UNIVERSITY OF SOUTHAMPTON

# Cue reactivity to self-harm cues: The development of a systematic treatment intervention for deliberate self-harm

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Thesis submitted for Doctor of Philosophy

School of Psychology
Faculty of Medicine, Health and Life Sciences
2007

UNIVERSITY OF SOUTHAMPTON
ABSTRACT

FACULTY OF MEDICINE AND LIFE SCIENCES
SCHOOL OF PSYCHOLOGY

DOCTOR OF PHILOSOPHY

**CUE REACTIVITY TO SELF-HARM CUES: THE DEVELOPMENT OF A SYSTEMATIC TREATMENT INTERVENTION FOR DELIBERATE SELF-HARM**

By Claire Rachel Hepworth

There is increasing awareness of the prevalence of deliberate self-harm (DSH) although the phenomenon is still poorly understood. Those who self-harm often have a poor long-term prognosis, yet systematic focused treatment interventions are scarce. DSH appears to share fundamental characteristics with addictive behaviour, including; impulsive or compulsive urges to act in the presence of triggers, positive and negative reinforcing consequences and endorsement of the diagnostic criteria for clinical dependence. Given this fact, a behavioural mode of DSH may be appropriate. A range of events are anecdotally reported to trigger DSH. This thesis was designed to identify these cues, to develop an understanding of how those who self-harm respond to these cues and the processes by which these cues may operate to maintain DSH. An intervention based on the management of urges to self-harm in the presence of these cues was developed.

Study I identified that triggers for DSH (interpersonal, intrapersonal and environmental) were similar to those that reliably predict addictive behaviour. Respondents endorsed the diagnostic criteria for dependency and reported that the act of DSH reduced negative emotions. The second two studies identified self-reported cue reactivity, and generalised hyperarousal to both DSH and neutral stimuli in those who self-harm but no evidence of psychophysiological cue reactivity. Study IV used ERP methodology to evaluate cue reactivity at the CNS level and to evaluate two mechanisms by which cues might operate to maintain DSH. There was some preliminary support for enhanced preconscious attentional bias towards emotional, but not environmental DSH cues, and no support for emotional interference. Study V identified that those who self-harm exhibited enhanced tolerance to physical and psychological stressors, and that priming with interpersonal distress did not impact on this tolerance. Finally, a single case intervention study identified a reduction in DSH, reduced psychophysiological arousal and urges to self-harm and improved clinical symptomatology. However, clinical improvements were not time-locked to targeted exposure intervention phases. The clinical and theoretical implications for these findings are discussed.

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## Declaration of Authorship

I, Claire Rachel Hepworth, declare that the thesis entitled: "Cue reactivity to self-harm cues: The development of a systematic treatment intervention for deliberate self-harm" and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- where I have consulted the published work of others, this is always clearly attributed;
- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- Where the thesis is based on work done by myself and jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- none of this work has been published before submission.

Signed:

Date:

## Acknowledgements

I wish to take this opportunity to express my gratitude to my supervisors Professor Bob Remington and Professor Sue Clarke for their guidance, support and continued motivation over the past few years. I also wish to thank Dr Anke Karl for her supervision and guidance, in showing me a new methodology. I am grateful for all you have taught me.

I also wish to thank my advisors Dr Chas Skinner and Dr Anke Karl for their encouragement and belief in me, throughout the completion of this thesis.

I could not have completed this thesis without the hard work and dedication of Martin Hall, Jin Zhang and Luke Phillips who have provided endless technological support, guidance and knowledge over the past few years.

I would like to thank the staff at the Intensive Psychological Therapies Service, particularly Kim Meldrum and all those in the laboratory at the Center for Addictions, Personality and Emotion Research at the University of Maryland for their enthusiasm, commitment, provision of facilities and assistance with data collection. I am particularly grateful to Dr Kim Gratz and Dr Carl Lejuez.

I wish to express my heartfelt thanks to my family, friends and PhD colleagues who have been with me every step of the way. Thank you for your endless support, patience and inspiration throughout the good times and the bad.

Finally I wish to thank the many individuals who contributed to this research. Thank you so much for your interest, enthusiasm, dedication and most of all courage. I wish to particularly express my gratitude and admiration for Kate who took the brave first step. Thank you for allowing me to share this part of your journey with you.

Abbreviations

| | |
|---|---|
| ACT | Acceptance and Commitment Therapy |
| ANS | Autonomic Nervous System |
| BPD | Borderline Personality Disorder |
| CBT | Cognitive Behaviour Therapy |
| CNS | Central Nervous System |
| CSA | Childhood sexual abuse |
| DBT | Dialectical Behaviour Therapy |
| DoH | Department of Health |
| DSH | Deliberate self harm |
| ERP | Event related potentials |
| IST | Incentive Sensitization Theory |
| LREC | Local Research Ethics Committee |
| MBT | Mentalization Based Treatment |
| NICE | National Institute for Clinical Excellence |
| NHS | National Health Service |
| OPT | Opponent Process Theory |
| PTSD | Post Traumatic Stress Disorder |
| RCT | Randomised Control Trial |
| TAU | Treatment as usual |

# Chapter I Deliberate Self Harm

## *1.1 Chapter Overview*

> "I was alone in the house and I went into the bathroom. I got out a razor blade and put a towel over my legs and just looked at my arm. It always takes a few minutes for the first cut but after that I just can't stop until all I see is blood on my entire arm (Leibenluft, 1987, p318)".

Deliberate Self-Harm (DSH) has challenged, perplexed and frustrated health professionals and researchers alike. The seemingly irrational nature of a behavioural pattern that involves repeatedly and deliberately self-inflicting harm is poorly understood (Hawton, Rodham, Evans & Weatherall, 2002). Individuals who engage in DSH often have a poor long-term prognosis (Linehan, 1993) and for some, DSH is maintained for many years, often throughout adulthood. Favazza (1996) examined the historical and cultural interpretations of DSH and identified a range of behaviours throughout history that demonstrate its antiquity. Surprisingly, there is a scarcity of research that investigates why this seemingly illogical behaviour is alarmingly common.

Clinical research into DSH has only been established within the past three decades. DSH has however, received increased attention, both in the media and clinically over the past few years (e.g., National Institute for Clinical Excellence (NICE) guidelines DoH, 2004). Pattison and Kahan (1983) were the first to suggest that the 'Deliberate Self-Harm Syndrome' should be classified as an independent psychological disorder, although the DSH as a phenomenon has long been evident to clinicians (Graff & Mallin, 1967; Grunebaum & Kleerman, 1967; Rosenthal et al., 1972).

Despite these critical issues, empirical investigation into the development and maintenance of DSH is scarce and effective treatment that is specific to the problem is not commonly available in the National Health Service (NHS). This chapter will provide an overview of the concepts and controversies regarding the development and maintenance of DSH, addressing the challenges involved in understanding the phenomenon, and proposing that a new strategy for interpreting and treating it is long overdue.

*1.2 What is Deliberate Self-Harm?*

Pattison and Kahan (1983) suggested that DSH is both impulsive and compulsive and that individuals who engage in DSH may experience irresistible urges or 'cravings' to complete the act.  They described the psychological symptoms experienced as follows:

1. Sudden and recurrent intrusive impulses to harm oneself without the perceived ability to resist;
2. A sense of existing in an intolerable situation which one can neither cope with nor control;
3. Increasing anxiety, agitation and anger;
4. Constriction of cognitive-perceptual processes resulting in a narrowed perspective on one's situation and personal alternatives for action;
5. A sense of psychic relief after the act of self-harm
6. Depressive mood, although suicidal ideation is not typically present (p 867).

In this description the desperation and urgency to complete the act is clear. Although DSH may be deliberate, it is characterised by a subjective lack of available alternatives, and a sense of uncontrollability and inevitability. Liebenluft, Gardner, and Cowdry (1987) proposed that there are five identifiable elements in an act of DSH:

1. A precipitating event (such as loss of a significant relationship),
2. Escalation of the dysphoria,
3. Attempts to forestall the "self-injury",
4. "Self-mutilation"
5. The aftermath (for example, relief from tension) (p 318).

This account assumes that DSH is a learned behavioural response, triggered by a specific event or emotion. In keeping with this view, many individuals develop a preference for a particular method of DSH, cutting being the most common (Favazza, 1996). Most favour a particular implement, but some use a variety of tools over time (Briere & Gil, 1998). Acts of DSH may be time and location-specific, depending on personal preference. The experience of DSH may change over time, increasing in frequency and severity (Bryant, 2005). Such contextual issues should be taken into account when developing interventions aimed at reducing DSH.

*1.3 Definitions*

For the purpose of this research, I shall use the following definition of DSH:

> "Deliberate, direct destruction or alteration of body tissue without conscious suicidal intent, but resulting in injury severe enough for tissue damage (e.g. scarring) to occur" (Kahan & Pattison, 1984).

This definition has been selected because it emphasises that DSH is intentional, goal-directed, non-fatal and socially unacceptable (Walsh & Rosen, 1988). Gasperoni (1998) proposed a distinction between ritualised group acts of DSH, associated with cultural or religious practices, and individual DSH: "One is a shared act of pride (or defiance); the other a secretive act steeped in shame". Shame as an emotion may be critically important to the development and experience of DSH for the individual. More socially or culturally acceptable means of DSH such as those associated with religious or cultural practice, (Favazza, 1996) are not described in this thesis.

The identification and treatment of DSH is hindered by the lack of a nosological definition. At present the DSM-IV (APA, 2000) classifies DSH only as a feature of four specific disorders; Trichotillomania, Impulse-Control Disorder Not Otherwise Specified, Axis II Borderline Personality Disorder (BPD) and Stereotypic Movement Disorder with Self-Injurious Behaviour. These classifications refer to a wide range of DSH related behaviours, from compulsive behaviours such as trichotillomania, to impulsive behaviours such as cutting and burning the skin (Simeon & Hollender, 2001). There are currently no independent

DSM-IV criteria for DSH. Favazza (1996) offers four distinct conceptualisations of DSH; stereotypic, major, compulsive and impulsive. Stereotypic behaviours refer to: “highly repetitive, monotonous, fixed, often rhythmic, seemingly highly driven, and usually contentless (i.e., devoid of thought, affect and meaning) acts” (Simeon & Favazza, 2001, p.6). Major “self-injurious behaviours” refer to:

> “the most dramatic and often life threatening forms of self-injury and involve major and often irreversible destruction of body tissue. They most commonly occur as isolated rather than repetitive events. Castration, eye enucleation and (to a lesser degree) amputation of extremities are the most common behaviours” (p8. Simeon & Favazza, 2001).

Compulsive DSH includes:

> “repetitive, often ritualistic behaviours that typically occur multiple times per day, such as trichotillomania (hair pulling), onychophagia (nail biting) and skin picking or skin scratching (neurotic excoriations)” (p.9, Simeon & Favazza, 2001).

Finally, “impulsive self-injurious behaviours” may be episodic or repetitive, and include behaviours such as skin cutting and skin burning. Repetitive behaviours may have a seemingly “addictive quality” and involve:

1. Preoccupation with harming oneself physically

2. Recurrent failure to resist impulses to harm oneself physically, resulting in the destruction or alteration of body tissue
3. Increasing sense of tension immediately prior to the act of self-injury
4. Gratification or sense of relief when committing the act of self-injury
5. No conscious suicidal intent associated with the act and it is not in response to psychosis, transexualism, mental retardation, or developmental disorder.

(p.16, Simeon & Favazza, 2001).

These conceptualisations are a useful reference guide for clinicians and researchers. Throughout this thesis I refer to what Favazza terms ‘impulsive behaviours’ such as skin cutting. DSH does, however, also show traits of compulsivity, as individuals describe ‘irresistible urges’ to act. As Evans (2000) maintained, “Deliberate self-harm is a behaviour and not a diagnosis” (p.1). It is therefore unlikely that a single treatment intervention would be suitable for individuals demonstrating such a heterogeneous range of behaviours. Researchers and clinicians have operationalised a range of definitions, in order to describe their clients. Terms such as ‘parasuicide’, ‘self-mutilation’, ‘self-injury’, and ‘cutting’ are often used interchangeably in the literature. This adds to the complexity of identification, and confusion in the research field. For example, there is controversy over the inclusion of suicide attempts in the definition. To avoid such confusion, I shall use only the term Deliberate Self Harm (DSH) and exclude intentional suicide attempts.

*1.4 Prevalence and distribution*

The prevalence and distribution of DSH is difficult to estimate, because so much DSH goes unreported. Contrary to popular belief, rather than an attempt to seek attention, DSH is, to most, a personal and private issue, encased in shame and guilt. Individuals may engage in DSH for years without seeking professional help, even when medical attention is urgently required. Despite these limitations, current reports suggest that 4.6-6.6% of the UK population and up to 13% of young people have self-harmed at least once (Melzer et al., 2000a). A recent US study by Nock and Prinstein (2004) reported a series of widely varying figures that suggest that between 14-39% of adolescents in the community and 40-61% of adolescents in psychiatric inpatient services, have engaged in DSH.

*1.5 The Costs of self-harm*

DSH has major economic implications, for the Government and National Health Service (NHS), in terms of clinician time, waiting lists, and hospital beds. The National Institute for Clinical Excellence (NICE) guidelines (Department of Health (DoH), 2004) estimated that 150,000-170,000 individuals attend Accident & Emergency wards year as a direct result of DSH. During the period 2001-2002, 68,716 people were hospitalised because their DSH related injuries could not be treated on an outpatient basis. Although the financial burden of DSH is great, the cost to individual lives is immeasurable. DSH is associated with a poor long-term prognosis (Hawton & Sinclair, 2003), and individuals who engage in DSH often present with co-morbid conditions that may severely impair quality of life (Haw, Hawton, Houston & Townsend, 2001).

There are many misconceptions surrounding DSH, some of which may be partially grounded in case examples, such as the belief that individuals will ‘grow out’ of DSH activity. Reports of ‘contagion cutting’ within inpatient units and prisons (Ross & McKay, 1979; Taiminen, Kallio-Soukainen, Nokso-Koivisto, Kaljonen & Helenius, 1998) must be reviewed with caution because it may be both misleading and stigmatising to assume that DSH does not serve a very real function for the individuals who engage in it. These misconceptions and media misinterpretations have led to the development of a culture in which DSH elicits feelings of anger and disgust. Individuals who engage in DSH report experiencing feelings of guilt and shame (Linehan, 1989) but health professionals often underestimate the significance of these negative emotions for patients.

Research with health professionals working to help individuals who engage in DSH, shows that they are often viewed negatively (Slavern & Kisely, 2002; Smith, 2002). Warm, Murray and Fox (2003) reported that when individuals do seek help from health professionals, the majority are dissatisfied with the help that they receive. Patients frequently report the lack of respect and understanding that they are often faced with when they seek professional help (Smith, 2002). It is clear that health professionals too, are dissatisfied with current guidelines and training, and are frustrated with the lack of opportunity to intervene effectively (Smith, 2002). As long as individuals who engage in DSH report strongly negative consequences of seeking professional help, it may be expected that effective treatment will remain difficult and relapse common.

*1.6 Self-harm and suicide*

One of the most frequent misconceptions surrounding DSH is that its presentation is synonymous with suicide or is a failed suicide attempt. Hawton and Sinclair (2003) have reported that DSH is the most important risk factor for suicide. Accidental suicide through acts of DSH is also reported. The relationship between suicide and DSH is often exacerbated by co-morbid psychological issues such as the co-occurrence of depression. Nevertheless DSH should not be seen as a failed attempt at suicide. Kroll (1993) reported that individuals with a diagnosis of BPD with a history of DSH, who do not present with co-morbid depression or alcohol dependence, are at a very low risk of suicide. Although many individuals who engage in DSH experience suicidal ideation, DSH does not include acts carried out with suicidal intent. In fact, some authorities regard DSH as an act of self-preservation. Thus, Menninger (1938) described DSH as ‘an action to avert suicide and promote self-healing’. Rather than an attempt to end life, Menninger saw engaging in an act of DSH as the individual’s way to keep on living despite experiencing intolerable emotions or environmental conditions.

*1.7 Co-morbid conditions*

Co-morbidity is medically defined as ‘A concomitant but unrelated pathological or disease process’ (American Heritage Stedman’s Dictionary, 2007). In this case the definition has been extended to include two co-existing disorders or behavioural patterns. Individuals who engage in DSH often experience a range of complex psychological issues, and present with a variety of co-morbid conditions. Co-morbidity between DSH and other psychological issues or disorders is a complex issue that requires further investigation. Increased risk for suicide preceding DSH may be apparent in individuals who present with a co-morbid diagnosis. Co-morbid conditions must also be taken into consider when developing treatment interventions, and researchers must consider whether DSH is a behavioural expression of psychological issues related to the co-morbid condition or whether the high rates of co-morbidity observed are a function of the fact that DSH may be identified by health professionals only when an individual presents for treatment for another condition. Another possibility is that DSH is an overt expression of a common psychological issue underlying many presentations, such as for example, difficulty with emotion regulation. Haw and colleagues (2001) reported that in their sample of patients presenting to a general hospital following an act of DSH, 92 % were diagnosed with at least one psychiatric disorder. These co-morbid disorders are discussed in the following sections.

*1.7.1 Depression.* Depression is the most common co-morbid psychiatric diagnosis in individuals who engage in DSH (Haw, Houston, Townsend & Hawton, 2002). Prevalence rates vary from 31 to 61.9% (Haw et al., 2002). This co-morbidity means that individuals present as more complex cases to diagnose and treat, and any intervention must take this into consideration. Depression increases the risk of suicide by a factor of 20 (Harris & Barraclough, 1997) so it is important to take account of this co-morbidity when investigating and treating DSH.

*1.7.2 Borderline Personality Disorder.* Linehan (1993) reported that 70-75% of individuals with a diagnosis of BPD also have a history of at least one act of DSH. The formal DSM-IV classification of BPD can be seen in Appendix A.

Criterion five in the DSM-IV criteria for BPD is ‘Recurrent suicidal threats, gestures or behaviour, or self-mutilating behaviour’. This fact alone invites researchers to investigate why this specific population is by definition, at such high risk for engaging in DSH and more specifically what drives individuals repetitively to inflict harm upon themselves.

Although DSH often precedes suicide, these phenomena are regarded as independent. An investigation of the cluster of symptoms that form a diagnosis of BPD may give some indication of the temperamental characteristics associated with DSH. Impulsivity, instability, reactivity of mood, intense anger, and stress-related dissociation are all found to correlate closely with DSH in individuals with and without a diagnosis of BPD.

Consideration of the emotional processes and biological mechanisms underlying BPD may indicate some of the dysfunctional processes that drive the development and maintenance of DSH. Treatment interventions designed for individuals with BPD, such as DBT and Mentalization Based Treatment (MBT, Bateman & Fonagy, 2004), which will be discussed in detail later in this chapter, show great promise in reducing DSH, supporting further investigation into this association. It must be asserted that although there is clearly a strong association between BPD and DSH, many individuals who engage in DSH do not necessarily meet the criteria for a diagnosis of BPD.

*1.7.3 Eating Disorders.* Approximately half of all individuals who engage in DSH have a history of anorexia nervosa, bulimia nervosa or both (Favazza, DeRosear & Conterio, 1989). Patients presenting with eating disorders are at a particularly high risk of engaging in DSH (Paul, Schroeter, Dahme & Nutzinger, 2002). Interventions and assessment tools specifically targeting DSH in this clinical population have recently been introduced (Sansone & Levitt, 2002; Sansone & Sansone, 2002). Conterio and Lader (1998) and Favazza (1987) suggest that eating disorders and DSH are functional equivalents, however this has yet to be empirically investigated (Sansone & Levitt, 2007).

*1.7.4 Substance Dependence.* Haw et al., (2001) reported that a third of individuals who engage in DSH exhibit co-morbid drug or alcohol misuse. Substance dependence is reported to increase the risk for suicide in those who engage in DSH (Briere & Gil, 1998). Despite similar features (see chapters II and III) there is a scarcity of research that considers why DSH is frequently associated with addictive behaviours.

### *1.8 Risk factors for deliberate self-harm*

Previous empirical research has identified a range of factors (biological, psychological and social) that increase the probability that an individual will engage in self-harm. These risk factors are discussed in detail in the following sections. Although each may act independently, in combination, they may greatly increase an individual's vulnerability to engage in DSH.

*1.8.1 Childhood adversity.* Yates (2004) proposed two pathways to the development of DSH; a developmental psychopathological route that begins in childhood and retains its course throughout adulthood, and a 'less enduring' pathway that may begin late in adolescence and does not last throughout adulthood. Gratz (2002) revealed that among college students, insecure attachment, childhood separation, emotional neglect, sexual abuse and dissociation are significant risk factors for DSH. Many researchers have focused their investigations on the impact of early childhood trauma, such as sexual abuse (Zlotnik, Shea, Recupero, Bidadi, Pearlstein & Brown, 1997) and comparisons have been made to Post Traumatic Stress Disorder. Van der Kolk, Perry and Hermann (1991) reported that DSH could be predicted by the presentation of a history of childhood sexual or physical abuse.

Zlotnik, Shea, Recupero, Bidadi, Pearlstein and Brown (1997) reported that in a population of substance abusing or substance dependent inpatients, 74% of individuals who have self-harmed reported experiencing at least one incident of trauma in their lifetime. Seventy-six percent of these individuals retrospectively rated this specific traumatic event as having affected their life ‘very much’ or ‘extremely’ during the past year. All those who reported distressing traumatic histories were at an increased risk for co-morbid dissociation, and impulsivity. In accordance with the literature (e.g., Sales, Baum & Shore, 1984) it is the perception of, and response to the traumatic event, rather than the presence of a traumatic history that is important in the development of psychological distress. The presence of psychological symptoms such as difficulties with affect regulation or impulsive behaviour might reflect difficulties in psychological adaptation post trauma with a cognitive/emotional interpretation of the trauma as distressing and overwhelming.

