behaviours of other people
5.2. DESCRIPTION OF REACTIONS DURING L'AQUILA EARTHQUAKE OR OTHER PREVIOUS EARTHQUAKE	Participant recalls reactions to the L'Aquila earthquake or other previous earthquakes in the past
5.3. BEING WOKEN UP BY EARTHQUAKE	Participant reports on how they were sleeping and the earthquake woke them up
5.4. COMPLEXITIES OF BEING FIRST RESPONDERS IN ONE'S OWN COMMUNITY	Participants report how hard it was to be first responders in their own communities (e.g. having to fetch out people they knew, the fact that they knew all the people that died etc.)
5.5 USING MOBILE PHONE LIGHTS	Participant reports using mobile phone torch light

8.8 Appendix H: Invitation letter to participants that had participated in previous study

Gentile partecipante,

Prima di tutto vorremmo ringraziarti molto per la tua partecipazione l'anno scorso allo studio della University College London (UCL). Il tuo input é stato essenziale e siamo ora in procinto di pubblicare i risultati. Siamo fiduciosi che questo permetterà una migliore gestione e compresione della salute mentale di popolazioni esposte a eventi simili in Italia e in altre parti del mondo. Se fossi interessato/a a sapere di più su quello che abbiamo scoperto sarei molto felice di discutere i risultati con te.

Ti stiamo scrivendo perchè vorremmo invitarti a partecipare, nelle prossime settimane, al proseguimento di questo studio. Vorremmo sapere in che modo ricordi gli eventi relativi ai terremoti e come questo ti fa sentire. Ti verrà chiesto di fare un colloquio (durata massima di 1 ora e mezza), compilare dei questionari (durata massima di 1 ora e mezza) nella stessa sessione, e di completare un breve diario per una settimana (durata massima di 10 minuti al giorno). Riceverai 40 euro come ringraziamento per il tuo tempo. Lo scopo di questa ricerca è di capire come le persone reagiscono a questo tipo di eventi così che nel futuro saremo in grado di concepire metodi efficaci per promuovere il benessere psicologico di persone che sopravvivono a disastri. Vogliamo anche fornire un resoconto accurato delle difficoltà che comporta vivere un evento come quello che hai vissuto tu e tenere alta l'attenzione su Amatrice. Per fare questo la tua opinione è preziosissima e abbiamo bisogno di raccogliere più punti di vista possibili.

Gentilmente fammi sapere se sei interessato/a a partecipare nel proseguimento di questo studio e se sì quando (scegli un giorno e un'ora tra il 19 Maggio e il 29 Luglio, se è possibile non durante i fine settimana a meno che non sia l'unico momento disponibile). Questo progretto è stato approvato dal Comune di Amatrice e dalla ASL di Rieti. **Ti siamo incredibilmente grati per il tuo prezioso input e speriamo che accetterai di partecipare.**

Rimaniamo a tua completa disposizione per rispondere a potenziali domande

Grazie infinite per il tuo contributo nell'aiutarci a trovare soluzioni per le persone affette da disastri

Alessandro Massazza,

UCL, Department of Clinical, Educational and Health Psychology,

London, UK

[redacted]

Questo progetto e' stato finanziato da:

Economic and Social Research Council
Shaping Society