It is difficult to distinguish between the relative contributions of a traumatic history and intolerance for negative affect in individuals who self-harm. Rosenthal, Cheavens, Lejuez and Lynch (2005) investigated this association using self-report measures of affect, thought suppression and experiences of childhood trauma, in a community sample of individuals who fulfilled the diagnostic criteria for BPD. This study reported that both the intensity of negative affect and the behavioural response to the negative affect, contributed significantly towards the diagnosis of BPD.  The presence of childhood sexual abuse (CSA) did not significantly predict BPD symptoms over and above this reactivity. These data must be interpreted cautiously because it might be argued that the high correlation between negative affect intensity and a diagnosis of BPD is a function of the role of negative affective intensity in the formal diagnostic criteria for BPD. This research supports the notion that although environmental factors such as trauma and abuse are highly correlated with DSH and the development of BPD, it is the way that the individuals regulate their response to the trauma that predicts whether an individual will engage in DSH.

There is evidence to suggest a link between maltreatment and 'alexithymia', which is a disorder in which individuals are unable to label and express emotions or for example, pain. The presence of alexithymia might increase the risk for adopting strategies such as DSH to regulate emotions and self-soothe (Guralnik & Simeon, 2001). Invasive physical trauma in childhood, for example through surgery or mutilation, is also associated with DSH (Rosenthal, 1972). Specific events occurring during childhood, such as parental separation, may have a lasting legacy on development and there is evidence to suggest that occurrence of parental divorce, during childhood is high in individuals who subsequently engage in DSH (Abrams & Gordon, 2003).

Finally, parenting attitudes play an important role in the development of risk for DSH (Bateman & Fonagy, 2004).  Parenting styles and expressed emotion have been demonstrated to contribute to the development of a range of psychiatric disorders, for example psychosis (Zweig-Frank & Paris, 1991). Bateman and Fonagy (2004) argued that low parental care (that is without the protective role of one parent) or conversely overprotection by both parents may contribute to the risk for DSH, although empirical support for this is currently lacking.

Although a strong correlation between childhood adversity and DSH has been identified in these studies, not all individuals who engage in DSH have experienced trauma, abuse or maltreatment and not all individuals with a history of trauma have engaged in DSH. Although a traumatic or insecure attachment history may be an important risk factor for DSH, it would be a mistake for health professionals to make assumptions based on a trauma model without substantive evidence.

A traumatic history or maladaptive attachment might play a role in the development of DSH through its association with an invalidating environment (Koerner & Linehan, 1997). An invalidating or inconsistent environment where, in operant conditioning terms, (Skinner, 1953), reinforcement contingencies are unreliable, punishment is high, behaviour is not reliably reinforced and there is poor stimulus control is likely to have a huge impact on the development of the child. The environment may impact on the ability to form interpersonal relationships, communicate effectively, self-soothe and regulate emotions, exert control, and work towards long-term goals as well as seeking immediate gratification or relief. This invalidation, and subsequent need for reliable reinforcement, may enhance vulnerability to engage in DSH to self-regulate and provide consistent reinforcement. This account is described in detail in the next chapter.

*1.8.2 Ethnicity and culture.* Dohm et al., (2002); Thompson & Bhugra (2000) and Marshall and Yazdani (1999) reported that causes and rates of DSH vary between Asian and white women. UK born Asian females are 7.8 times more likely to be referred to hospital for DSH than UK born white females. In addition, membership of an ethnic minority group modifies the association between unemployment and rates of DSH (Neeleman, Jones, Van Os, & Murray, 1996).

*1.8.3 Gender.* Hawton et al (2002) reported that women are three times as likely as men to engage in DSH. In males, DSH may be particularly prevalent in enclosed, stressful environments such as prisons (Sansone et al., 2001). Gratz, Conrad and Roemer (2002), however, reported comparable rates of DSH between male and female participants in their undergraduate sample. Similarly, Briere and Gil (1998) suggested that DSH is equally prevalent among males and females but reports may be biased by the use of solely female samples. The differential rates of presentation within multidisciplinary service settings, and terminological confusion (e.g., the inclusion of suicidal acts) may contribute to controversy with regard to the prevalence and distribution of DSH. This suggests that further research into the presentation, development and maintenance of DSH in both men and women would be useful.

*1.8.4 Sexuality.* Homosexuality is an important risk factor for DSH. In an early study of DSH by Pattison and Kahan (1983), 26% of their sample reported that they were homosexual. Skegg, Nada-Raja Dickson, Paul and Williams (2003) reported that in their sample of 946 adults aged 26, one quarter of the variance in DSH among men and one-sixth among women was potentially attributable to homosexuality. Although there is clearly an association between sexual orientation and DSH, researchers and clinicians should be conservative in making causal judgements. For example, it is possible that the association between homosexuality and CSA may explain the relationship between homosexuality and DSH because previous homosexual contact is a risk factor for later non-family sexual abuse (Vander-Mey, 1988). Alternatively, CSA may impact on fear and confusion with regard to sexuality, which may in turn increase the risk for DSH.

*1.8.5 Socio-economic status.* DSH is more prevalent in individuals of lower socio-economic status (Hawton et al., 2001; Melzer, 2002a) and changing levels of socio-economic conditions within the UK over time have been found to correlate negatively with prevalence rates (Gunnell et al., 2000). Those who are single, divorced, live alone, are single parents, or who are lacking in social support are at a higher risk. The absence of social support may be correlated with increased stress, impacting on both physical health and emotional well-being. A lack of social support and impaired interpersonal functioning, perhaps in terms of the diminished capacity to form strong attachment bonds, may impact negatively on long-term prognosis. A traumatic history or poor interpersonal development may again mediate this relationship.

*1.8.6 Summary of risk factors.* There are a variety of identifiable risk factors for the development of DSH. In assessing the risk for DSH for a particular individual, clinicians and researchers must take these bio-psycho-social considerations into account, but additionally, an awareness of particular high risk groups may enable the target of specific interventions, as well as including psycho-educational programmes, to alleviate risk on a more global scale.

*1.9 Treatment interventions*

At present there is little information regarding the efficacy of treatments for DSH (Evans et al., 1999; Hawton & Sinclair, 2003). Those that are currently available are primarily designed for individuals with BPD. Successful reduction of DSH is currently achieved primarily as a side-effect of a more general intervention. The exception is Dialectical Behaviour Therapy (DBT, Linehan, 1993) where the primary treatment target is life threatening behaviour. However DBT requires a commitment to reduce DSH, prior to acceptance into the treatment program. Although specific interventions are available for a range of other similar behaviours, such as alcohol or substance abuse, there is currently no empirically based intervention that is designed specifically to reduce frequency of DSH or to manage urges that may precede an episode of DSH.

Among those treatments currently available are; psychological interventions such as DBT (Linehan, 1993a), Cognitive Behaviour Therapy (CBT), Psychodynamic Interpersonal Therapy, Partial Hospitalisation Programmes, and pharmacological treatments such as Paroxetine, Mianserin and Flupenxitol. A review of the prevailing literature reveals that Randomised Control Trials (RCT) within the clinical domain are scarce, and results equivocal. Websters' Medical Dictionary (2007) defines a Randomized control trial as: "An epidemiologic experiment in which subjects in a population are randomly allocated into groups, usually called study and control groups, to receive or not to receive an experimental prevention or therapeutic product, manoeuvre, or intervention. The results are assessed by rigorous comparison of rates of disease, death recovery, or other appropriate outcome in the study and control groups, respectively. RCTs are generally regarded as the most scientifically rigorous method of hypothesis testing available".

At present the therapeutic intervention that holds the greatest promise for the long-term prognosis of individuals who engage in DSH is DBT (Linehan 1993a). This is a long-term intervention, primarily offered to those with a diagnosis of BPD.

*1.9.1 Dialectical Behaviour Therapy.*The biosocial theory of DSH suggests that those individuals who develop BPD are have an emotional vulnerability, that is, they are biologically predisposed and then are born into an invalidating environment (where private events are invalidated and reinforcement is unpredictable). DBT is based on a dialectical perspective through which a realistic acceptance of the patient's current situation is balanced with change strategies to enable him or her to move forward from that position. DBT teaches skills in both a group format and in individual therapy sessions. Weekly groups cover mindfulness, interpersonal effectiveness, emotion regulation, and distress tolerance. In weekly individual sessions, patients are offered the opportunity to practice and generalize these skills more adaptively. Telephone coaching is also offered to assist with skills generalization.

Emotion regulation skills, for example, involve helping individuals to identify emotions and teach them how to manage behavioural responses to triggered emotions through behavioural exposure. This involves changing the experience with regard to the trigger, learning to respond to longer-term reinforcement contingencies and to detect the role of stimulus control in their behaviour (e.g., don't go to bar if it means you can't avoid drinking). Lynch et al. (2007) reported that DBT has been found to be efficacious for the treatment of BPD in seven RCTs, across four independent research teams (Koons et al., 2001: Linehan et al, 1991, 1993, 1994, 1999, 2002, 2006b; Turner 2000a; Verheul et al., 2003) thus meeting the criteria for a 'well-established treatment intervention' outlined by Chambless and Ollendick (2001). Despite such promising and replicated results for the treatment of BPD symptoms, it is noteworthy that only four of these RCTs reported significant main effects for the reduction of DSH (termed intentional self-injury in this review).

Specifically, DBT significantly reduced the proportion of patients who engaged in DSH for longer than a year, compared with those receiving Treatment As Usual (TAU) (Bohus et al., 2004). Low, Jones, Duggan, Power and MacLeod (2001) reported a significant reduction in DSH in individuals participating in a DBT programme in a high security hospital. This reduction was maintained at a 6 month follow-up. Evidence suggests that this effect is consistent worldwide. For example, Verheul et al. (2003) revealed similar reductions in DSH in a 12-month RCT in the Netherlands.

However, it is most commonly the case that in the NHS, DBT interventions are offered primarily to those with a diagnosis of BPD. DBT is highly resource intensive and so many services use elements of DBT with clients who self-harm but the benefits of these modified procedures are as yet not established and the interventions must be treated with caution until efficacy is established. There is some evidence that using elements of DBT without the full support mechanism may actually increase suicidal urges or ‘acting out behaviours’ (Springer, Lohr, Buchtel & Silk, 1996).

*1.9.2 Cognitive Behavior Therapy.* Davidson and Tyrer (2006) reported results from the Borderline Personality Disorder Study of Cognitive Therapy (BOSCOT), a large scale Multicentre Randomised Control Trial (RCT) comparing CBT plus TAU to TAU, in a sample of 106 individuals with BPD. Analysis was blind, and intervention focused on strategies to identify new ways of thinking and to promote behavioural change. However, brief cognitive intervention was of limited efficacy in the direct reduction of DSH, although it was superior in terms of cost and effectiveness than TAU (Byford et al., 2003). Manual assisted CBT with bibliotherapy is thus a promising treatment option that requires further development (Evans et al., 1999). Cognitive behavioural approaches to DSH appear to be hampered by high drop-out rates (Evans et al., 1999) and have limited efficacy for reducing the prevalence of DSH (there were no significant differences compared to treatment as usual). Brief CBT has also been shown to be of limited efficacy compared to treatment as usual (Tyrer et al., 2003). It might be that the limited efficacy of CBT is related to the high attrition rates in therapy.

*1.9.3 Emotion regulation.* Gratz and Gunderson (1996) developed a 14 week emotion regulation, group intervention that draws from Acceptance and Commitment Therapy (Hayes, Strosahl & Wilson, 1999), DBT (Linehan, 1993) and Emotion-focused psychotherapy (Greenberg, 2002). The intervention focuses on the functionality and acceptance of emotions and its elements include:

1. Awareness, understanding, and acceptance of emotions,
2. Ability to engage in goal-directed behaviours, and inhibit impulsive behaviours, when experiencing negative emotions
3. Flexible use of situationally appropriate strategies to modulate the intensity and/or duration of emotional responses, rather than to eliminate emotions entirely; and
4. Willingness to experience negative emotions as part of pursuing meaningful activities in life (Gratz & Roemer, 2004).

A small scale RCT comparing this intervention plus TAU to TAU, reported positive effects on DSH with 42% of participants showing a reduction in DSH of 75% or greater (assessed using the Deliberate Self-Harm Inventory (Gratz, 2003), 17% showing a reduction of 45-57%, and 16% showing a reduction of 25-33%. Twenty-five percent of the sample did not evidence a substantial reduction in DSH but these were individuals that only reported 2 episodes of DSH in the 3 months prior to treatment.

*1.9.4 Mentalization Based Treatment (MBT).* MBT is an evidence-based approach to BPD that is derived from a developmental psychodynamic approach to attachment (Bateman & Fonagy, 1999). Frith and Wolpert (2004) defined *mentalization* as the ability to: “perceive and communicate mental states such as beliefs, desires, plans and goals”. According to MBT, the capacity to *mentalize* is achieved through the development of a stable sense of self, which arises as children begin to internalize the perceptions of caregivers. It is postulated that individuals with a diagnosis of BPD do not acquire the capacity to mentalize, owing to the development of inconsistent and inaccurate perceptions of the self and others. In addition, inconsistencies in the expression of emotion to the child, results in core deficits in attentional control and mentalization, which are argued to be requirements for the development of successful attachment relationships.

In contrast to the biosocial approach taken by Linehan (1993) where the emphasis is on a functional deficit arising from a biological disposition, environmental context and the transaction between the two, MBT emphasises that the deficit lies not in the ability to regulate emotions, but rather in the inability to access the experience of feeling regulated. This may account for a distinction between subjective report and psychophysiological assessments of affective lability in individuals with a diagnosis of BPD. In addition, MBT suggests that inability to self-soothe results from a failure to develop a buffer between feelings and actions which arises because the caregiver failed to provide a perceptual marker for emotions during childhood. Thus, the main distinction between DBT and MBT is the adoption of a dialectical world-view in the former, versus a developmental attachment approach in the latter. Despite these differences, there are many similarities in the two approaches, for example the focus on developing a strong therapeutic alliance. What makes both these approaches to the treatment of BPD so relevant to understanding DSH and developing a treatment specific to DSH is the emphasis on the relevance of specific cues that lead to the dysfunctional regulation of the system, including cues arising from interpersonal factors such as trauma, insecure attachment, loss or abandonment. MBT in particular emphasises the importance of providing a ‘secure base’ in therapy to counteract this insecure attachment.

Bateman and Fonagy (1999) conducted an RCT of an intervention with a focus on MBT that involved partial hospitalisation v TAU for 18 months. In comparison to a control group receiving TAU, the Partial Hospitalization Program reduced the frequency and duration of inpatient admissions, the use of psychotropic medication, suicidal behaviours and DSH. In addition to the benefits reported for DBT, this intervention produced significantly reduced depression and anxiety, and improved social and interpersonal functioning. Participants also continued to improve during 18 month follow up (Bateman & Fonagy, 2001). MBT is also a very resource intensive treatment. Despite the promising findings published by Bateman and Fonagy, (1999) following an RCT of a psychodynamic partial hospitalisation program, and those reported by Giesen-Bloo et al., (2006) regarding a trial of schema-focused therapy compared to transference focused therapy, the results for both interventions have yet to be replicated.

*1.9.5 Pharmacological Treatments.* Grossman and Siever (2001) suggested that there is currently no empirical evidence for the efficacy of pharmacological treatments, based on double-blind or placebo controlled studies. The use of certain pharmacological agents does, however, hold some promise in the management of self-harm. Often, agents are used to alleviate co-morbid symptoms such as depression (Monoamine-oxidase inhibitors, Tricyclic antidepressants), mood lability (mood stabilizers), aggression and impulsivity (SSRIs, β-blockers) and anxiety (Benzodiazepenes), which may indirectly impact on the urge to self-harm. A promising pharmacological intervention that warrants further investigation involves the administration of opiod antagonists. This intervention has some efficacy in reducing repetitive DSH in those with a diagnosis of autism and learning disabilities (Willemsen-Swinkels et al., 1995). Roth et al., (1997) reported the results of a small scale open-label trial (n=7) that suggested that naltrexone administered 50mg/day for an average of 10.7 weeks reduced DSH.

*1.9.6 Treatment summary.* Despite the high prevalence of DSH and the impairments in quality of life of sufferers, treatment interventions for DSH are scarce. DBT and MBT hold promise but there are limitations. Both interventions are costly and require an extended time period for therapy. There is little published data on the active components of therapy, service teams must be trained as a whole, and a large amount of therapist time is required. Waiting lists for treatment on the NHS are lengthy. The contractual agreement to commit to reducing DSH as a prerequisite for treatment may not be feasible for some individuals. For these reasons, brief interventions that directly target DSH and can be implemented in a broad range of service settings might aid in the treatment of DSH.

Much DSH goes unrecognised as individuals may only present to emergency services when the behaviour is severe or life threatening. Often, it appears that individuals who engage in DSH may only be identified if the problem is concurrent with a co-morbid diagnosis such as BPD. Interventions for these disorders may be effective at reducing DSH as a side-effect. It would therefore be useful if brief, focused interventions that directly target DSH were available. DSH should be considered not only as a reaction, symptom or side effect of other diagnoses but as a maladaptive behaviour in its own right, serving a functional purpose for the individual. Were health professionals aware of DSH an earlier stage and able to offer effective tools to manage the distress and reduce symptom severity, many accidental suicides and severe injuries might be avoided. Early intervention relies on three factors:

1. The development of improved assessment tools to identify individuals at risk of DSH,
2. The identification of specific situations and triggers that may precipitate specific acts of DSH,
3. The development of brief focused interventions that directly target DSH and that can be used in a variety of service settings.

Education of health professionals is needed. The concurrent stigma associated with DSH may be reduced if health professionals and the public were more knowledgeable about the phenomenon. Many self-harmers fail to present to emergency services, or seek help, because they fear retribution or disregard. If effective treatments were readily available, staff would feel more empowered in addressing this issue and individuals who engage in DSH might communicate their needs and seek help sooner.

## 1.10 Chapter Summary

This chapter has described how DSH is still poorly understood although clinicians and researchers are becoming increasingly aware of its prevalence. Individuals who engage in DSH may be particularly vulnerable to the stigma associated with it and opportunities for empirically based treatments for DSH are currently limited in the NHS. There is little research into the development and maintenance of DSH but such work might generate effective treatment interventions and thus improve the long-term prognosis of individuals who engage in DSH. Treatment must be based on a sound theoretical and empirical understanding of the phenomenon, thus the following chapter reviews the evidence for a variety of functional models of DSH, examines some of the proposed underlying psychological mechanisms and identifies how this knowledge might provide some insight into the development of an intervention for DSH.

# Chapter II Deliberate self-harm: Functional models and underlying mechanisms

## *2.1 Chapter Overview*

Chapter I described DSH, identified the common co-morbidities and the risk factors that increase an individual's vulnerability to engage in DSH and concluded that treatment options are limited at present. The behaviour itself is, however, still puzzling. DSH is maintained despite what are objectively negative long-term consequences, often including severe disruptions to quality of life. For the past two decades, researchers have endeavoured to explain why a behaviour that is as painful, distressing, socially isolating, culturally rejected and as dangerous as DSH occurs at all.

This chapter is concerned with the motivation behind DSH. The prevailing theoretical models and psychological functions of DSH are reviewed and the mechanisms underlying DSH are explored with the aim of explaining the prevalence of such a seemingly irrational behaviour.

One way of thinking about a pathological behaviour, involves taking a bio-medical approach. This model assumes that such a behaviour is the result of some underlying problem (e.g., a neuro-anatomical impairment, inhibited neuro-chemical process or system malfunction) that always elicits a similar symptom profile. Using this syndromal approach, DSH would be considered to be a symptom that is the result of a consistent underlying biological pathology. However, Chapter I identified that environmental, psychological and social factors as well as biological pre-dispositions increase an individual's vulnerability to engage in DSH.

An alternative approach involves the use of a functional classification. This model assumes that there is a transaction between the person and the environment. This approach would first consider the impact of the person on the environment, the performance of the behaviour (in this case, DSH). A functional approach would then consider how the environment would impact on the person as a result (i.e., the consequences of DSH for that individual).

DSH is a behaviour and not a diagnosis, it is highly heterogenous, and a functional analytic approach enables specific identification of setting events, and reinforcing consequences of the behaviour. There appears to be subtypes of individuals who engage in a similar pattern of behaviour (Klonsky, 2008) and Nock and Prinstein (2004) identified that functional classification of DSH may to some extent map on to diagnostic classification, for example, it may be that someone who has a diagnosis of PTSD, may be more likely to report emotional avoidance as a reinforcing consequence of DSH. There does also appear to be some evidence to suggest ethnic variations in presentation (Selby, 2008) that suggests that subtypes of the behaviour may be apparent.

However, this may reflect subgroups that are functionally rather than diagnostically distinct. There is no evidence to suggest that those individually who meet criteria for a particular diagnosis, engage in a similar form of DSH, that is there not does appear to be a direct relationship with topography of DSH, and diagnostic or functional classification. In addition, individuals may meet criteria for a range of different diagnoses, for example both depression and BPD, or PTSD and GAD, and the form that their self-harm takes, may change over time, for example moving from cutting to burning, or testing out the use of different implements. In addition there does not appear to any evidence at present to suggest a relationship between topography and personality subtype, those more likely to endorse items on an assessment measure relating to impulsive or compulsive behaviour. Further research in this area may further our understanding.

Thus, a functional analytic approach to classification may enable specific identification of the antecedents and consequences that maintain self-harm. However, working within a medicalised system that recognises syndromal distinctions of disorders, means that some identification with a syndromal approach may be required to enable access to services, funding for intervention and research and ensure clear communication between health professionals.

It is important also to consider the role of individual differences. Factors that maintain DSH may vary across time and contexts and may be multiply controlled by a variety of contingencies of reinforcement that reflect both behavioural and biological processes.

One popular argument for the maintenance of DSH is that despite appearances, DSH is somehow functional and adaptive for the individual (Favazza, 1989; Suyemoto, 1998; Warm, Murray & Fox, 2003). Favazza and Conterio (1989) explain that some of the benefits of DSH include:

> "…tension release, termination of depersonalisation, euphoria, relief from feelings of depression, alleviation of feelings of loneliness and alienation, decreased troublesome sexual feelings, release of anger, satisfaction from self-punishment, a sense of security and uniqueness, and manipulation of others" (Favazza & Rosenthal, 1993).

A functional approach should have utility in explaining how these consequences maintain DSH. Recently, Nock and Prinstein (2004) used a functional approach to examine the self-reported motivations for DSH in an adolescent inpatient sample. The authors concluded that all participants reported that DSH was either automatically or socially reinforced, and described both negative and positive reinforcement contingencies for the behaviour. In this study *Automatic-negative reinforcement* was used to describe an individual's use of DSH to reduce tension or other negative affective states (e.g., "to stop bad feelings"). *Automatic-positive reinforcement* refers to an individual's use of DSH to create a desirable physiological state (e.g., "to feel something, even if it was pain"). *Social reinforcement* functions refer to the use of DSH to modify or regulate one's social environment. *Social-negative reinforcement* refers to an individual's use of DSH (in this article referred to as self-mutilative behaviour) to escape from interpersonal task demands (e.g., "to avoid punishment from others" or "to avoid doing something unpleasant"). *Social positive reinforcement* involves gaining attention, or access to material from others (e.g., "to let others know how unhappy I am"). This research revealed that DSH shares similar functions with stereotypic self-injurious behaviour observed in individuals with learning disabilities (Iwata, 1987). As Bennum (1987) suggested, if the reinforcement contingencies for DSH can be identified then an applied behavioural approach to intervention similar to that use in stereotypic self-injury may likewise be appropriate (see Iwata, 1987) for a review of treatment options. Nock and Prinstein (2005) further identified that the differential functions of DSH were related to their clinical correlates, e.g., automatic negative reinforcement was uniquely associated with hopelessness and a history of suicide attempts, whereas automatic positive reinforcement was associated with a diagnosis of Major Depressive Disorder and PTSD.

Examination of the positive and negative reinforcement contingencies of DSH may help to explain the motivation for the behaviour. Catania (1968) described positive reinforcement as the increase in responding that occurs as a consequence of the presentation of a positive reinforcer (which is a stimulus e.g., food). Negative reinforcement refers to an increase in the rate of a behaviour as a result of contingent withdrawal (or prevention of occurrence) of reinforcing stimulus. Negative reinforcement typically involves: ‘the removal, reduction, postponement, or prevention of stimulation; these operations strengthen the response on which they’re contingent’ (Hineline, 1997).

Examination of the positive and negative reinforcement contingencies of DSH may, however, not be as simple as it seems at first glance. Some stimulus changes associated with an increase in behaviour are difficult to explain in simple terms of presentation or removal. Iwata (1987) provided a useful example of this dilemma. A response to a temperature change might be accurately described as either responding to the *presence* of heat, or to the *absence* of cold. When identifying the reinforcement contingencies associated with DSH there are similar challenges. For example, as discussed in detail later in this chapter, it might be considered that DSH functions to alleviate emotional pain, or to induce analgesics that provide pain relief (see 2.3.1). The functional autonomy of a behaviour (Allport, 1937) also means that outcome should not necessary imply motivation. Despite these challenges, the focus on a functional approach to DSH and the identification of the relevant reinforcement contingences may have clinical utility.

*2.2 Negative reinforcement*

A normative model of coping presented by Rachman (1980) defined emotional processing as: ‘a process whereby emotional disturbances are absorbed, and decline to the extent that other experiences and behaviour can proceed without disruption’. Rachman proposed that if an individual was unable to adequately process these experiences there would be direct signs of such a failure, for example, the development of fears or obsessions. He hypothesised that disturbances in behaviour would develop if emotional reactions to stressful life events were avoided or suppressed over a prolonged period of time. Gratz and Roemer (2003) conceptualised healthy emotion regulation as involving:

> “a) Awareness and understanding of emotions, b) acceptance of emotions, c) ability to control impulsive behaviours and behave in accordance with desired goals when experiencing negative emotions, and d) ability to use situationally appropriate emotion regulation strategies flexibly to modulate emotional responses as desired in order to meet individual goals and situational demands.”

However, it is apparent that some individuals are unable to use such methods of coping. Haines and Williams (1997) explored the relationship between coping and problem solving in DSH and suggested that when experiencing aversive tension, individuals who engage in DSH cannot problem solve to find effective solutions and as a result they may resort to using maladaptive strategies such as avoidance or DSH.

Emotional dysregulation is well documented in individuals with BPD (Yen, Zlotnik & Costello, 2002; Koenigberg et al., 2001; Bland, Williams, Scharer & Manning, 2004; Levine, Marziali & Hood, 1997). Emotional dysregulation (or 'affective instability'), is the inability to regulate, or control emotional reactivity to stressful situations (Linehan, 1993a, 1993b) and is an important risk factor for DSH. Linehan suggested that emotional dysregulation includes: a) a heightened reactivity to emotional stimuli, and b) a skills deficits in emotion regulation. Linehan suggested that emotion dysregulation is the result of a biological predisposition and an unpredictable environment where behaviours, emotional expression and communication are inconsistently reinforced. This facilitates the drive for self-control. DSH serves to alleviate these aversive responses to emotional stimuli, and as such is negatively reinforced. Rosenthal et al. (2008) provides the most comprehensive review to date of the evidence base regarding emotional responding in BPD. Despite a strong theoretical conceptualisation of emotional responding in BPD (Linehan, 1999) that matches clinical observation, and the development of effective treatment (DBT) based on these assumptions, specific research into emotional processes in BPD is at best inconsistent. Research has been criticised for methodological weakness and disparity in measurement and only recently have studies incorporated bio-behavioural measures of emotional responding.

Several constructs have been used to describe the emotional difficulties commonly experienced by those with a diagnosis of BPD. These include; heightened affect intensity, affective reactivity, negative affectivity, affective instability and emotional vulnerability (Rosenthal et al., 2008). Although clear definitions of these constructs are offered by the authors, the degree of overlap between these constructs is unclear. Moreover, the development of individual self-report measures for each construct, in conjunction with the heterogeneity of the presentation of those with BPD, has added to the lack of clarity. Having systematically examined self-report, behavioural and psychophysiological evidence, Rosenthal, et al. (2008) conclude that, based on subjective measures of state emotional responding, BPD is associated with increased reactivity to neutral stimuli and a negative evaluation of both neutral and positive stimuli. However, they found no evidence of enhanced reactivity or negative evaluation of negative emotional stimuli.

In contrast, studies of trait emotional responding have identified evidence that those with BPD are more reactive to negative emotional stimuli, particularly when these are of personal relevance.

Linehan (1989) proposed that individuals who engage in DSH experience greater physiological reactivity to emotional stimuli than do other individuals. This theory has initial empirical support (Levine, Marziali, & Hood, 1997; Stein, 1996). Linehan (1989) suggested that such individuals have a higher emotional baseline, and that physiological reactivity to emotional stimuli is slower to return to this baseline, resulting in increased, intolerable levels of emotional arousal, for longer periods of time. Additionally, such reactivity may be triggered more readily by emotional than non-emotional cues. This physiological profile facilitates the development of an association between emotional cues and high levels of arousal.

Rosenthal et al. (2008) reported that the psychophysiological evidence regarding emotional responding in BPD is less conclusive, and the results studies of heart rate and skin conductance responding to emotional stimuli, vary greatly according to methodology.

There are also inconsistencies between self-reported responding and psychophysiological measures. For example, some individuals report being highly reactive to negative emotional stimuli (e.g., feeling very upset, angry etc) but psychophysiological measures have failed to identify this reactivity. It is important to conduct research that considers psychophysiological responding in conjunction with self-report to establish whether individuals report being subjectively less able to tolerate distress, in fact respond with a similar intensity and reactivity to controls.

Neuro-imaging research into emotional responding in BPD is very much at the developmental stages. There have been few published studies that use a neuro-imaging approach, and methodology and design across studies has been inconsistent. However, despite this, some consistent findings have been reported that may indicate an underlying neuro-biological vulnerability in individuals with a diagnosis of BPD. These include: a) reduced hippocampal, orbitofrontal and amygdala volumes to controls (limbic circuitry associated with emotional responding and autobiographical memory), b) increased activation in the amygdala in response to emotional cues compared to neutral cues, and c) decreased metabolic rate in the prefrontal cortex, anterior cingulate and hippocampus in resting conditions (areas that may be involved in regulating inhibitory control).

A range of models have described the negative reinforcement contingencies of DSH, suggesting that it is maintained because it serves to alleviate some negative, undesirable state. It is useful to consider a temporal framework of motivation. Individuals who engage in DSH often describe such acts as both impulsive, and compulsive. The term 'impulsive' refers to a behaviour that is directed by a positive motivation, where the intention is to obtain immediate reward. In contrast, an act is termed 'compulsive' if the motivation is to avoid immediate negative consequences, such as an aversive environment, at the cost of longer-term benefits. If DSH is negatively reinforced, these acts might be best described as compulsive, whereas behaviours that are positively reinforced might be described as impulsive.

*2.2.1 Tension reduction.* Carr (1987), Pattison and Kahan (1983) and Bennum (1984) proposed that under some circumstances aversive tension can be alleviated by DSH. Herpertz (1985) explained that this aversive tension may result from 'external frustrating events (such as rejection, loneliness, or failure) that trigger a dysphoric mood'. Tantam and Whittaker (1985) developed a tension reduction model of DSH. More recently Brain, Haines and Williams (2002) provided empirical support for such a model, and suggested that DSH:

> "Represents a simple drive reduction mechanism…. Upon the experience of intolerable anxiety and tension, individuals injure themselves in an effort to reduce these unpleasant, escalating feelings….Any relief, albeit temporary, from this distressing mental state serves to reinforce the behaviour and increase the likelihood of self-harm occurring again when similar emotions are experienced."

This model suggests that DSH is maintained by its tension reducing properties. Haines (1995) examined psychophysiological reactivity and self-reported urges to engage in DSH in male inmates with a history of DSH, inmate controls and non-prison controls. Haines reported that individuals currently engaging in DSH reported increases in the urge to self-harm (psychological response to the script) whilst listening to a guided imagery script describing an act of DSH. They exhibited decreased psychophysiological reactivity (tension reduction) in the final stage of the imagery (describing the completion of the act). Haines, Williams, Brain and Wilson (1995) and Brain, Haines and Williams (2002) reported that there was time lag between the initial psychophysiological response to DSH imagery and the first reports of urges, suggesting that self-report and psychophysiological indices index different components of the process underlying DSH. Despite experiencing psycho-physiological arousal in response to triggers, individuals may be unaware that their urges are rising, making them increasingly vulnerable. The fact that a description of a recent act of DSH can elicit tension reduction suggests that cues to the behaviour may have become classically conditioned to elicit a response.

This pattern of psychophysiological arousal was consistent across participants, despite frequency of DSH, which suggests that once a psychophysiological response to triggers associated with DSH is established it is maintained.

Several hypotheses for the tension reducing effects of DSH have been put forward, including the opiod hypothesis described later in this chapter, the distractor hypothesis, and perhaps the most influential, the self-punishment hypothesis. Swann, Wenzlaff, Krull and Pelham (1992) proposed that individuals preferentially seek information that confirms rather than disconfirmations their hypotheses. This information processing bias is referred to as self-verification theory. Someone who is depressed, selectively seek or attend to information that confirms their negative cognitions (Swann, Wenzlaff & Tafarodi, 1992) maintaining negative appraisals. They may even go so far as to challenge feedback to the contrary, by taking actions that re-affirm their low self-esteem and self-worth. Chapman, Gratz and Brown (2006) suggest that self-verification may underlie the self-punishment function described by some individuals who engage in DSH (Brown 2002; Gratz, 2000, Rosenthal, Cukrowicz, Cheavens & Lynch, 2006). The authors describe how DSH may serve to reduce the arousal experienced through a state of tension, or cognitive dissonance, (Festinger, 1978) which occurs when an individual receives feedback contrary to their negative cognition. The authors cite the example of an individual who believes that he deserved to be punished, but felt that they had not been punished by external environmental factors. In this occasion DSH may be used to restore the individual's sense of cohesion and control, reducing emotional arousal.

*2.2.2 Dissociation.* Models of dissociation have been used to describe a specific means of affect avoidance. Although dissociation as a mental state is to some extent a normal phenomena (e.g., the experience of driving somewhere familiar with little conscious awareness of the route whilst doing so), its prevalence is greatest in individuals with psychiatric disorders. Baker (1991) suggested that dissociation represents aberrant processing of emotions at the level of experience. That is, an individual who dissociates is unable to fully experience emotion, a fact that fits the clinical presentation of individuals who engage in DSH, particularly those with a diagnosis of BPD (Linehan, 1993).

Janet (1907) distinguished between two subtypes of dissociative experiences; somatoform experiences, for example, analgesia and tonic immobility, and psychological experiences, such as the experience of *derealization* and *depersonalisation*. Both subtypes are associated with DSH (Russ et al., 1996). There are two alternative theories to explain the relationship between dissociation and DSH. The first theory, involving the alleviation of dissociative states shall be discussed here, the second, involving the induction of dissociation will be considered in detail later in this chapter.

Barron and Sandman, (1985) suggested that either due to congenital dysfunction or during early development, there are alterations in the levels of neurochemicals that mediate pain sensitivity. This *pain hypothesis* suggested that the experience of pain functions to enable the individual to break through dissociative states in order to feel physical sensations again. DSH is thus positively reinforced through the induction of pain. Favazza (1996) commented on the association between child abuse, dissociation and DSH:

> "Perhaps the most commonly mentioned mechanism in the linkage between sexual child abuse and self-harm involves the dissociative process of depersonalization; the child deals with the tension of the abuse by depersonalizing and thus, by becoming numb and distant from the abuse. Years later, whenever the depersonalisation process recurs, DSH serves to end the depersonalisation and allows the person to feel real again" (Favazza, 1996, p268).

Although dissociation clearly has adaptive purposes in the short-term, this strategy for coping has clearly negative long-term consequences. This disruption to attention may influence how individuals experience and respond to stimuli in the environment. Rachman (1980) suggested that without the capacity to adequately process such stimuli, individuals are unable to habituate to their potentially emotionally arousing properties, meaning that stimuli or events remain powerful, threatening or arousing. Psychological and somatoform dissociation is associated with aversive tension (Stiglmayr, Shapiro, Stieglitz, Limberger & Bohus, 2001) in individuals with BPD. Over time, aversive tension can become a stimulus for uncontrolled dissociation. Patients who dissociate under non-specific stress may lack the capacity for cortical regulation for example during the process of habituation to stimuli, and there may be a general hyperactivity of motivational processes. This means that under stress, individuals are unable to activate coping mechanisms and self-regulate, relying on dissociation to escape from aversive experiences. Individuals, who continually dissociate when faced with a stressor, may have difficulties in experiencing and labelling emotions, and arousal is unable to habituate, so the cycle of aversive tension and dissociation is maintained. This explicates the importance of triggers for negative affect in the maintenance of DSH, and suggests that in individuals who engage in DSH, dissociation may impair the usual process of tension reduction, so that individuals rely on more maladaptive methods of tension reduction such as DSH.

Another negative long-term consequence of dissociation may be impairments in the retrieval of autobiographical memory (Jones et al., 1999). Aberrant recall aids in the avoidance of specific negative affective episodic information (e.g., recall of traumatic events). However, the tendency for overgeneralization of autobiographical memories means that negative affective memories may be triggered by a simple cue so that strategies employed in an attempt at avoidance are maladaptive. Nijman et al., (1999) highlighted the link between dissociation and fantasy proneness and suggested that there may be confusion in autobiographical memories. Empirical evidence suggests that individuals who engage in DSH are indeed over-general in their recall of autobiographical memories (Williams & Broadbent, 1986). For example, when presented with a cue word such as ‘happy’, a specific response would be ‘when I received a telephone call yesterday, telling me good news’, a general memory would be ‘when I get telephone calls’. When cued with memories involving such emotions as ‘shame’, ‘guilt’ or ‘loss’ these might become over generalised and trigger an associative network of all such memories (Evans et al., 1992). For example, the death of a loved one may activate memories of all situations associated with loss, sadness and grief. The difficulty in labelling emotions and distinguishing between specific emotions may exacerbate this over generalisation. It is clear that dissociation is maladaptive in the long-term; however, although researchers have proposed that DSH is negatively reinforced through the alleviation of these dissociative states, there is as yet no empirical evidence for such a model. Studies have also failed to consider the impact that state dissociation may have on psychophysiological responding (Ebner-Priemer et al., 2005).

*2.2.3 Experiential avoidance. Experiential avoidance* is defined by Hayes, Wilson, Gifford, Follette and Strosahl (1996) as; “any behaviour that has as its purpose the avoidance of, or escape from, unwanted internal experiences or those external conditions that elicit them". Chapman, Gratz and Brown (2004) suggested that an experiential avoidance model unifies previous theoretical accounts of DSH, providing an explanation for the functions of affect regulation, dissociation and the threat to boundaries that precipitate the development of DSH.

Chapman, Specht and Celluci (2004) highlighted the association between DSH and other experientially avoidant behaviours (e.g., eating disorders and substance abuse) and the high use of avoidance as a coping strategy in DSH. Although there is evidence of an association between DSH and experiential avoidance, there is currently no evidence for a mediating role for experiential avoidance in explaining the maintenance of DSH. Although the authors suggest that avoidance might serve as a primary function for DSH, they do acknowledge that it is important that future research does not makes assumptions based on this. For example, Baker's (2001) model of emotional processing rests on the assumption that all emotions are generated as a response to a negative stressor. This does not explain dysfunctions in emotional processing caused by inability to respond appropriately or with full awareness, to positive events. The reliance on self-reported motivations for DSH necessitates caution as in fact these accounts may serve as retrospective explanations for the behaviour rather than identification of the operant reinforcers for the behaviour. Further investigation of the relationship between self-reported urges to engage in DSH, psychophysiological reactivity to triggers for DSH and the reinforcement contingencies of the behaviour is required.

One common form of experiential avoidance is thought suppression. Najmi (2007) identified that a self-reported propensity to engage in thought suppression was associated with both the presence and frequency of DSH, suicidal ideation, and suicide attempts. Thought suppression was also found to partially mediate the relationship between emotional reactivity and the frequency of DSH and suicidal ideation. Those who reported a greater tendency to engage in thought suppression were also those that reported using DSH to reduce aversive emotions (a negative reinforcement contingency) rather than for reasons of social communication (positive reinforcement). Increased emotional reactivity was associated with increased frequency of DSH, although the directionality of this relationship is not known.

Although the experiential avoidance model may unify negative reinforcement models for DSH, support is tentative and findings are inconsistent. Further investigation into the role of thought suppression, avoidance and distress tolerance in DSH is required. If DSH can be described as experientially avoidant this suggests that interventions such as Acceptance and Commitment Therapy (Hayes, Stroshal & Wilson, 1994) might be valuable in the treatment of individuals who engage in DSH.

Chapman et al., (2004) highlighted that the assessment of psychophysiological reactivity to triggers would aid in the understanding of attentional and avoidance processes in DSH. It is proposed that experiential avoidance would increase psychophysiological reactivity, given evidence that emotional suppression may increase reactivity, and also given that experiential avoidance may interfere with individuals' ability habituate to cues in the environment (Gratz, 2002, personal communication).

2.2.4. *Shame and anger.* Two emotions that are commonly clinically reported to be associated with DSH are shame and anger. Both may act as both antecedents and consequences of DSH (Kleindienst et al., 2008). Brown (2002) explains that a biosocial approach to DSH proposes three key roles for negative emotions in maintaining DSH: First, shame-related emotions directly lead to self-attack, self-punishment, or an extreme desire to hide or disappear. Second, the reduction of emotional arousal following [DSH] negatively reinforces the behaviour. Finally, anger, contempt and shame interfere with problem solving and emotional processing. Thus according to the biosocial approach both anger and shame appear to play a central role in maintaining DSH. Linehan's (1993) biosocial theory emphasised a central role for negative emotions in DSH, incorporating theories that suggest that DSH serves to enable escape from negative emotions.

Feelings of shame or anger may act as motivational states that drive an individual to make attempts to remove them, but they may also interfere with therapy (Milton, 2002). Particularly high levels of anger, hostility and aggression do appear to be apparent in individuals who engage in DSH (e.g. Briere & Gil, 1998). For some individuals who engage in DSH the reduction of anger serves as a negative reinforcing consequence of DSH (e.g. Kemperman, Russ & Shearin, 1997).

*2.2.5 Summary of negative reinforcement models.* The models described above have proposed a range of negative reinforcement contingencies that may be a useful way of analysing and describing DSH. The models are conceptually distinct in the locality of dysfunction; the *tension reduction model* implicates a dysfunction in the ability to regulate affect, and to self-soothe. In Bakers (1991) model of emotional processing, this would suggest that those who engage in DSH experience a deficit in the control of emotions, at the ‘expression’ level. The *experiential avoidance model* would suggest however that the dysfunction lies at the level of ‘deployment of attention’ according to Gross (1998) or the ‘input’ level according to Baker (1991), and the dissociation model of negative reinforcement would place the dysfunction at the ‘experience’ level of emotional control. Although the models presented above are conceptually distinct, there are two clear commonalities: a) DSH is maintained by the alleviation of the tension experienced as a result of an interpersonal stressful event or an environmental stressor. These models postulate that although deficits in emotional processing underlie the maintenance of the behaviour, DSH is reinforced by alleviation of the aversive state created by a negative stressor and, b) the models highlight the importance of cues in the maintenance of DSH.

However, it is also apparent that people report positive benefits of DSH that go beyond the termination of aversive states. Winchel and Stanley (1991) noted that self-harmers reported feelings of empowerment after engaging in DSH, and Nock and Prinstein (2004) identified that inpatient adolescents also reported feeling generation after DSH. It is also notable that not all DSH results in relief. Even in the absence of tension relief DSH is maintained. Schwartz, Cohen and Hoffman (1989) reported changes in mood before and after DSH in a population of drug abusing adolescents. Although 27% of the adolescent females reported short-term tension relief, 32% reported feeling unrelieved, and many reported the compelling urge to continue. It appears that tension reduction alone, is insufficient to account for the maintenance of DSH. Positive reinforcement may also play a role in the maintenance of DSH.

*2.3 Positive reinforcement*

Models of positive reinforcement propose that DSH is maintained by its appetitive function; that is, DSH serves to move the individual towards a more positive (or preferable) state rather than simply terminating or reducing an aversive state. As described earlier, appetitively motivated behaviours may become impulsive if the desire is to seek immediate gratification.

If DSH is described as impulsive, this would suggest that individuals were unable to exert cognitive control over their urges to self-harm. Favazza (1993) identified that a significant number of individuals who engage in DSH report difficulties with impulse control. Those who self-harm may exhibit a variety of impulsive behaviours (Favazza & Rosenthal, 1993). DSH is included as a behaviour characteristic of individuals experiencing Impulse Control Disorders, in the DSM-IV (APA, 2000). Moeller et al., (2001) suggested that impulsivity involves: a) decreased sensitivity to the negative consequences of behaviour, b) rapid, unplanned reactions to stimuli before complete processing of information; and c) lack of regard for long-term consequences. In addition impulsivity may be associated with sensitivity to reward.

Herpertz et al., (1997) reported that individuals with impulsive personalities were more likely than controls to exhibit a higher intensity of affective responses and a tendency towards more rapid changes in the experience of affect. This provides support for a link between emotion dysregulation and impulsivity in DSH. Herpertz et al., (1997) reported that trait impulsivity is associated with DSH. This impulsivity is evident as a deficit in future-oriented problem solving rather than in motoric or cognitive impulsivity. Individuals may have a tendency to choose immediate rewards over long-term gains.

An understanding of the underlying neurobiological mechanisms of impulsivity has supported the clinical picture, but empirical behavioural investigation of impulsivity in DSH is required. Empirical investigation into the relationship between impulsivity, distress tolerance and emotional regulation may aid in the development of therapeutic interventions for individuals who engage in DSH. Herpertz, Sass and Favazza (1997) reported that trait impulsivity was found to be associated with hyperactivity of serotonergic functioning, a severe variant of that demonstrated in patients who present with other behaviours that are often co-morbid with DSH such as eating disorders, gambling, risky sexual behaviour and driving recklessly. Describing DSH as an impulsive behaviour might help researchers to understand how an individual who engages in it might attempt to seek gratification, but it does not identify the pleasurable states, that individuals seek to obtain through DSH.

*2.3.1 Dissociation.* A model of dissociation whereby DSH serves to alleviate dissociative states was described earlier in this chapter. This model proposed that dissociation was a negative reinforcement contingency. Dissociation may alternatively plausibly present as a consequence of DSH (Konicki & Schultz, 1989), releasing analgesic beta-endorphins that provide pain relief. This model suggests that DSH is maintained because, through doing so, individuals are able to elicit relief from pain by inducing depersonalisation or derealization. There is evidence that links dissociation to analgesia in DSH.

Approximately half of all patients with BPD, who engage in DSH, report that they experience no pain during DSH (Leibenluft et al., 1987). Russ, Shearin, Clarkin, Harrison, and Hull (1993) reported that women with BPD, who reported no pain during an episode of DSH, also experienced significantly less pain during completion the Cold Pressor Test (CPT). Russ et al., (1997) proposed that pain perception and emotion regulation may be related by neurochemical and neuroanatomical substrates. The relationship between pain perception and emotion regulation may be mediated by dissociation.

Russ et al., (1996) suggested that individuals who report ‘analgesia’ during DSH are less able to distinguish between pain sensations (mild or severe). Painful sensations are also more likely to be reinterpreted, a coping strategy that is associated with dissociative tendencies. Russ, Campbell, Kakuma, Harrison and Zanine (1999) provide support for an affect regulatory model of DSH, and individuals who use DSH to induce dissociation, the fact that dissociation mediates pain responsivity may further reinforce the behaviour assessed. The authors assessed EEG responses (a cortical indicator of emotional processing) during the CPT in individuals with BPD who reported experiencing pain during DSH, those who do not report pain, female inpatients with major depression and normal controls. Their aim was to investigate the relationship between pain perception and cortical brain activity. They noted that the ‘no pain’ group reported significantly less pain intensity during the CPT than Controls. EEG Theta activity during the CPT was significantly higher in the BPD ‘no pain’ group than depressed and healthy Controls, with a trend towards being significantly higher than in the BPD ‘pain’ group. Theta activity was significantly correlated with pain rating and scores on the Dissociative Experiences Scale (Bernstein & Putnam, 1989). The results suggest that increased theta power may provide an index of the tendency towards dissociation and may act as a marker for the pain insensitivity or 'analgesia' that may be a common somatoform symptom of dissociation providing support for a model whereby dissociation mediates the responsivity to pain in DSH. However, the authors propose that derealization and depersonalisation serve to alleviate the dysphoria associated with the aversive tension that is triggered by stressful events. Dissociation (and analgesia) might be described as a positive consequence of DSH, or the very same model might be used to provide evidence for the negatively reinforcing properties of DSH, as it serves to alleviate aversive tension or pain. Conceptual clarity is required to address these issues.

*2.3.2. Feeling generation.* One hypothesis is that to some, DSH serves an appetitive function by generating feelings such as joy or elation. For the purposes of this review, feeling generation might be defined as the deliberate induction of an emotional state through the act of DSH. DSH can be positively reinforced through the enhancement of positive affect (Nock & Prinstein, 1994) and Brown, Comtois and Linehan (2002) revealed that in their sample, 54% of participants who engage in DSH cited emotional 'feeling generation' as a motivation for engaging in the behaviour. This feeling generation may refer to either the generation of physical sensations or emotions.  Evidence for this model is again limited to self-report, however ecological momentary assessment techniques are currently being utilised to obtain contemporaneous data. DSH may be used as a way to communicate anger, in individuals who find it difficult to express this emotion in a more adaptive way (Brown, Comtois & Linehan, 2002).

Linehan (1993) describes how DSH is sometimes considered to be an aggressive act against the self. Generating feelings of anger, may alternatively replace a more intolerable emotion or cognition, such as feeling vulnerable. However, not all feelings generated may be intentional, for example, many individuals also experience shame following an act of DSH, and this may be an undesired consequence of the behaviour (Briere & Gil, 1998).

*2.3.3 Secondary gains.* Yates (2004) suggested that DSH may be positively reinforced by secondary gains such as the receipt of attention, sympathy or favoured status from others. Clinical experience also suggests that DSH may be reinforced through re-admission to hospital in individuals who wish to receive care from health professionals. There is as yet no empirical evidence for the receipt of secondary gains as a motivation for DSH.

*2.3.4 Boundaries.* Suyemoto (1998) discussed an object relations based model of DSH, whereby DSH serves to provide a basic physical boundary between the self and others (e.g., Carroll et al, 1980), particularly for those who have experienced trauma, or who may have found it difficult to develop a strong sense of self, either through pushing others away, or through the confirmation of physical boundaries to the body through the sight of blood.

Suyemoto (1998) suggests that parallel to this, DSH may serve to provide a sense of identity as a ‘self-harmer’ or ‘cutter’. Raine (1992) proposed that the scar or wound that results from an act of DSH is a marker of this identity. This fits with the clinical picture, whereby individuals feel a loss when attempting to abstain, may spend time associating with others who engage in the behaviour, use self-harm websites or chat rooms, and discuss methods of DSH, with others. It is clear that for some individuals, membership of a social group and the provision of an identity may positively reinforce DSH.

*2.3.5 Opiod hypothesis.* The opiod hypothesis suggests that DSH may have biologically rewarding properties (Winchel & Stanley, 1991), with the development of tolerance requiring an increased release of endogenous opiates in order to maintain opiatrogenic tone. Tantam and Whittaker (1992) explained the addiction hypothesis of DSH with regard to detoxification and the need for consideration of withdrawal symptoms associated with recovery, highlighting the experience of dysphoria, increased tension and restlessness in individuals abstaining from DSH, comparable to that experienced in opiod detoxification. If Endogenous Opiates were involved in the maintenance of DSH, one might expect similar tolerance, withdrawal and recovery. Abstinence from DSH has been found to elicit similar symptoms of dysphoria (including increased tension and restlessness, to that experienced in opiate detoxification (Tantam & Whittaker, 1992) and Favazza (1987) developed a detoxification oriented treatment intervention for DSH that followed this model. However, as considerable motivation was required to produce any success with this approach, Tantam and Whittaker (1992) proposed the use of pharmacological treatments to alleviate this distress, highlighting the efficacy of 5-HT antidepressants on impulsivity, a psychological presentation often seen in individuals who engage in DSH.

Studies investigating the efficacy of opiate antagonists such as naloxone and naltrexone and measures of endogenous opiates present within cerebrospinal fluid in inpatients hospitalised for DSH further support the investigation of such hypotheses (Simeon & Hollender, 2001). The addiction hypothesis posits that repeated stimulation of the endogenous opiod system produces a positive elevation in mood. Over time, as tolerance develops an increased opiod release is required to maintain opiatrogenic tone. Rohsenow et al., (2000) report that Naltrexone reduces both the urge to consume alcohol and the self-reported attention to alcohol cues after repeated exposure. It is proposed that this is because naltrexone reduces mesolimbic dopaminergic activity. Naltrexone is found to reduce negative affect which increases individuals' ability to override a learned response. Naltrexone has been found to reduce DSH (Roth et al., 1997) as described in chapter I, the proposed mechanism being its opiate antagonistic effect during an act of DSH (Simeon & Hollender, 2001).

## 2.4 Summary

The present chapter has reviewed the prevailing theoretical models underlying the maintenance of DSH. Two key issues are apparent: a) Negative and positive reinforcement contingencies appear to play a role in the maintenance of DSH and b) all the accounts emphasise the relevance of cues in the maintenance of DSH. A review of the prevailing literature suggests that a learning approach to the treatment of DSH is appropriate. This chapter has so far considered the consequences of DSH. A behavioural model must consider the antecedents too. The next chapter will consider how it might be possible to elucidate the types of cues that trigger DSH.

# Chapter III Cue Reactivity and Cue Exposure

## *3.1 Chapter Overview*

Chapter II identified that DSH can be described as both compulsive and impulsive, and identified a range of powerful reinforcers for the behaviour. Conceptualising DSH in such a way makes it difficult not to draw parallels with addictive behaviour. Both the Tension Reduction model of negative reinforcement and the Opiod model of positive reinforcement that have utility in explaining the motivation for DSH are also common ways of thinking about addiction.

Traditionally, addiction research focused on a biomedical model that emphasised the chemical dependency of a particular substance of abuse. This notion of physical dependence led to the development of approaches that focused on the identification of the biological and neurological substrates that are affected in the development and maintenance of an addiction and the subsequent psychopharmacological approaches to intervention. The biomedical model defined addiction is defined as a 'compulsive psychological need for a habit forming drug' (Webster's New Collegiate Dictionary, 1983) thus implying that the individual is unable to control his own behaviour. The DSM-IV criteria for substance dependency (APA, 1994) identified the features of an addictive behaviour (see Table 1).

Although early models of addiction focused on chemical dependency with the ingestion of a substance a necessary component of addiction, more recently, there has been a trend towards acknowledgement of the behavioural and cognitive components of addiction. It has been recognised that the intrapersonal, social and cultural context, are relevant to treatment efficacy.

Donegan, Rodin, O'Brien and Solomon (1983) identified the behavioural features of addiction:

1) Ability of the substance to act as an instrumental reinforcer.
2) Acquired tolerance- repeated use can result in reduced effectiveness of this substance.
3) Development of dependence with repeated use. Repeated use produces withdrawal effects that motivate further use.
4) Affective contrast. The substance tends to produce an initial affective state (euphoria) which is then followed by an opposing state (dysphoria).
5) Ability of the substance to act as an effective Pavlovian unconditioned stimulus.
6) Ability of various states (general arousal, stress, pain) to influence substance use.

Brown (1997) proposed six behavioural features of addictive behaviour: salience, conflict, tolerance, euphoria, withdrawal symptoms, and relapse. *Salience* refers to the importance of the behaviour for the addicted individual, for example the time spent thinking about the behaviour, *Conflict* includes both intra-personal (internal concerns about the behaviour) and inter-personal (arguments with others over the behaviour). *Tolerance* refers to the decreasing effect achieved from the same dosage. *Withdrawal* effects are the aversive responses to cessation of an addictive behaviour and *relapse* refers to the reinstatement of that behaviour after a period of abstinence.

The identification of these criteria has enabled a range of behaviours such as pathological gambling, internet and computer game addiction and shopping to be recognised as addictive (e.g., Griffiths, 1996; Lemon, 2002). Bradley (1990) suggested that there are features that are common to both behavioural and chemical additions: a) external cues, b) secondary conditioning processes and c) habituation of craving and withdrawal.

The same classical conditioning processes that occur in chemical addiction might be expected to occur in the development and maintenance of behavioural addictions such as pathological gambling (Kushner et al., 2007). Because DSH shows some of the characteristics of an addictive behaviour, (e.g., Bryant, 2007; Nock & Prinstein, 2004) it might be expected that a similar conditioning process would occur in the maintenance of DSH.

Table 1. *DSM-IV criteria for substance abuse (APA, 1994).*

| | |
|---|---|
| | Three out of the following must be experienced within the past year. |
| 1 | Tolerance, as defined by either of the following;<br>a) need for markedly increased amounts of a substance to achieve intoxication or desired effect<br>b) Markedly diminished effect with continued use of the same amount of the substance. |
| 2 | Withdrawal, as manifested by either of the following;<br>a) the characteristic withdrawal syndrome for the substance<br>b) the same (or closely related) substance is taken to relieve or avoid withdrawal symptoms |
| 3 | The substance is often taken in larger amounts or over a longer period than was intended. |

4 Any unsuccessful effort or a persistent desire to cut down or control substance use.

5 A great deal of time is spent in activities necessary to obtain the substance (e.g., visiting multiple doctors or driving long distances), use of the substance (e.g., chain-smoking), or recover from its effects.

6 Important social, occupational, or recreational activities given up or reduced because of substance use.

7 Continued substance use despite knowledge of having had a persistent or recurrent physical or psychological problem that is likely to be caused or exacerbated by the substance (e.g., current cocaine use despite recognition of cocaine-induced depression, or continued drinking despite recognition that an ulcer was made worse by alcohol consumption).

Specify if;

- With physical dependence: Evidence of tolerance or withdrawal (i.e., either items (1) or (2) are present).
- Without physical dependence: No evidence of tolerance or withdrawal (i.e., neither items (1) nor (2) are present).

*3.2 Cues to addictive behaviour*

Addiction models have identified two main antecedents of behaviour: 1) establishing operations and 2) discriminative stimuli. The first is based on a simple classical conditioning approach, whereby it is proposed that addictive behaviours are established only when an individual is motivated to move from one state to another. Thus a pre-requisite for the establishment of a behaviour is a 'need state' such as thirst, hunger. The stimulus pairing of a response with a previously unconditioned stimulus is contingent on the presence of these establishing operations. These establishing operations are 'clues' to a behaviour. This *clue hypothesis* states that: 'stimuli that reliably predict a reinforcer become conditioned reinforcers' (Hendry, 1969, p.20). An establishing operation is defined by Michael (1982) as 'any change in the environment which alters the effectiveness of some object or event as reinforcement and simultaneously alters the momentary frequency of the behaviour that has been followed by that reinforcement'. An establishing operation for an addictive behaviour (e.g., heroin use) can be primary (e.g., deprivation of a drug; abstinence) or conditioned (e.g., a cue related to the drug).

The second hypothesis, based on an operant approach, identified that triggers in the environment termed 'discriminative stimuli', 'set the scene' for a conditioned response to occur (Skinner, 1938, p.241). Hendry (1969) termed this hypothesis the *cue hypothesis* and explained that discriminative stimuli that 'control the rate of an operant are conditioned reinforcers' (p.20). Therefore, it is proposed that two types of stimuli predict the reliability of a conditioned response; 'clues' that drive the individual to change from their current state (e.g. aversive tension) and 'cues' that predict the rate at which the behaviour occurs (e.g. environmental triggers such as paraphernalia associated with the addictive behaviour).

Two theories of addictive behaviour have particularly utility when exploring the importance of these antecedents in the maintenance of an addictive behaviour: a) the *Opponent Process Theory* (OPT, Solomon, 2003) and b) the *Incentive Sensitization Theory* (IST, Robinson & Berridge, 1993).

*3.2.1 Opponent Process Theory.* OPT (Solomon, 2003) states that there exist, a-processes which are primary affective process that are elicited by unconditioned stimuli. According to Solomon (2003) these 'correlate closely with stimulus intensity, quality and duration of the reinforcer'. A primary unconditioned response induces in turn a b-process which opposes and suppresses the affective strength of the a-process which is sluggish and inertia laden. The a-process has a relatively long latency or reaction time and is slow to build up to maximum amplitude. It is then slow to decay after the removal of the unconditioned stimulus and after the a-process response has ceased. In contrast the b-process has a hedonically opposite quality to the a-process. The affective state of an organism is equal to the sum of the intensities of the 'a' and 'b' processes. At onset most a-processes are more intense and then gradually decline, even while the unconditioned stimulus is present. In contrast the b-process decays slowly, leaving the organism in the negative b-state. According to this theory:

> "Addiction is not viewed as an abnormality. Instead, it is the inevitable consequence of a normally functioning system which opposes affective or hedonic states" (Solomon, 2003).

OPT suggested that addiction results from both positive and negative reinforcement processes. The state of craving can be elicited and perhaps increased by the presence of cues associated with the stimulus (discriminative stimuli). OPT would predict that addicted individuals should demonstrate physiological and psychological reactivity to cues associated with the subject of their addiction.

> "…as unconditioned responses they are responses to the unconditioned stimulus of the drug itself. By repetition, they become associated with a variety of conditioned stimuli which are associated by time and place with

> the drug (for example, the smell of alcohol or the sight of injecting equipment)" (Hammersley, 1992).

There are, however, behaviours that persist despite the fact that the immediate CR is aversive, for example, individuals who engage in exhaustive excessive exercise may experience initial pain, followed by tension relief, and those who engage in free fall parachuting may experience an initial fear response followed by a euphoric state (Solomon & Corbit, 1974). According to OPT it would be predicted that DSH stimulates an initial aversive a-process (pain, tension) which in turn elicits a hedonically opposing b-process (tension relief or pain relief which experienced physiologically as production of an endogenous analgesic, endorphin). The b-process reduces the aversiveness of the immediate sequelae of the act (pain tolerance) but also extends beyond the period for which the a-process is active. Repetition of the act would strengthen the opposing process, and moderate the initial affective response, increasing tolerance for pain. This provides a longer-term, rewarding tension-reducing effect which mitigates against the chronically high levels of tension clinically observed in this population.

In accordance with a classical conditioning model this tolerance would be greatest in the presence of cues that reliably predict DSH. Over time the b-process would become conditioned to cues associated with DSH so that even in the absence of the initial stimulation, individuals might achieve the opposing b-state in the presence of cues, i.e., cues such as razor blades used to DSH, may in turn elicit tension relief. This supports the clinical picture. Some individuals report that merely carrying a razor blade is powerful enough to activate tension relief.

Changes in mood state may also act as conditioned stimuli that trigger such opponent processes. This is supported by evidence for an emotion regulatory function for DSH (e.g., Bennum, 1984; Haines, 1995).

An OPT account of DSH has qualitative support (Bryant 2007) whereby individuals with a history of DSH reported an increased tolerance for pain over time, long lasting positive after effects of DSH, and fits with the endogenous opiod theory of DSH (Simeon and Hollander, 1992) supported by the efficacy of naltrexone in reducing repetitive DSH (Roth et al., 1996). The opiate antagonistic effect on the blocking of naltrexone is hypothesised to block the reward of enhanced endogenous opiod release during DSH.

If so, cues that reliably predict DSH (e.g., razors) would potentially be sufficient to abolish or reduce even the initial aversive effect of an act of DSH (i.e. a conditioned tolerance effect).

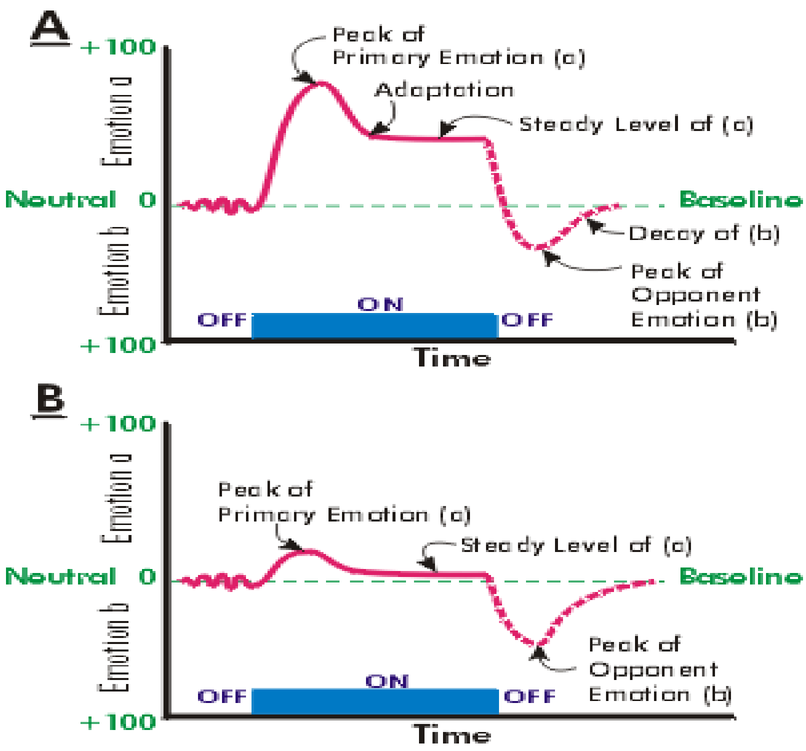


*Figure 1*. The Opponent Process Theory of Acquired Motivation.

*3.2.2 The Incentive sensitization theory.* IST (Robinson & Berridge, 1993) asserted that the positive reinforcing effects of addictive drugs are potentiated rather than diminished by repeated exposure and that craving should be increased when the conditioned stimulus, (e.g. drug paraphernalia) is present. This model of addiction asserted that:

> "1) potentially addictive drugs share the ability to alter brain organization; 2) the brain systems that are altered include those normally involved in the process of incentive motivation and reward; 3) the critical neuro-adaptations for addiction render these brain reward systems hypersensitive (sensitized) to drugs and drug-associated stimuli; and 4) the brain systems that are sensitized do not mediate the pleasurable or euphoric effects of drugs (drug 'liking') but instead they mediate a subcomponent of reward we have termed incentive-salience (drug 'wanting')".

Therefore, repeated use of drugs enhances sensitization to drug related cues, increasing wanting but not liking for the behaviour. An IST model of DSH would hypothesise that increased engagement in DSH would enhance 'wanting' or 'urges' to engage in the DSH in the presence of cues that reliably predict DSH.

Addiction models of acquired motivation might go some way towards explaining the importance of cues in the maintenance of DSH. It is useful to consider how these theories have been tested in addictive behaviours. The assessment of cues has involved four main lines of research: a) the identification of cues through self-report, b) the assessment of self-reported reactivity to cues ('urges' or 'craving' to engage in the addictive behaviour), c) assessment of psychophysiological reactivity to cues (to detect Autonomic Nervous system response) and d) the more recent assessment of Event Related Potentials to index reactivity in the Central Nervous System (CNS).

*3.3 Identification of cues*

If environmental cues play a role in the development of tolerance to an addictive behaviour, the identification and management of responses to such cues would be expected to have clinical utility. Marlatt (1979) explored situations that are associated with a high risk for relapse in alcohol dependent patients. These were defined as ‘any situation that poses a threat to the individual’s sense of control and increases the risk of potential relapse’. Detailed descriptions of specific relapse episodes were obtained including information regarding the exact circumstances of the first drink episode e.g., physical location, time of day, presence or absence of others, beverage consumed and concomitant external (environmental) or internal (subjective) events. The descriptions were sorted into categories and inter-rater agreement confirmed. This information provided the basis for an analysis of high risk situations; the categories included: frustration and anger, social pressure, intrapersonal temptation, negative emotional state, miscellaneous other (e.g. celebration), no situation given.

It appeared that the situations in which individuals were vulnerable to relapse or act on cravings and urges were relatively specific. Cummings, Gordon and Marlatt (1980) and Marlatt and Gordon (1980) replicated these findings in cigarette smokers, heroin addicts, individuals in weight-loss programmes and compulsive gamblers, indicating that these triggers are consistent across addictive behaviours.

Cummings et al., (1980) identified three primary high risk situations for relapse through the analysis of data from 311 initial relapse episodes from individuals experiencing a range of addictive behaviours including alcohol dependence, smoking, heroin addiction, overeating etc). Negative emotional states accounted for 35% of all relapses in the sample, Interpersonal conflict accounted for 16% and social pressure accounted for 20%. See Table 2 for taxonomy of the high-risk situations for relapse (Marlatt & Gordon, 1985).

Table 2. *Taxonomy of high-risk situations for relapse (Marlatt & Gordon, 1985).*

| Intrapersonal-Environmental Determinants | Interpersonal Determinants |
|---|---|
| A Coping with negative emotional states: | A Coping with interpersonal conflict |
| 1) Coping with frustration and/or anger | 1) Coping with frustration and/or anger |
| 2) Coping with other negative emotional states | 2) Coping with other interpersonal conflict |
| B Coping with negative physical-physiological states | B Social pressure |
| | 1) Direct social pressure |
| 1) Coping with physical states associated with prior substance abuse | 2) Indirect social pressure |
| 2) Coping with other negative physical states | |
| C Enhancement of positive emotional states | C Enhancement of positive emotional states |
| D Testing personal control | |

This taxonomy of triggers is a useful reference to identify the cues that may become conditioned stimuli in the maintenance of addictive behaviours. Marlatt and Gordon (1985) identified that high risk situations play a major role in the movement from abstinence to relapse and that aiding an individual to develop a sense of control or mastery in the presence of such cues is vital in maintaining abstinence. Because it is not possible to eliminate risky situations, the capacity to manage urges in the presence of triggers may be an important component in the treatment of addictive behaviour. Urges or cravings that occur in the presence of triggers are primarily nonverbal impulses or emotional/affective states. Urges do not always result in immediate action, either due to the situational constraints, the presence of others or the unavailability of the tools to act. In such situations, planning or fantasising about the act may occur, and denial or rationalization may be employed as a cognitive mechanism to cope with the immediate situation. Suppression of thoughts or urges (Wegner, 2003) may result in a strong rebound effect, ultimately placing the individual at a higher vulnerability to relapse at a later date. Such suppression may mean that the individual is unaware their increasing vulnerability so that when placed under further stress, or the availability of tools to act, an individual may be less able to exert conscious behavioural control.

The rebound effect associated with thought suppression appears to be attenuated when using a focused distractor (Salkovskis & Campbell, 1994). The use of such a distractor may both reduce the distress associated with an intrusive thought (Johnstone & Page, 2004) and the frequency of the thoughts (Salkovskis & Campbell, 1994). This therefore suggests that deliberate diversion of attention that involves active engagement of attention may under some circumstances reduce the maladaptive effects of cognitive avoidance. Najmi, Wegner and Nock

(2007) however, emphasise that this focused distractor may be maladaptive in its own right (e.g., DSH)

*3.4 Assessment of cue reactivity*

> "…Cues previously associated with drinking-behaviour can, under certain conditions, elicit cue reactivity, which can be symbolic expressive (e.g. craving, anxiety, pleasure), physiological (e.g. drug-like, withdrawal-like, appetitive), and behavioural, (e.g. drink-seeking behaviour, consummatory behaviour)…. The cue reactivity paradigm involves exposure to a cue or set of cues (e.g. the sight and smell of a favourite drink) and observation and measurement of a variety of responses." (Drummond, 2000).

Cues that act as conditioned stimuli for addictive behaviour have been identified and responses to these cues (termed *cue reactivity*) assessed (for example, Carter & Tiffany, 1999; Drummond, 2000; Drummond & Glautier, 1994; Niaura, 1998; Rankin et al., 1983) in cocaine addicts (e.g., Killeen & Brady, 2000; Robbins, Ehrman, Childress & O'Brien, 1999), alcoholics (e.g., Rajan, Murthy, Ramakrishnan, Gangadhar & Janakiramaiah, 1998; Mulligan & McKay, 2001) and cigarette smokers (e.g., Drobes & Tiffany, 1997). The majority of studies have relied on self-report methods to assess craving. Carter and Tiffany (1999) revealed that over 90% of studies identified in their meta-analysis of cue-reactivity research, used a single-item measure to assess craving.

Cue reactivity in the autonomic nervous system has been assessed using psychophysiological approaches (Childress et al., 1986; Drummond et al, 1990; Drobes & Tiffany, 1997; Hodgson & Rankin, 1976; McKay & Schare, 1999).

There is strong empirical evidence to suggest that physiological assessment of craving taps into the reduction in tension following implementation of the addictive behaviour. Increased heart-rate (HR) and galvanic skin response (GSR) and decreased skin temperature have been identified as the most reliable physiological indicators of urge in the addiction field (e.g., Carter & Tiffany, 1999).

Barlow, Hayes and Nelson (1984) identified some of the methodological concerns with a reliance on psycho-physiological assessment; cost, inter-individual variables (e.g., differing baseline resting levels), the importance of identifying stimulus situations (environmental context) and response specificity (inter-subject response inconsistency). There are also inconsistencies in the reactivity identified by subjective and physiological measures of craving (Drobes & Tiffany, 1997). Carter and Tiffany (1999) suggested that this variance reflects the specificity of self-report of craving, as physiological indices tap into a much wider range of physiological responses, of which only a proportion might reflect reactivity to cue-manipulation. In contrast, Carter and Tiffany (1999) and West (1987) suggested that subjective reports of craving may be influenced by social-desirability although consistent effect sizes across studies suggests that this is not a major concern.

In their meta-analysis of cue reactivity research (41 studies) comparing the self-reported urges and physiological responses of alcoholics, cigarette smokers, cocaine addicts and heroin addicts to drug-related versus neutral cues, Carter and Tiffany (1999) reported an effect size of +.092 for self-reported cue reactivity across all addict groups, with alcohol related reactivity producing significantly smaller effects (+0.53) than other addictive behaviours. Physiological cue reactivity produced significantly smaller effect sizes, with a general profile of response indicating increased HR and GSR to drug-cues, and a decrease in skin temperature.

The recent trend towards the classification of behaviours such as pathological gambling as addictive has fuelled interest in the relevance of cues for the behaviour. Kushner et al., (2007) reported that 2/3 of participants in his sample of individuals who exhibit pathological gambling (n=18) self-reported increased urges to gamble when exposed to gambling related cues (a casino environment). Blanchard, Wulfert, Freidenberg and Malta, (2000) reported that pathological gamblers exhibited a greater psychophysiological response (HR) to gambling related imagery scripts than to fear related scripts, and when compared to Controls.

Recently, researchers have approached the assessment of cue reactivity at the level of the CNS. Event related potentials (ERP) are sensory evoked waveforms that represent voltage changes in the brain and scalp in response to specific time-locked to events. Warren and McDonough (1999) and Fehr, Wiedenmann and Herrmann (2006) used ERP as a means of assessing cue specific reactivity in nicotine addicts. Herrman, Weijers, Wiesbeck, Boning and Fallgatter (2001) revealed that ERP cue reactivity successfully distinguished between individuals with alcohol dependence and social drinkers.

*3.5 Cue reactivity*

Following on from this work, the first aim of this research thesi is to investigate the extent to which DSH related cues (e.g., razor blades, knives etc) elicit urges and psycho-physiological changes in individuals who regularly engage in DSH. There are three major applications of cue reactivity research; a) to understand the nature of dependence, b) to predict relapse, and c) to evaluate treatment effects (Drummond, 2000).

*3.6 Cue exposure*

Cue exposure requires patients to remain in contact with powerful drug-related cues (e.g., a syringe of heroin) and engage in drug-related behaviours (e.g., cooking and preparing to inject the drug) without completing the act, e.g. drug ingestion (response prevention). Cue exposure with response prevention has demonstrated efficacy across a range of clinical domains e.g., in the eating disorders, phobias, and Post-traumatic stress disorder. Abramowitz (1996) notably reported the consistent effectiveness of exposure interventions for Obsessive Compulsive Disorder.

Research into eating disorders has highlighted the importance of the conditioned response to interoceptive and exteroceptive cues (Toro et al., 2003; Carter et al., 2001). Carter et al. (2001) identified that cue exposure with response prevention significantly decreased self-reported cue reactivity. Toro et al., (2003) highlighted the clinical utility of exposure in resistant bulimia nervosa and reported that motivation was an important mediator in the efficacy of this intervention. Jansen, Brokemate and Heymans, (1992) compared cue exposure to self-control treatment for binge eating and reported that 100% of patients in the cue exposure condition were binge free at post treatment assessment and one year follow-up, whereas only 33% of those in the self control techniques and relapse prevention condition were abstinent.

Bradley (1990) suggested that Cue exposure might provide a useful treatment option for both chemical and behavioural addictions. Rohsenow, Monti and Abrams (1995) reviewed 30 years of cue exposure interventions for alcohol dependency, and concluded that both; single case designs (Pickens, Bigelow & Griffiths, 1973; Hodgson & Rankin, 1976; Blakey & Baker, 1980), and group series designs (including Rankin, Hodgson & Stockwell, 1983; Drummond & Glautier, 1994) reported strong evidence for treatment effectiveness.

Dawe and Powell (1995) similarly reviewed the evidence for cue exposure treatment in opiate and cocaine dependence, and concluded that in this field evidence is promising although equivocal (Bradley & Moorey, 1988; Powell, Bradley & Gray, 1992). For example, Powell et al., (1992) assessed the efficacy of cue exposure versus cue exposure plus cognitive aversion versus a no treatment control, and reported a significant reduction in craving and self-reported withdrawal to stimuli pre-post exposure, that was not found in Controls. A larger clinical trial, however, was unable to replicate these findings (Dawe et al., 1983). In nicotine dependence, although evidence of cue reactivity is well supported (Brandon, Piasecki, Quinn & Baker, 1995) there appears to be little evidence to support cue exposure as an effective intervention over and above other treatment options currently available. The authors reported that at the time of press only five treatment outcome trials and one single case approach were in publication, and although the single case design held promise at short and long term follow-up (Self, 1989), controlled trials revealed no significant differences in outcome when compared to supportive counselling (Raw & Russell, 1980), rapid smoking (Corty & McFall, 1984), relaxation training (Gotestam & Melin, 1983) and self-control training (Lowe et al., 1980). A large RCT with four treatment conditions: a) brief cognitive behavioral; b) cognitive behavioral and nicorette gum; c) cognitive behavioral and cue exposure and , d) cognitive behavioral and cue exposure with nicorette gum, revealed no significant between groups difference in outcome (point-prevalence abstinence rates or in time to first slip). Recently, a preliminary study of cue exposure to gambling cues in 18 problem gamblers reduced self-reported urges to gamble, and a gambling related negative mood induction further enhanced this intervention (Kushner et al., 2007). Preliminary investigation of the efficacy of Cue exposure interventions suggest that they hold great promise, however, cross-domain methodological parity is required.

Animal extinction paradigms, however, have identified the behavioural and context related processes that may limit the effectiveness of behavioural exposure interventions. Bouton (2004) describes the recent behavioural evidence relevant to theoretical accounts of extinction paradigms. He surmises that the greatest evidence suggests that exposure is effective due to its role in generalization decrement and violation of expectation about the presentation of an unconditioned stimulus (US) following the conditioned stimulus (CS). It is important to note that recent evidence consistently supports the notion that exposure based or extinction paradigms involve the generation of new leaned associations rather than an elimination of the original association. There is evidence to suggest that: 1) both associations are context dependent and that the second, the non-reinforced association, is more so than the original context dependent learning, and 2) original association remains intact. This has some major implications for the relative effectiveness of an extinction program. Firstly, because the association remains intact it may be reinstated relatively easily by a change in context (known as the renewal effect). In terms of our understanding in relation to exposure interventions for DSH, this could mean that while new learning may take place in the therapy room, the relationship between a specific trigger (e.g., a knife) and the response (DSH) may be reinstated easily, in a different context, e.g. the home environment. For this reason, generalisation training is imperative. Secondly, this new relationship may be more rapidly re-acquired than the original learning (rapid re-acquisition). Thirdly, extinction itself is more highly context dependent than the original learning (hypothesised to be related to the fact that it is the second-learned association (Nelson, 2002). After extinction, the US may reinstate the original CR in the same context as the extinction procedure, because it is encoded as part of the context of original conditioning (e.g., after exposure with response prevention to a needle used to inject heroin, if the individual were to see that knife (the US), in the same context as extinction, this may rapidly reinstate the previous learned association). Therefore, it is important to consider generalisation, and context learning when developing an exposure intervention. Extinction may be context dependent on time as well as location and Spontaneous recovery (Pavlov, 1927) may occur after a period of time has elapsed. For example, long periods of time between testing sessions may also reinstate a response. Therefore future research is required to identify the most effective methodology in terms of the timings of exposure sessions and intervals between stimulus presentations.

*3.7 Cue exposure and DSH.*

Clinical and anecdotal reports have suggested that cues play a role in the maintenance of DSH. DSH shows similarities with addictive behaviours and individuals who self-harm report cravings and urges to engage in it. There is evidence of psychophysiological tension reduction to DSH imagery and functional models of DSH identify a range of negative and positive reinforcement contingencies.

Evidence from cue-reactivity research in the addiction field had revealed that once an appropriate trigger has been identified, craving and increased urges to engage in an addictive behaviour in the presence of a cue can be assessed using psychophysiological and self-report methodologies. If psychophysiological or self-reported reactivity to cues associated with DSH can be evidenced then it is expected that cue exposure with response prevention would have clinical utility. Thus, the second aim of this research is to develop a cue exposure intervention for DSH.

This intervention would involve repeatedly presenting an identified stimulus to elicit habituation, whilst reactivity is assessed. The clinical efficacy might be enhanced through the incorporation of skills to manage associated emotions. ACT based techniques and mindfulness have been shown to enhance the efficacy of cue exposure in addictive behaviours (Follette & Orsillo, 1994).

When working with a vulnerable population where understanding about idiosyncratic requirements, clinical context and triggers for relapse is so limited, single case research designs that focus specifically on what works for this individual, under these specific circumstances, at this particular time are a vital stepping stone towards the development of effective intervention for DSH.

## 3.8 Summary

The present thesis was designed to explore the development of an intervention using a behavioural approach to DSH. In a behavioural approach it is assumed that there are functional relationships between the environment and behaviour, and behaviours are viewed as a product of a dynamic system of reinforcement contingencies. The methodologies used to investigate such an approach draw on data gathered from behaviourally based models of addictive behaviour, and thus, whilst this thesis focus on a behavioural approach to investigating and intervening to reduce DSH, it also draws from literature within the field of addictions.

Study I was designed to identify cues that reliably predict DSH, Study II was designed to investigate the extent to which DSH related cues (razor blades, knives) elicit urges and psycho-physiological changes in individuals who regularly engage in DSH. The third study was designed to investigate how this reactivity changes in the presence of interpersonal distress cues. A fourth study explored whether this reactivity can be assessed at the CNS level using ERP techniques to specifically consider initial attention, evaluation of the intensity of the stimulus, and further processing of cues. Study V considered the impact of interpersonal distress priming on distress tolerance in DSH and finally Study VI was designed to draw together the evidence from the previous studies and assessed the impact of a cue exposure with response prevention with emotion regulation skills in a single case patient series design with multiple baseline components.

# Chapter IV Study 1: The Role of Triggers in Deliberate Self-Harm

## 4.1 Introduction

### *4.1.1 Chapter overview*

The importance of triggers in the maintenance of addictive behaviour is well established (Drummond et al., 1995). Drummond (2000) proposed that a greater understanding of cue triggered craving is central to relapse prevention and can extend scientific knowledge of the processes underlying addiction. Marlatt and Gordon (1985) identified a specific set of events that act as triggers for addictive behaviour. These triggers include events that are intrapersonal, environmental and interpersonal in nature.

Clinical experience and anecdotal reports have identified the importance of triggers in the maintenance of DSH. Chapter II discussed the fact that individuals often describe their DSH as addictive and experience many of the characteristic physical, psychological and behavioural symptoms of an addictive behaviour such as craving, urges and lapses. Nixon, Cloutier and Aggarwal (2002) reported that in their sample of 42 hospitalized adolescents who were currently self-harming, all but one endorsed three or more addictive symptoms to describe their behaviour (thus meeting the criteria for dependence outlined in the DSM-IV). The identification of triggers that make individuals vulnerable to engage in DSH might be of considerable value to clinicians in guiding intervention. In the sample described by Nixon et al. (2002) the two primary reasons that participants endorsed for engaging in self-harm were: to cope with feelings of depression (83.3%, $n$ = 35) and, to release unbearable tension (73.8%, $n$ = 31). DSH may resemble other forms of addictive behaviour in terms of: a) its triggers and b) the changes in affect surrounding an episode. The present study was therefore designed to investigate whether individuals report that the events that have previously been identified to act as triggers for addictive behaviour (Marlatt & Gordon, 1985) are also those that trigger episodes of DSH (see Table 2). A secondary research question explored the role of affect in maintaining DSH.

*4.1.2 Emotion regulation and self-harm*

Chapter III described a range of theoretical models that highlight negative and positive reinforcement contingencies for DSH. Affect played a key role in these models. Haines, Brain and Wilson (1995) reported psychophysiological evidence in support of a tension reduction hypothesis of DSH (Bennum, 1984). Schwartz, Cohen and Hoffman (1989) reported changes in affect after an episode of DSH in adolescents with co-morbid substance dependence. Baker et al. (2004) highlighted that negative affect impacts on the ability to exert cognitive control in addictive behaviour, leaving individuals vulnerable to act on their urges. Winchel and Stanley (1991) identified that self-harmers retrospectively reported feelings of empowerment after engaging in DSH. Similarly, Nock and Prinstein (2004) reported that respondents in their adolescent inpatient sample reported the generation of both positive and negative feelings after engaging in DSH.

In the addiction literature, self-report measures, such as the Positive and Negative Affect Schedules have been used to assess affect. The present research study therefore used a similar approach, to consider whether affect regulation in DSH is similar to that reported in addictive behaviour.

Thus, the aim of the study was to assess whether those with a history of DSH: a) identified addictive qualities to the behaviour, and b) reported addictive-type triggers for DSH. Furthermore, the study was designed to consider whether such individuals identified addictive-type changes in affect, and reported a change in the types of events that trigger episodes of DSH over time.

### *4.1.3 Methodological Issues*

A self-report methodology was selected for this preliminary research stage in order to obtain a person focused account of the importance of triggers for DSH. Questionnaires were selected and adapted from the addiction literature in order to obtain self-report information relating to each of the identified aims.

The difficulties in conducting research with this client group often restrict the development of scientific and clinical understanding. Individuals wish to remain anonymous and non-attendance rates for participation in research are high. This is reflected in the huge variance in the published estimates of prevalence and distribution of DSH, as described in Chapter I. A key challenge in developing an understanding of the experience of DSH is participant recruitment.

Recent advances in computer and Internet technology have opened up new opportunities for psychological research. The capacity to test a large scale convenience sample, whilst assuring total anonymity makes the Internet an excellent tool for conducting research with sensitive populations. Data can be accessed with ease, questionnaires or tasks amended easily and stored on secure sites with password access. Individuals can take part in research from the privacy of their own home. The availability of specialist programs, websites and an established internet community, as well as common access to technology and enhanced computer literacy, has broadened opportunities for the advancement of internet based research.

A further advantage of this approach is that minimal intervention on the part of the experimenter is required. Data can be directly downloaded from secure servers, eliminating the need for time-consuming data entry. In addition, the methodology increases statistical power by providing easy access to culturally and demographically diverse populations (Birnbaum, 2000) with the potential to recruit large multinational databases. However, disadvantages include the use of a sample that is self-selected and may be biased by access or computer literacy.

The World Wide Web is now an important source of support for many individuals who engage in DSH. There are a range of websites available specifically for this population[1] and the Internet provides a confidential, accessible and supportive network where individuals feel safe to disclose and share information and feel accepted.

Warm, Murray and Fox (2003) used a web-based survey methodology to explore why individuals engage in DSH. Fox, Murray and Warm (2003) discussed the advantages of this technique in exploring the nature of DSH and developed guidelines for the use of this methodology including practical, technical and methodological issues, as well as ethical considerations. The present study used an internet questionnaire designed with these guidelines in mind.

In the addiction literature, Marlatt and Gordon (1985) used self-report measures to identify the triggers for addictive behaviour. Heather and Stallard (1989) suggested that the approach used by Marlatt and Gordon (1985) to identify triggers for addictive behaviour could be enhanced. They distinguished between proximal and distal factors and explained that: "asking someone to give the main reason for relapse, or the feelings or events which 'triggered it off', can be likened

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[1] Internet sites specifically relevant to DSH include; www.siari.co.uk, www.self-harm.org.uk, www.nshsn.co.uk, www.self-harm.org, and www.self-harm-uk.org.

to asking what was the main reason for the First World War…. It is likely that all the reasons given…are valid."

The authors identified that addicts often report more than one reason for relapse, and that research should take this into consideration. They also proposed an increased importance for the role of substance related cues and that the effect of such cues might combine with other factors to precipitate relapse. Cooney et al. (1983) explained that substance cues are by definition, the 'final common pathway' in all relapse situations. The current study has been adapted to enable individuals to report as many or as few triggers as are personally relevant.

Marlatt and Gordon (1985) asserted that abstinence from an addictive behaviour is necessary for craving to occur, but empirical evidence from cue reactivity research suggests otherwise (Carter & Tiffany, 1999). The present study was designed to identify the triggers for DSH in both individuals currently engaging in DSH and those abstaining from DSH.

Bryant (2005) identified that the experience of DSH changed over time, so the current research was designed to assess triggers reported for both early and recent episodes.

### *4.1.4 Hypotheses*

1) Individuals will report addictive type qualities to their DSH. They will endorse the DSM-IV criteria for addiction, to describe their DSH.
2) Individuals will report addictive type triggers for DSH. The reported triggers for DSH will be similar to the triggers for addictive behaviours identified by Marlatt and Gordon (1985). Intrapersonal/environmental and interpersonal triggers for DSH will be endorsed.

3) Individuals will report addictive-type changes in DSH over time. There will be more interpersonal triggers than environmental triggers reported for early episodes, but this will be reversed in recent episodes.

4) Individuals will report addictive-type changes in affect following an episode of DSH. Reported negative affect will decline after an episode of DSH, but positive affect will be unchanged.

## 4.2 Method

### *4.2.1 Design*

This study used a single sample design, with within-participant comparisons to explore the experience of DSH over time. For the second hypothesis the within groups factor was Episode (Early v Recent). For hypotheses three and four the within subjects factor was Time (Pre DSH (time 1) v Post DSH (time 2)).

The present study used an Internet hosted questionnaire to examine the triggers associated with DSH in individuals with a history of DSH.

### *4.2.2 Participants.*

*Ethics.* Ethics approval was obtained from the University of Southampton, School of Psychology Ethics Committee. Participants were 187 individuals over the age of 18 who were currently engaging in DSH or who had engaged in DSH in the past [2]. Participants were recruited through DSH related Internet sites, national self-help groups and information services, newspaper and radio advertisements

[2] Participant information presented in this section, includes only data where information was disclosed.

and posters at the University[3]. Participants were requested to contact the researcher via e-mail to request access to a password protected website hosted on the University of Southampton Server. 116 respondents reported their age. This ranged from 18-53 years (*M*=24). 112 respondents reported their gender, there were 103 females (92%), and nine males (8%). 130 participants recorded the age at which they first self-harmed. This ranged from seven to 41 years (*M*=15). Duration of DSH ranged from 'less than 1 year' to 36 years (*M*=10).The highest proportion of respondents engaged in DSH '1-3 times a month' (25.2%) and 11.5% of the sample engaged in DSH 'more than once a day' (see Table 3). See tables 4-7 for further demographic information. The most common tool used to self-harm was a razor (see table 8). Previous attempts to abstain from DSH had been made by 92.1% of the sample (see table 9).

Table 3. *Frequency of DSH.*

| Frequency of DSH (n=131) | N | Valid% |
|---|---|---|
| 1-3 times per month | 33 | 25.2 |
| 1-3 times per week | 20 | 15.3 |
| 2-5 times per year | 18 | 13.7 |
| Less than once a year | 15 | 11.5 |
| more than once per day | 15 | 11.5 |
| 6-11 times per year | 14 | 10.7 |
| 4-6 times per week | 14 | 10.7 |
| Once a year | 2 | 1.5 |
| Total disclosed | 131 | 100 |

[3] These included amongst others: SIARI, Bodily Harm, Saints FM, Hampshire Echo, and Southampton Voluntary Services.

Table 4. *Employment status.*

| Employment status (n=115) | N | Valid % |
|---|---|---|
| Student | 66 | 57.4 |
| Employed full-time | 27 | 23.5 |
| Employed part-time | 7 | 6.1 |
| Long-term sick | 7 | 6.1 |
| Self-employed | 2 | 1.7 |
| House-person | 2 | 1.7 |
| Other | 2 | 1.7 |
| Unemployed | 1 | 0.9 |
| Short-term sick | 1 | 0.9 |
| Total | 115 | 100.0 |

Table 5. *Marital status.*

| Marital status (n=116) | N | Valid % |
|---|---|---|
| Single | 66 | 56.9 |
| Stable relationship (living apart) | 19 | 16.4 |
| Co-habiting | 13 | 11.2 |
| Married | 10 | 8.6 |
| Divorced | 5 | 4.3 |
| Other | 2 | 1.7 |
| Total | 116 | 100.0 |

Table 6. *Education.*

| Education (n=116) | N | Valid % |
|---|---|---|
| A-level | 45 | 38.8 |
| Graduate | 29 | 25.0 |
| Post-graduate | 27 | 23.3 |
| Other | 9 | 7.8 |
| GCSE | 5 | 4.3 |
| Pre-GCSE | 1 | 0.9 |
| Total | 116 | 100.0 |

Table 7. *Housing.*

| Housing (n=116) | N | Valid % |
|---|---|---|
| Shared accommodation | 45 | 38.8 |
| With partner | 24 | 20.7 |
| Parent (s)/relative(s) | 23 | 19.8 |
| Live alone | 18 | 15.5 |
| Other | 3 | 2.6 |
| Sheltered | 2 | 1.7 |
| Temporary accommodation | 1 | 0.9 |
| Total | 116 | 100.0 |

Table 8. *Tools used to self-harm (via cutting).*

| Implement | N | Valid % |
|---|---|---|
| Razor | 82 | 64.1 |
| Scissors | 15 | 11.7 |
| Kitchen Knife | 11 | 8.6 |
| Penknife | 6 | 4.7 |
| Stanley knife | 5 | 3.9 |
| Broken glass | 3 | 2.3 |
| Nail scissors | 2 | 1.6 |
| Tweezers | 1 | 0.8 |

Table 9. *Percentage of total respondents who had received previous treatment.*

| Problem | Psychotherapy | Counselling | Pharmacological treatment |
|---|---|---|---|
| Self-harm | 0.8 | 2.5 | 32.3 |
| Eating disorders | 4.4 | 32.3 | 25.8 |
| Alcohol dependence | 52.3 | 26.6 | 8.4 |
| Drug dependence | 9.7 | 1.9 | 5.9 |
| Other mental health concern | 18.4 | 6.0 | 3.5 |

*4.2.3 Materials.*

The Internet hosted questionnaire was a purpose designed questionnaire consisting of a series of Likert scale, forced choice and open ended response options. This contained a range of questions requesting demographic information, enquiring about the role of specific triggers for both early and recent episodes of DSH, the role of affect in early and recent episodes of DSH, and questions pertaining to its addictive nature (See Appendix B). The questionnaire was designed with sensitivity to enable the respondent to selectively answer questions so that responses to incomplete questionnaires could be submitted. The questionnaire included a consent form, and electronic submission was explicitly regarded as written consent. The questionnaire also contained a debriefing statement and contact information in case further information was requested. Participant contact details could also be left so that participants could be contacted for participation in future studies.

*Addiction criteria.* Respondents were asked to respond with a forced choice 'yes' or 'no' response to a series of nine questions relating the criteria for substance dependency (DSM-IV, APA, 2000) to DSH (see Table 10). The criteria for substance dependence can be found in Chapter III.

Table 10. *Questions relating to DSH dependence.*

| Please answer these questions about what has happened since you started to self-harm. Either describe your current experiences, or your experiences in the past. |
|---|
| 1. Despite my attempts to control it, the frequency or severity of my self-harm has increased over time. |
| 2. Despite recognising that there are negative consequences, I continue to self-harm. |
| 3. If I stop self-harming I feel tense. |
| 4. I have tried to stop myself from self-harming in the past. |
| 5. I have neglected social activities because of self-harming. |
| 6. In order to achieve the same effect as I used to, I have increased the frequency I self-harm. |
| 7. In order to achieve the same effect as I used to, I have increased how severely I self-harm. |
| 8. Self-harm takes up a lot of my time. |

*The role of triggers.* Respondents were asked to identify typical triggers for DSH from a list of triggers for substance abuse compiled by Marlatt and Gordon (1985). Respondents marked positively if these were triggers for their DSH[4]. They could endorse as many triggers as were personally applicable. The full list of items appears in Appendix A.

One sample item relating to interpersonal/environmental triggers is:

"Please think back to when you first started to self-harm. Some people find that it is difficult to resist the urge to self-harm in situations that involve close relationships, or when thinking about close relationships. Which of the following

[4] The words 'substance abuse cues' were replaced with 'self-harm cues'.

situations describe your early experience of self-harm? You may mark as many situations as are applicable:

1) Experiencing frustration or anger associated with others e.g., hostility, aggression. Please give an example.
2) Experiencing other conflict associated with others e.g., anxiety, fear. Please give an example.
3) Direct social pressure e.g., being urged to self-harm by others. Please give an example.
4) Indirect social pressure e.g., observing others engaging in self-harm. Please give an example.
5) Enhancement of positive motivational states e.g., pleasure, celebration. Please give an example."

*Affect.* Respondents rated their affect using the items from the Positive and Negative Affect Schedule (PANAS, Watson & Tellegen, 1989). They were asked whether they experienced any of a list of twenty emotions before or after an episode of self-harm using a five point Likert scale with responses ranging from 'very slightly or not at all' to 'extremely'. They were asked about affect during both early and recent episodes of DSH.

Information about the rate and frequency of DSH, length of time since last episode and modes of DSH was requested, in addition to demographic variables. The questionnaire was written using html. The data were processed using a Perl script and posted on the School of Psychology secure web-server accessed by password. The questionnaire took approximately one hour to complete.

*4.2.4 Procedure*

This study was granted ethical approval by the School of Psychology, University of Southampton Ethics Committee. Potential respondents were invited to contact the researcher for information and a password. They then accessed the website in their own time. Responses were submitted via the secure Internet server and remained confidential. The data were stored in Excel files before being transferred to SPSS v 15.0 for analysis. Respondents could also choose to retain their anonymity or to leave contact details to obtain further information about the results of the study, and future research participation. Eighty-nine participants chose to leave this information.

## 4.3 Results

*Hypothesis 1: Addiction criteria.* Data for 144 respondents were available. However, one participant failed to respond to the item referring to, 'neglect of social activities' and the data for two participants are missing from item concerning 'other withdrawal attempts' (percentage values presented in Table 7 below are out of the available sample, not the total sample). One hundred and thirty-two (93.6% out of an available sample of 141 participants) individuals met criteria for an addictive behaviour (that is, they endorsed 3 or more of the criteria for substance dependence), see table 11.

Table 11. *Frequency of endorsement of criteria for substance dependence.*

| Addiction criteria | Endorsed | |
|---|---|---|
| | N | % |
| Use despite negative consequences (n=144) | 117 | 81.3 |
| Control (n=144) | 84 | 57.9 |
| Unsuccessful quit attempts (n=144) | 124 | 54.1 |
| Withdrawal- tension (n=144) | 104 | 39.1 |
| Neglect of social activities (n=143) | 94 | 35.3 |
| Tolerance (n=144) | 85 | 32.0 |
| Other withdrawal symptoms (n=142) | 74 | 27.8 |
| Increased frequency (n=144) | 63 | 23.7 |
| Time spent procuring (n=144) | 40 | 15 |

*Hypothesis 2: Triggers for DSH.* This study was designed as a pilot study to consider whether the triggers that have been reported for addictive behaviours also characterize the experiences of those who self-harm, and to examine whether individuals retrospectively self-report that the type of triggers that increase their urges to self-harm, change over time.

*Interpersonal and Intrapersonal triggers for DSH.* Not all items were completed by all respondents. One hundred and sixty-six participants provided information regarding triggers for early episodes and 149 provided information regarding recent episodes of self-harm. Two participants failed to record a response for the item referring to ‘recent frustration or anger associated with others’ and ‘recent conflict associated with others’. Table 12 shows the number of participants and percentage (out of the available sample) who endorsed each criteria for early and recent episodes of DSH. The most frequently endorsed items in early episodes were ‘coping with other negative emotional states [not frustration or anger]’ and ‘coping with frustration or anger [not associated with others]’– intrapersonal triggers, and ‘coping with other interpersonal conflict [not frustration or anger]’ and ‘coping with frustration or anger associated with others’-interpersonal triggers.

Table 12. *Percentage of respondents who endorsed Marlatt and Gordon (1985) triggers for addictive behaviours, for early and recent episodes of DSH.*

| | Early episodes | | Recent episodes | |
|---|---|---|---|---|
| Intrapersonal-Environmental | N | % | N | % |
| A Coping with negative emotional states not associated with others: | | | | |
| 1) Coping with frustration and/or anger | 73 | 44.0 | 73 | 49.0 |
| 2) Coping with other negative emotional states | 111 | 66.9 | 94 | 63.1 |
| B Coping with negative physical-physiological states: | | | | |
| 1) Coping with physical states associated with prior substance abuse | 12 | 7.2 | 13 | 8.7 |

| | | | | |
|---|---|---|---|---|
| 2) Coping with other negative physical states | 37 | 22.3 | 26 | 17.4 |
| C Enhancement of positive emotional states | 19 | 11.4 | 15 | 10.1 |
| D Testing personal control | 41 | 24.7 | 26 | 17.4 |
| E Giving in to temptations or urges | | | | |
| 1) In the presence of cues | 67 | 40.4 | 54 | 36.2 |
| 2) In the absence of cues | 55 | 33.1 | 50 | 33.6 |
| Interpersonal | | | | |
| A Coping with interpersonal conflict | | | | |
| 1) Coping with frustration and/or anger | 93 | 56 | 80 | 54.1 |
| 2) Coping with other interpersonal conflict | 111 | 66.9 | 91 | 61.1 |
| B Social pressure | | | | |
| 1) Direct | 7 | 4.2 | 10 | 6.7 |
| 2) Indirect | 23 | 13.9 | 16 | 10.7 |
| C Enhancement of positive emotional states | 24 | 14.5 | 17 | 11.4 |

Exploratory analyses using examination of histograms, Kolmogorov-Smirnov tests, examination of outliers, and consideration of the skewness and kurtosis of the data revealed that these data were not normally distributed, and the sample size was small. Therefore, non-parametric analyses were selected. Participants were excluded pair-wise such that only those who completed information regarding all triggers for both early and recent episodes were included.

Wilcoxon's Rank Test was used to examine any differences in the number of early interpersonal and environmental triggers reported for early episodes. This was repeated for recent episodes. There was a significantly greater number of environmental than interpersonal triggers reported for early episodes ($Z = -4.63$, $p = .000$), however, for recent episodes, this difference was not significant ($Z = -1.25$, $p > .05$).

One hundred and forty participants were included in the analysis. Friedman's rank test was employed to consider any differences in the number of interpersonal triggers reported between early and recent episodes and this was repeated to consider environmental triggers. There was no significant difference in the rank number of interpersonal triggers between early and recent episodes ($\chi^2(1) = 1.52$, $p = .218$. The rank test also revealed no significant difference in the number of environmental triggers reported between early and recent episodes ($\chi^2(1) = 2.58$, $p = .108$.

*Hypothesis 3: Emotion regulation.* One hundred and twenty-two participants completed information regarding both their positive and negative affect before and after an episode of DSH. A total positive affect score was generated by summing the 7 point ratings for each item on the PANAS related to positive affect, and a total negative affect score was generated by summing those relating to negative affect. Exploratory analyses revealed that the data were normally distributed and skewness and kurtosis for each item and totals generated were at acceptable levels.

A paired t-test revealed no significant difference in total positive affect between before and after an act of self-harm ( ($t$)=-6.03, df 121, p=.548). A paired t-test revealed that total negative affect was significantly greater before (25.55) than after (21.93) an act of DSH (($t$)=6.76, df=121, p=.000).

## 4.4 Discussion

### *4.4.1 Purpose of the study*

The purpose of the present study was to identify whether: a) those who engage in DSH describe it as addictive, b) whether the kind of events that act as triggers for addictive behaviour (Marlatt & Gordon, 1985) also function as triggers for DSH and c) whether individuals described addictive-like affective changes following an episode of DSH.

### 4.4.2 *Who engages in self-harm?*

In this sample, respondents were primarily female, students and had a mean age of 24 years. This fits with the current clinical picture. In this sample, respondents ranged in age from 18 to 53 years old and individuals reported a duration of DSH that ranged from under 1 year to 36 years, with a mean of 10 years. It is pertinent that 92.1% of individuals in this sample that had previously tried to stop engaging in DSH.

Respondents presented with a range of co-morbid mental health concerns including: substance dependence, alcohol dependence, eating disorders and other non specified mental health concerns. This is similar to the presentation often described by clinicians. Fifty-two point three percent of respondents had previously received psychotherapeutic support for alcohol dependence, 18.4% for other mental health concerns, yet only 0.8% had received psychotherapeutic support for DSH. Pharmacological treatment for DSH had been received by 32.3% of respondents, yet as explained in Chapter I, there is limited support for the effectiveness of pharmacological intervention.

### *4.4.3 The role of triggers in self-harm*

As hypothesized, respondents reported both intrapersonal/environmental and interpersonal triggers for DSH. The former category included: giving into temptations, or urges in the presence of cues associated with the behaviour e.g., razor blades or coping with negative emotional states. The latter category included for example coping with frustration or anger associated with others.

All the triggers for addictive behaviour were endorsed to some extent by respondents. The most frequently endorsed triggers, however, appeared to be those reflecting negative internal states (either frustration or anger), or other negative states such as shame, guilt, sadness, whether this was in response to others or another situation in the environment. Whilst it is clear therefore that physical triggers in the environment may increase urges to self-harm, it might be hypothesised that there may be an interaction between these negative internal states that increase vulnerability, and triggers in the environment that result in the immediate act.

Although there appeared to be a greater number of environmental/ intrapersonal triggers reported for early episodes, the difference in the reported number of environmental and interpersonal triggers had disappeared by recent episodes. Future research might consider investigating the difference in reactivity to these triggers experimentally. Were a large enough sample of participants across the developmental course of DSH to be available, it would be interesting to consider whether in the early stages of DSH, those with greater reactivity to environmental triggers are more likely to use DSH to manage these feelings of intrapersonal personal distress. The self-reported reduction in the frequency of these triggers may reflect a tendency for these cues to become less important once DSH is established, or it may reflect the notion that individuals become less aware of these cues over time, and it is the intrapersonal or interpersonal conflict that becomes most salient to them. This possibility is supported by qualitative evidence reported by Bryant et al., (2007), which suggested that individuals reported a range of social and emotional factors as triggers for early episodes, but these are overshadowed by intrapersonal affective states for more recent episodes.

It might be hypothesized that interpersonally stressful situations increase an individual's urges, without conscious awareness, priming an individual's vulnerability to act on those urges when in the presence of environmental cues (e.g. a razor blade) or intrapersonal cues (the increased state of aversive tension).

Cooney et al., (1983) highlighted that the environmental cue (e.g. the razor blade that is used to cut) is *always* by definition the final common pathway to relapse. However, in this study only 36.2% of individuals reported that they gave into urges in the presence of cues for DSH in recent episodes. There are clearly a range of events that are important when identifying what triggers a specific episode of DSH. The most infrequently endorsed events were ‘direct social pressure’ and ‘indirect social pressure’. Contrary to media opinion and reports of contagion cutting, it appears that social pressure is a markedly less salient trigger for DSH than other distressing interpersonal events.

This pilot study appears to indicate that the cue categories identified by Marlatt may be useful in understanding potential triggers for DSH, but, the categorical distinction between environmental/intrapersonal and interpersonal triggers may be less useful. It is clear that environmental and intrapersonal triggers may be very different, environmental cues in self-harm may include both physical objects (implements used to self-harm), and contexts (both location and situational determinants), and intrapersonal triggers may be independent of these triggers. Further research that looks specifically at reactivity to these cues in more detail is required. A clearer understanding of the specific intrapersonal factors that enhance vulnerability to engage in DSH may also have clinical utility. The assessment of reactivity to the identified cues may be a way of identifying those individuals at the greatest risk for DSH.

### *4.4.4 Affect*

The PANAS data indicate that acts of DSH do not impact on individuals’ reported positive affect, (e.g. feeling interested, excited, attentive) but they do serve to reduce feelings of negative affect (which include feeling distressed, afraid, hostile etc). In addition, levels of negative affect were higher than levels on positive affect both before and after DSH. These results provide some level of support for a tension reduction model of DSH. Individuals not only report that negative intrapersonal states trigger DSH, but also that DSH effectively appears to regulate that negative affect. Such tension reduction has been assessed using psychophysiological approaches (Haines, 1995). However, the limitations of the PANAS findings described n this study will be discussed below.

### *4.4.5 Addictive nature of self-harm*

Most importantly, 132 participants (93.6%) of the available sample (141 participants had no missing data for this item) reported that their engagement in DSH met the criteria for an addictive behaviour by endorsing three or more items. Significantly, in this sample, the majority of participants described their self-harm as addictive. This might be important to consider when tailoring treatment interventions to help individuals to manage their urges to self-harm. All the criteria for substance dependency were endorsed by some respondents as relevant to describe their experience of DSH. Items that were less frequently endorsed were those referring to neglect of social activities', 'time spent procuring', 'an increase in frequency of DSH' and 'other attempts at withdrawal'. Significantly the most heavily endorsed criteria was 'use despite negative consequences', an item endorsed by 81.3% of available participants. Respondents also reported a range of implements that they used to self-harm, the most common being razor blades.

### *4.4.6 Limitations*

*Methodology.* The study was designed to balance empirical rigour against ethical considerations with a sensitive sample. Thus, there were limitations that may not occur in research with healthy human participants. Because it was necessary to design a questionnaire that enabled individuals to complete only those questions that they felt comfortable with, the number of participants who responded to each question shows some variability. This adds a question of selection bias to the research because individuals may have chosen to respond to specific questions for particular reasons. An alternative would have been to include only the data from those participants who completed the entire questionnaire in analyses, but this would have biased the participant sample.

Individuals may have difficulties retrospectively recalling their first experience of DSH because it may be impacted by more recent experiences. Memory distortions may be subject to inter-individual differences including memory ability, current experiences of DSH and also that some individual's first experience of DSH may have been five years before, whilst others may have started engaging in self-harm only a few months prior to the study. The data may also be subject to social desirability biases. A more rigorous way of assessing emotions and triggers relating to experiences of self-harm would be the use of ecological momentary assessment using ambulatory monitoring systems. In these procedures, individuals carry a palmtop computer and are prompted by an emitted signal to respond to a range of questions. However, cost limitations precluded the use of this type of technology for the current research. There are also several ethical considerations, due to the invasive nature of carrying out such a procedure, and these need to be balanced with the research benefits. Prior to conducting such a study, it would be important to collect self-report pilot data in order to identify whether the approach can be justified, and to develop preliminary hypotheses. Since the present research was conducted, Ebner-Primer et al. (2008) have successfully used this methodology to investigate the relationship between psychophysiological arousal and emotional distress in those with BPD and Controls.

*Questionnaire.* There were some ambiguities with the wording of the questionnaire. For example, participants were required to report how they felt ‘before’ and ‘after’ an episode of DSH. The presentation of the questionnaire might have been improved in order to highlight these important words were not overlooked by participants. Future research should include a specific operational definition of these terms and refer to a specific time-point, for example ‘the moment before you first felt an urge to cut’, or ‘a minute after engaging in the specific act of self-harm; the cut. This timeframe does not include that spent on any after care.’ Participants were also requested to respond to the question ‘what kind of situations were **stronger** triggers for DSH; situations that involve close relationships or situations that do not involve close relationships?’ As the question specifically asks which are situations are **stronger** triggers, participants should only have responded ‘yes’ to one option, however they may have overlooked the word **stronger.**

The provision of a definition for some of the items might have clarified the intention of the researcher. For example, ‘Testing personal control’ – this is taken directly from the cues to addictive behaviour identified by Marlatt and Gordon (1985), and reflects the notion that individuals may engage in an addictive behaviour, such as consuming one drink, or order to test out their capacity to stop themselves continuing (taking a second drink). In terms of DSH, this would mean, for example, making one small cut and then stopping, to prove to oneself that one was able to stop. A second example where clarity could have been provided is ‘Enhancement of positive motivational states’, where the interpersonal nature of the item should have been emphasized, perhaps through offering an example of a time when a motivational state might be likely to enhanced by the presence of others , such as when celebrating at a party.

The PANAS was used because it is a reliable and valid tool that has been used to assess a generic set of primary emotions. The purpose of using this assessment tool was to record affect related to addictive behaviour to establish whether engaging in DSH has a similar affective regulatory function as other addictive behaviours, such as smoking and drinking (e.g., Brandon, Wetter & Baker, 1996), as reported in hospitalized adolescents by Nixon, Cloutier and Aggarwal (2002). It was hypothesised that negative affect would reduce following an episode of DSH, in a similar way to that reported by those who engage identified in other addictive behaviours such as smoking (e.g., Brandon, 1994). Piloting would have been a useful way of identifying the psychometric properties of the measure prior to embarking on the research.

*Demand characteristics.* Demand characteristics or a social desirability bias might have affected responses to some of the items, for example; 'Some people find it hard to weigh up the pros and cons of self-harming when experiencing these negative emotions. I find it difficult to weigh up the pros and cons of self-harming when experiencing levels of emotions that are low, moderate or high'. The use of Beta testing, prior to embarking on future research may help the researcher to identify the most appropriate wording. In this example, a better way of asking this question would be to ask participants to rate the strength of their emotion at the last time that they engaged in DSH (ecological momentary assessment would be the most useful methodology to use here).

4.4.7 *Future Directions.*

Future research might focus on developing alternative ways of assessing reactivity to triggers from those abstaining from DSH. Empirical evidence from the addiction field suggests that psychophysiological reactivity to triggers might be a way of assessing this responsivity, that may occur beyond conscious awareness, or when social desirability bias may inhibit response.

Future research might include a specific group analyses, considering differences in both triggers and emotion regulation between those who are currently engaging in DSH and those who are now abstaining. For this to occur, a specific operational definition of abstinence would be required and it is suggested that because individuals' own definitions of abstinence and relapse may vary, group allocation might take place post-hoc, based on data collected regarding frequency and duration of DSH. DSH is a heterogeneous behaviour. Clinically it is observed that individuals may abstain from DSH for some time, and then 'relapse' or may consider themselves to be abstaining from DSH when they cut only occasionally. Others may identify themselves as a 'cutter', even though they self-harm less frequently or severely that they have at other points in their life. Qualitative research might be used to further examine the importance of identity on the types of triggers, experiences and emotions that are important.

There are several emotions that are known to relate to DSH such as shame and guilt, as discussed in Chapter II. Further research might also include measures of DSH that have been previously validated, such as the Deliberate Self Harm Interview (Gratz & Roemer, 2004) or the Parasuicidal History Inventory (Linehan, Wagner & Cox, 1983) to identify whether these triggers map on to emotions identified to play a role in DSH. Moreover, in the current study, individuals did not report a change in positive affect after an act of DSH. It may be that whilst the PANAS items relating to positive affect describe an addictive-like response, they are not those that are most relevant to the experiences of those who self-harm. Future research might consider some of the alternative positive affective states that might be relevant to the experience of DSH (e.g., content, happy, relieved, calm, relaxed).

#### *4.4.8 The role of triggers in self-harm.*

This study was developed to identify whether individuals reported similar triggers for DSH and addictive behaviours. Some individuals who engage in DSH report that they find it addictive, and DSH appears to be under the control of similar reinforcement contingencies to other addictive behaviours. Thus the purpose of this thesis was to identify whether DSH is triggered by similar cues to addictive behaviours and thus whether similar treatment interventions might have clinical utility. Because of this focus, the current study was designed as a pilot to see if triggers from addictive behaviours could be directly translated to DSH.

The study identified that individuals reported that both interpersonal and intrapersonal/environmental events trigger episodes of DSH. The cues that Marlatt identified to be important triggers for addictive behaviour may have some utility in identifying triggers for DSH, however further work is required. Specifically it may be important to understand intrapersonal triggers in more detail, to look at the interaction between intrapersonal, interpersonal and environmental triggers and to use experimental methodologies to consider reactivity to triggers. The addiction literature provides a wealth of information about the way that triggers might be assessed and managed. Interventions that focus on aiding the individual in managing the urges associated with cues for DSH might have great potential in reducing the risk associated with such triggers. This thesis considers such an approach.

Respondents endorsed the diagnostic criteria for substance dependency to describe describing their DSH. Research into the addictive nature of DSH including impulsivity, relapse and craving might have important implications for the understanding and treatment of individuals who engage in DSH.

### 4.5 Summary

In this study, 92.1% of respondents reported that they had previously tried to quit DSH yet 0.8% had received psychotherapeutic support to do so. There is a need for the development of treatment interventions specifically for DSH. This study identified first, that respondents reported that interpersonal and environmental /intrapersonal events similar to those that trigger addictive behavior, act as triggers for DSH. Second, respondents endorsed the diagnostic criteria for substance dependency to describe their experience of DSH. Finally, the study reported that those who engage in DSH report that it serves an emotion regulatory function. The present study identifies that empirical investigation of responsivity to triggers is warranted.

## Chapter V, Study II A pilot study of Cue reactivity in DSH

### 5.1 Introduction

*5.1.1 Chapter overview*

Functional models have considered how DSH might be maintained by positive and/or negative reinforcement (see Chapter II). Recent anecdotal, behavioural and psychophysiological evidence supports a learning model for the maintenance of DSH (Bryant, 2005; Faye, 1995; Nock & Prinstein, 2004, 2005). Despite the development of theoretical accounts, little is known about how a specific episode of DSH is triggered. Clinical reports have highlighted that before engaging in DSH individuals describe 'irresistible urges' to act on these 'intense cravings', when in the presence of triggers (or cues) previously associated with DSH. Study I explored the kinds of events that are commonly reported to trigger DSH. These were identified to include: interpersonal triggers (e.g., an argument with a friend) intrapersonal triggers (e.g., feelings of guilt or shame) or environmental/intrapersonal triggers (e.g., seeing a razor in the bathroom, negative affective states).

However, as explained in Chapter III, assessment via self-report may lack sensitivity to processes operating at the preconscious level. Young, Klosko and Weishaar (1992) proposed that abandonment related information that is presented at the preconscious level (for example, the presentation of an affective prime) activates abandonment schemas (dysfunctional belief systems) resulting in the implementation of escape/avoidance behaviours. Consistent with this theory, Schmahl et al., (2004) reported that individuals with BPD showed a trend toward a greater GSR to personalized imagery scripts related to abandonment when compared to neutral scripts and in comparison to individuals with a diagnosis of PTSD. Gunderson and Hoffman (2005) suggested that DSH is almost always triggered by a real or perceived loss through separation or abandonment.

The current study was designed to pilot the utility of applying the psychophysiological measures that are commonly used to assess reactivity to triggers for addictive behaviours (Carter & Tiffany, 1999; Drummond et al., 1995) to assess reactivity to DSH cues.

*5.1.2 Cue reactivity in clinical research*

Cue reactivity is evident across a range of clinical populations, such as those with Binge Eating Disorder (Jansen, 1998) and Post-Traumatic-Stress Disorder (PTSD; Foa & Kozak, 1986). Cue reactivity provides a valuable index of classically conditioned emotional responses, enabling the identification the specific triggers relevant to a response. Cohen et al., (1998) and Pitman, Orr, Forgue, De Jong, & Claiborn, (1987) identified that survivors of sexual abuse and war veterans displayed heightened emotional responses and physiological reactivity to specific trauma related cues that  typically trigger action urges such as avoidance or escape behaviour. Thayer, Friedman, Borkovec, Johnson and Molina (2000) suggested that psychophysiological indices may also enable the identification of specific patterns of response, such as habituation to cues and anticipatory anxiety that cannot be accessed by self-report.

Foa and Kozak (1986) proposed that the identification of physiological and self-reported reactivity to specific cues associated with the particular problem behaviour of interest is a useful indicator of the potential efficacy of treatment interventions based on cue exposure with response prevention. Drummond (2000) argued that cue reactivity is a reliable index of addictive behaviour, can offer a means of predicting relapse and may have validity in determining the clinical effectiveness of therapeutic intervention (e.g., Modesto-Lowe &  Kranzler, 1999). Cacioppo, Bertson and Andersen (1991) suggested that cue reactivity might have specific utility when evaluating the effectiveness of a cue exposure treatment intervention.

*5.1.3 Cue reactivity in self-harm*

To date, the application of psychophysiological measures to understand DSH is scarce. Haines, Williams, Brain and Wilson (1995) reported psychophysiological evidence for tension relief in the presence of an auditory presented imagery script describing an act of DSH, in incarcerated males with a history of DSH. This study, and a follow-up study using similar methods (Brain, Haines &Williams, 1998) reported both, a time lag between the onset of physiological arousal (GSR and HR), and self-reported distress associated with the imagery, with negative feelings persisting despite a decrease in physiological arousal. This research suggested that reactivity to DSH cues may be marked by psychophysiological changes. This warrants further investigation. If reactivity to DSH cues is typically observed, then interventions that are designed to reduce the arousal experienced in the presence of these specific cues may help to reduce urges to engage in DSH. Cue exposure with response prevention is designed to reduce arousal experienced in the presence of these cues in the expectation that such habituation will decrease the associated action urges (Foa & Kozak, 1986).

*5.1.4 Methodological issues in cue reactivity*

In their review of the application of cue reactivity methods in the addiction field, Drummond, Glautier and Remington (1995) indicated that results are equivocal and that methodological parity across studies is required. The physiological indices that are most commonly to index cue reactivity are Galvanic Skin Response (GSR) and Heart Rate (HR) (Carter & Tiffany, 1999). Killeen and Brady (2000) reported that in addicted individuals, GSR is highly sensitive to the presentation of stimuli associated with the addictive behaviour, and correlates well with other physiological and subjective measures of arousal and urge.

A variety of cue modalities have been employed in the study of reactivity to cues related to addiction. These include; in vivo exposure to stimuli, for example preferred alcoholic drink (Cooney, Litt, Morse, Bauer & Gaupp, 1997) or a cigarette (Drobes & Tiffany, 1997); slides of generic or personalized pictorial addiction related stimuli (Stritzle, Breiner, Curtin & Lang (2004); and audiotapes describing situations that present a high risk for relapse (Niaura et al., 1998). Other researchers have used a combination of these to assess the impact of modality on reactivity (Johnson, Chen, Schmitz, Bordnick & Shafer, 1998; Shadel, Niaura & Abrams, 2001). Imaginal exposure via guided imagery (Taylor, Harris, Singleton, Moolchan & Heishman, 2000), and, most recently, virtual reality have also been employed (Bordnick et al., 2004).

A meta-analytic review of cue reactivity in the addiction field (Carter & Tiffany, 2000) identified that only 10-16% of studies employed pictoral stimuli. Stritzke et al., (2004) however, argued that this modality most closely reflects the real-life experience of exposure, without the ‘overwhelming salience or intensity of in vivo exposure’. A range of different cues are typically used. Stimulus exposure periods typically range from 500 ms (Herrmann, Weijers, Wiesbeck, Boning & Fallgatter, 2001) to 6 seconds (Stritzke et al., 2004) and Inter-stimulus intervals have ranged from approximately 2 seconds (Herrmann et al., 2001) to 45 seconds (Strizke et al., 2004).

*5.1.5 Methodological Issues in Cue Reactivity to DSH*

Study I revealed that interpersonal and intrapersonal cues can also act as triggers for DSH. In keeping with the biosocial theory of DSH (Linehan, 1993), and evidence pertaining to the role of interpersonal functioning and early adversity in DSH (Gratz, 2003), emotional dysregulation (or affective reactivity) would be expected to be greatest in the presence of arousal associated with negative interpersonal situations. The present study begins to address the question of whether reactivity to environmental DSH cues changes in the presence of additional cues for interpersonal distress.

The relationship between cues and action urges has been explored in the addiction literature. Stasiewicz et al., (1997) showed that negative affective cues increased urges to drink alcohol, enhanced attention to alcohol related stimuli and increased thoughts about drinking in a sample of alcohol dependent patients. Cooney, Litt, Morse, Bauer and Gaupp (2007) reported that a guided imagery procedure designed to induce negative mood, when combined with the presentation of alcohol (when compared with the presentation of a non-alcoholic beverage) led to a significant increase in the urge to drink alcohol in a sample of male inpatients with alcohol dependence. The presence of self-reported urges to drink, predicted the time taken to relapse post discharge.

IST (Berridge & Robinson, 1998) highlighted the distinction between *liking* and *wanting* in the maintenance of addictive behaviours. As explained in detail in Chapter III, cue-triggered wanting involves both neural sensitization of the mesolimbic dopamine system, and the presence of a reward cue (a conditioned stimulus). This *wanting* may occur beyond conscious awareness and may be activated by 'hot' affective processing (Winkielman & Berridge, 2003). Such 'hot' affective processing might include that associated with interpersonal distress.

In summary, research suggests that negative emotional states make it more difficult for individuals to divert their attention and disengage from triggers relating to their addictive substances. It might be hypothesised that a similar process would operate in DSH. To test this theory, the present study incorporated a subliminal priming procedure. The affective priming hypothesis (Zajonc, 1980) proposed that 'positive and negative affective reactions can be evoked with minimal stimulus input and virtually no cognitive processing'. Kunst-Wilson and Zajonc (1980) reported that mere exposure to a positive affective prime induced affective preferences for novel neutral stimuli (Chinese ideographs). Importantly, this affective manipulation is only evident during subliminal (extremely brief) exposure durations, because minimal cognitive participation ensures that affective reactions are displaced and diffused onto unrelated stimuli (Murphy & Zajonc, 1993).

Empirical evidence suggests that interpersonal affective priming is at its most effective when accessed at a preconscious level (Mikulincer, Hirschberger, Nachmias & Gillath, 2001). Gerard, Kupper and Nguyen (1993) and Patton (1992) reported that the subliminal presentation of abandonment cues increased levels of eating in both clinical and non-clinical populations. Such fears of abandonment are also associated with an increased propensity to engage in addictive behaviours. Waller and Barter (2005) noted that this finding is not replicated when participants are aware of the cue that is presented. Jansma, Breteler, Schippers, de Jong, and Van der Staak (2000) and Robbins, Ehrman, Childress, Cornish, and O'Brien (2000) utilised supraliminal mood induction procedures and reported no effect of negative mood on cue reactivity in alcohol dependent inpatients and cocaine dependent patients respectively despite consistent self-report of the negative affect as a trigger for addictive behaviour. It might be hypothesised that in these studies individuals were able to employ cognitive coping mechanisms to counteract the effect of negative mood.

To summarise, the use of a subliminal priming procedure activates information processing, without eliciting conscious cognitive defence mechanisms such as dissociation and avoidance, or cognitive control mechanisms such as distraction which would be expected to detract from any arousal experienced.

Nunez and Vincente (2004) reported that 'consciousness of the CS-US contingency is not a necessary condition for acquiring a CR of the Autonomic Nervous System (ANS)' (see Chapter II for a definition). Ohman and Soares (1993) reported that a previously required conditioned response (GSR) could be elicited without conscious awareness of the participant by presenting visually masked fear-relevant stimuli. In this study the unconditioned stimulus was an electric shock. This suggested that it is not necessary for individuals to be consciously aware of the classically conditioned cue for a conditioned response to be elicited in addictive behaviours. Physiological reactivity to triggers can be elicited at a preconscious level. It is expected that physiological reactivity and action urges to engage in DSH in the presence of environmental cues could similarly be enhanced by affective information, without conscious awareness of the trigger.

*5.1.6 Aims*

The present study was designed as a pilot study to examine whether the psychophysiological measures used to assess reactivity to triggers for addictive behaviours can be applied to DSH. The study was designed to identify whether individuals with a history of DSH responded with differential physiological reactivity and urges to self-harm in the presence of neutral and DSH cues. The study also considered whether psychophysiological reactivity and self-reported urges to engage in DSH elicited by environmental cues (e.g. a razor blade) were enhanced when participants were pre-exposed to a negative interpersonal subliminal prime.

*5.1.7 Hypotheses*

1) Individuals with a history of DSH will respond with greater reactivity (defined as greater GSR amplitude, more responses to cues and increased HR) to DSH than neutral cues.
2) This reactivity will be enhanced in response to DSH cues that preceded by an interpersonally distressing prime.
3) Participants will report greater urges to engage in DSH in the presence of DSH, and subliminally primed DSH cues than neutral cues. There will be no significant difference between urges reported in the presence of DSH and primed DSH cues.

## 5.2 Method

### *5.2.1 Design*

Owing to the limited availability of DSH participants, the present study used a within-participants repeated measures design. Sample size was based on previous literature that explored psychophysiological responses (EEG) in a clinical population (Metzger, Orr, Lasko, McNally & Pitman, 1997), although this study utilised a mixed design. The independent variable was Cue Type (neutral, DSH, and DSH preceded by prime). The dependent variables were psychophysiological responses (GSR[1] and HR) and self-reported urges to engage in DSH.

### *5.2.2 Participants*

This study was granted ethical approval by the School of Psychology ethics committee, University of Southampton, Dorset NHS Healthcare Trust Local Research Ethics Committee (LREC), North and Mid Hants LREC and Hampshire Partnership Trust LREC. The participants were nine individuals with a history of DSH (one male and eight females). Age ranged from 21 to 57 years (*M*=28, *SD*=14.30). Duration of DSH ranged from 2 to 25 years (*M*= 7.43,

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[4] The GSR is a form of electro-dermal response (EDA) that indicates changes in the properties of the skin elicited by the interaction between the environment and the individual's psychological state. This conductance response is measured in microsiemens (ms), by passing an electric current through a pair of electrodes placed on the skin (Dawson, Schell & Filion, 1990). EDA reflects not only emotional state but also is an indicator of cognitive activity (Stern, Ray & Quigley, 2001). Phasic GSR is the skin response to a discrete environmental event, and may last 10-20 seconds before returning to baseline. A Phasic GSR begins within one to three seconds of stimulus onset, to be considered elicited by that stimulus (Dawson et al, 1990). Stern et al., (2001) reported that there can be challenges in the assessment of phasic activity, as the discrete response occurs against a background of tonic or 'baseline' activity.

*SD*=7.40). Frequency of DSH ranged from current abstinence (one participant) to more than once a day. Participants were recruited through Dorset NHS Healthcare Trust, Hampshire Partnership NHS Trust and recruitment advertisements at the University of Southampton and in the wider community. Participants were eligible for participation if they were over the age of 18 years. Exclusion criteria in the clinical sample included any expression of suicidal intent or a co-morbid diagnosis of psychosis or learning disability.

### *5.2.3 Apparatus*

Physiological recording apparatus included; A ML785 Powerlab/8SP with a ML 305 Pod Expander and GSR ML116 GSR Amp, a HR MP100 Pulse Transducer, and a ML309 Thermistor Pod attachments to measure Phasic GSR and HR. A Toshiba Satellite Pro 4600 laptop was used for stimulus presentation and a Highgrade Notino laptop (C2000) was used for data collection via acquisition software (Chart v5.2.1 for Windows, ADI Instruments, 2004). The study was conducted over two settings, the University of Southampton, School of Psychology and the Intensive Psychological Therapies Service Dorset. A laboratory with two adjacent rooms[2] connected via intercom and controlled for noise and electro-magnetic radiation was used. This contained blackout blinds to ensure that attention was focused to the laptop screen, armrests to contain arm movements and ensure participant comfort, and height adjusted seating and laptop screen (see Figure 2).

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[5] The experimental room used at Intensive Psychological Therapies Service was designed to be as close as possible to the set up at the University but the experiment took place in one room, rather than two adjacent rooms.

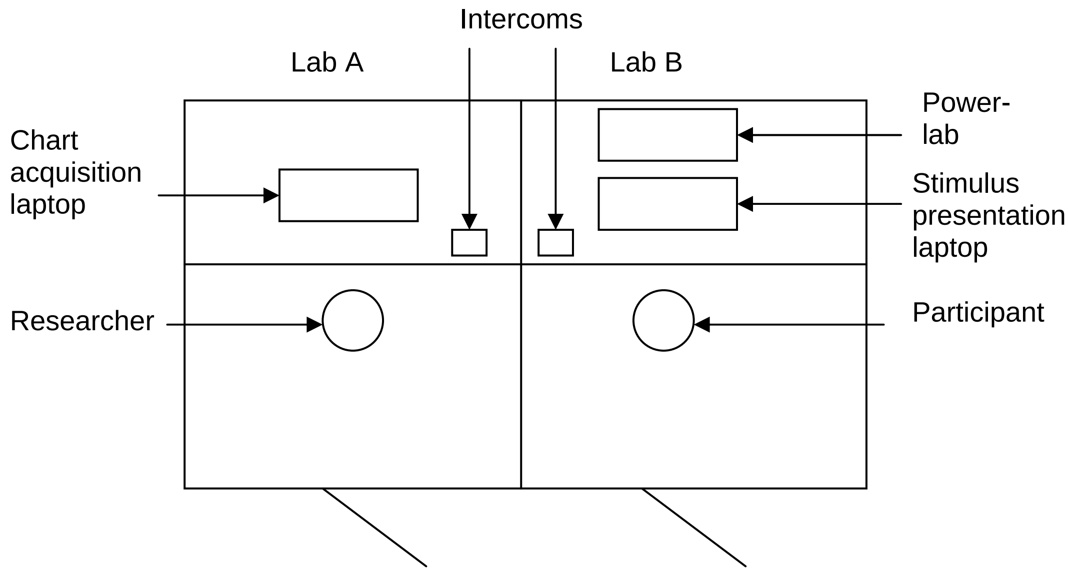


*Figure 2.*Topographical representation of laboratory environment at the University.

### 5.2.4 Materials

*Cues.* Experimental stimuli consisted of 30 (600x600pixel) colour photographs. These included were ten DSH-related implements (tools frequently used to self-harm, that were identified in Study I) shown paired with a neutral stimulus to create the same neutral context (e.g., a kitchen knife and chopping board, see Figure 3), 10 pairs of neutral stimuli that were contextually appropriate (i.e. would be observed together in the environment, e.g., a  cup and packet of biscuits, see Figure 4), and 10 of the same DSH cues that were preceded by the subliminally presented abandonment word ‘lonely’ (Waller & Barter, 2005) and a mask stimulus ‘xxxxxx’ (see Figure 5). The mask was incorporated to reduce visual afterimages. Stimulus duration was 10 seconds, and subliminal cues were presented for 1 ms (a shorter duration than the 4ms suggested by Waller & Barter, 2005).  The visual mask was presented for 50 ms. Stimuli were presented sequentially in the following order; ten neutral cues, ten DSH cues, then ten primed cues. Inter stimulus intervals (ISI) between the cues within each cue type (i.e., the first and second neutral cue) were pseudo-randomised to a duration of between 30 and 60 seconds, the inter-stimulus interval between trials (i.e. tenth neutral cue and first DSH cue) was 50 ms and the ISI between the mask and the primed DSH cue was 80 ms.

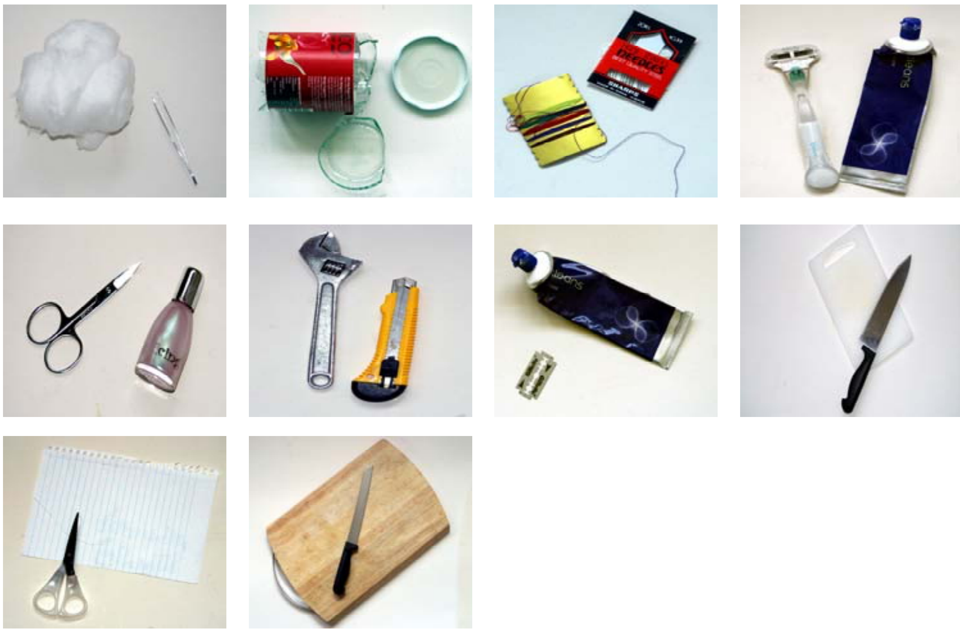

*Figure 3.* DSH stimuli.

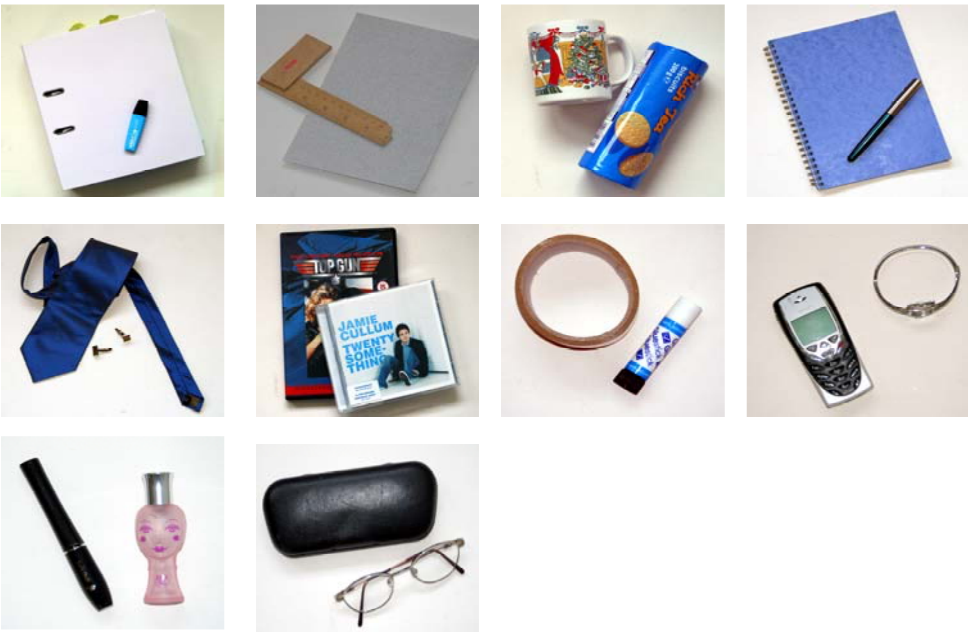


*Figure 4.* Neutral stimuli


*Figure 5.* Priming stimulus and mask.

*DSH Urge Questionnaire.* Participants in the DSH group were asked to report their urges to self-harm on a seven point Likert scale in response to each stimulus as it was presented (1=no urge, and 7=strongest urge imaginable).

*Self-harm implement rating form.* Participants in the DSH group were asked to identify which if any of the stimuli presented, were tools that they had previously used to self-harm. Participants were then asked to record which of these were the three implements that they used most frequently to self-harm.

*5.2.5 Procedure*

*Phase I: Establishing a baseline.* On attendance participants were invited to give written informed consent to participate in the study. Participants were seated in a comfortable chair, 50 cm from the stimulus presentation screen. Participants were asked to use an anti-bacterial wipe to clean their hands and then were instructed verbally and via instructions that appeared on the computer screen that they would shortly participate in a task where they would be shown a series of stimuli presented on the screen. They were requested to remain as still as possible during the study.

*Phase II: Measurement of phasic psychophysiological responses and self-reported urges.* Tonic baseline reactivity to a blank black screen was recorded for a 5 minute period. Phasic reactivity to a series of photographic stimuli presented on a laptop was assessed. Ten Neutral cues were presented, followed by ten DSH cues. The same ten DSH cues were then presented, preceded by a subliminally presented interpersonal prime (the word lonely) and a mask. All stimuli were presented on a black screen for 10 seconds. The inter-stimulus interval varied pseudo-randomly (between 30 and 60 seconds) in 5 second steps. After the series of cues was presented, a blank black screen was presented for a further 5 minutes, whilst the second baseline reactivity was recorded.

DSH participants rated their urges to self-harm immediately before the start of the presentation, as each cue disappeared from the screen, and at the end of the study. Responses were logged concurrently.

*Phase III: Psychometric testing.* Participants' urge to self-harm at the end of the study was monitored and a trained and experienced clinician was available to participants[3] . Control participants were asked whether they had ever engaged in DSH to ensure that initial group allocation was correct.

*Phase IV: Psychophysiological processing.* The raw GSR and HR data were screened in Chart to remove any noise. The main psychophysiological measures considered were GSR amplitude, measured in microsiemens, (the peak of the deflection post-cue onset, relative to the pre-stimulus peak), number of GSR responses (no. of times out of a possible ten times that there was a positive deflection to a cue) and mean HR (defined as the mean no. of bpm recorded across 1 second time-points at 2-9seconds post cue onset). The HR between 2 and 9 seconds after the onset of each cue was extracted. The mean HR is the mean of the beat-to-beat intervals within the window under consideration 2- 9seconds post cue (NB: the 2 second window could have 2-4 beats, whereas the 9 second window could have anywhere between 7-20 beats). The baseline psychophysiological responses were assessed for ethical reasons in order to identify whether responses had returned to pre-study levels after observation of the cues.

## 5.3 Results

### *5.3.1 Statistical analysis strategy*

Analyses were conducted to address physiological reactivity (GSR and HR) across cue types, considering first physiological reactivity during baseline, second, the mean response across cue types, and finally, specific differences in reactivity across cue types. Self-reported ratings of the urge to self-harm during

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[6] In accordance with protocol, participants were offered support from a clinical Psychologist if they exhibited signs of discomfort or distress, or reported increased urges to self-harm after the study.

the presentation of each cue type were compared. All analyses were computed using SPSS 15.0.

*5.3.2 Mean Amplitude of GSR.*

Exploratory analyses revealed some violations to normality therefore non-parametric analyses were conducted. Friedman's rank test revealed no significant difference in mean amplitude of GSR (across ten cues) across cue types ($p$=.627). Table 13 shows the preliminary statistics for the within group differences in psychophysiological responses.

Table 13. *Descriptive statistics for within group differences in mean GSR amplitude (ms).*

| | Neutral | | Threat | | Subliminal | |
|---|---|---|---|---|---|---|
| Measure | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Mean Amplitude | 1.07 | .78 | 1.06 | .75 | .92 | 1.28 |

*5.3.3 Number of GSR responses.*

The number of GSR responses refers to the number of times (out of a possible ten) that a positive deflection in GSR was made within a specific time window (between 2 and 9 seconds post cue onset) in response to a cue. Exploratory analyses revealed some violation to normality so non-parametric analyses were conducted. Friedman's rank test revealed no significant difference in frequency of GSR (across ten cues) across cue types ($p$=.446). See table 14 for descriptive statistics.

Table 14. *Descriptive statistics for within group differences in number of GSR responses.*

| | Neutral | | Threat | | Subliminal | |
|---|---|---|---|---|---|---|
| Measure | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Responses | 8.35 | 8.26 | 5.91 | 7.70 | 7.22 | 11.84 |

*5.3.4 Habituation of response*

Wilcoxon's rank tests were conducted to examine habituation to cues, across cue types. Within subject differences in amplitude of GSR were considered (for descriptive statistics see Table 14). Wilcoxon's rank test revealed that the first neutral cue elicited a significantly larger mean GSR (2.24) than the last neutral cue (.00; $p<.05$), there was a trend to suggest that the response to the first DSH cue was greater than the last neutral cue ($p=.068$), no difference between the first and last DSH cues, a trend towards a greater response to the first primed cue than the last DSH cue ($p=0.68$) and no significant difference in GSR to the first and last primed cues ($p=.715$). See Table 15 for descriptive statistics.

Table 15. *Descriptive statistics for GSR amplitude (ms).*

| GSR amplitude | *M* | *SD* |
|---|---|---|
| First neutral | 2.24 | 3.0 |
| Last neutral | 0.00 | 0.00 |
| First DSH | 1.28 | 2.77 |
| Last DSH | 0.15 | 0.44 |
| First primed | 0.67 | 1.06 |
| Last primed | 1.00 | 2.27 |

The same analysis strategy was repeated to assess habituation of HR across cue types.

The difference in HR between the first and last neutral cue, last neutral and first DSH, first and last DSH cue, last DSH and first primed cue, or first and last primed cues was non-significant (see Table 16 for descriptive statistics).

Table 16. *Descriptive statistics for HR amplitude.*

| GSR amplitude | *M* | *SD* |
|---|---|---|
| First neutral | 72.9 | 12.84 |
| Last neutral | 72.44 | 15.98 |
| First DSH | 73.44 | 14.79 |
| Last DSH | 74.78 | 14.21 |
| First primed | 69.42 | 12.71 |
| Last primed | 71.37 | 12.71 |

Table 17 shows the descriptive statistics for the GSR amplitude during the first and second baseline recordings and shows that after observation of the cues there is a return of GSR amplitude to pre-study levels.

Table 17. *Descriptive statistics for within group differences(pre and post cue reactivity) in GSR amplitude (ms) during baseline recording.*

| | | | | | Within group differences |
|---|---|---|---|---|---|
| | Baseline 1 | | Baseline 2 | | |
| Measure | *M* | *SD* | *M* | *SD* | *P* |

| | | | | | |
|---|---|---|---|---|---|
| Mean Amplitude | .58 | .78 | .55 | .72 | .566 |

*5.3.5 HR analyses*

The analysis strategy was repeated to consider mean HR across cue type. A Friedman's rank test revealed no significant difference in mean HR across cue types (*p*=.223). Table 18 shows the descriptive statistics for mean HR across cue types.

Table 18. *Descriptive statistics for within group differences in mean HR (bpm).*

| | Neutral | | Threat | | Subliminal | |
|---|---|---|---|---|---|---|
| Measure | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Mean Amplitude | 75.25 | 14.23 | 76.13 | 13.66 | 79.34 | 12.15 |

*5.3.6 Self-reported urge to engage in self-harm*

Due to technical difficulties the data regarding self-reported urges is available for seven out of the nine participants. A Repeated measures Analysis of Variance revealed no significant difference in self-reported urge to engage in DSH between Neutral (*M*=2.57, *SD*= 1.79), DSH (*M*=2.57, *SD*=1.79) and primed DSH cues (*M*=2.66, *SD*= 1.92) ($F_{(2,10)}$=.607, *p*=.561). When considering the highest urge reported for each cue type, a Repeated Measures Analysis of Variance revealed a trend towards a significant difference between neutral (*M*=2.71, *SD*= 2.29), DSH cues (*M*= 4.14, *SD*=2.41) and primed DSH cues (*M*=3.86, *SD*=2.48) ($F_{(2,10)}$=3.60, *p*=.060).

## 5.4 Discussion

### *5.4.1 GSR*

The present study identified no differences across cue type in mean GSR. When considering the first and last cues within each cue type, however, it was observed that responses to neutral cues habituated, but there was a trend to suggest that the presentation of the first DSH and then the first primed DSH cues may have reinstated this reactivity. This effect may simply be the result of reactivity to the presentation of a novel stimulus; the orienting response (Pavlov, 1927). However, whilst there was habituation to neutral cues, there was not the same habituation to the DSH cues or the primed DSH cues- there was no significant change in reactivity to these over time. As explained in Chapter II this might indicate that the cues are not adequately processed and that participants might have found it difficult to manage the arousal experienced, making them more vulnerable to rely on maladaptive methods of emotion regulation.

GSR amplitude did not differ significantly between pre and post study baselines, suggesting that after observation of cues psychophysiological responses returned to pre-study levels.

### *5.4.2 HR*

This study revealed no significant difference in mean HR across cue types. HR did not appear to habituate with repeated cue presentation. This measure may be less susceptible to recovery after an initial orienting response.

*5.4.3 Self-reported urges*

Contrary to hypotheses, the present pilot study identified no significant differences in the mean self-reported urge to engage in DSH in the presence of DSH and neutral cues. Examination of the means highlights that urges reported across all cue types were low. This may be a limitation of the small sample size. However, as hypothesised there was also no significant difference between urges reported in the presence of DSH and primed DSH cues. This suggests that individuals may not always be aware of times when they are at their most vulnerable. Szegali et al., (2000) reported that 58% of participants in their sample did not self-report cue reactivity to an alcohol related cue, 27% of the 58% did however, respond physiologically.

However, when considering the highest rated cue there was a trend to suggest that self-reported urges were greater in the presence of the highest rated DSH cue than the highest rated neutral cue. This strongly suggests that personalisation of cues would enhance this effect. Future research and intervention should focus on the use of cues that are individually identified to be the most relevant for each participant.

The present sample included those who were on the waiting list to receive DBT and had a diagnosis of BPD. This was a clinically severe population. In accordance with the biosocial model of BPD (Linehan, 1993), individuals with BPD might be expected to experience difficulties in recognising, labelling and managing both physiological and emotional responses.

This study was unable to identify cue specific reactivity. However, there was an indication that whilst physiological responses to neutral cues habituated, GSR reactivity to DSH cues and primed cues was sustained. Some further refinement of the methodology is required, but this pilot study may indicate that reactivity to DSH triggers may not be subject to the usual processes of habituation, that is those with a history of DSH may find it hard to adapt in the presence of a trigger. There is some indication that these processes may go unobserved by the individual concerned. It is important to consider whether individuals who engage in DSH may be vulnerable to triggers, due to a failure in habituation of arousal that may be beyond their conscious awareness.

### *5.4.4 Limitations*

*Participants.* A major limitation of this study was the small sample size. A larger sample would have allowed consideration of the limitations identified by Szegali et al., (2000) by examining whether individuals were physiologically reactive before including individuals in the analyses. Without addressing this concern, there is the potential for inter-individual variability in reactivity. This variability might have been addressed through alterations to the analyses.

The frequency of DSH that was reported ranged from abstinence (one participant) to more than once a day.  Taking this continuum approach may have artificially grouped a heterogeneous range of individuals with a range of different concerns into one group. A larger sample size would have allowed individuals to have been classified according to frequency/duration of self-harm.  The inter-individual variability of frequency and duration of self-harm reported by participants in this study was a key limitation. Subtracting each individual’s baseline GSR from their own GSR response rather than using a group mean by have enhanced control.

In addition it was not possible to confirm whether individuals met diagnostic criteria for BPD using a structured clinical diagnostic interview. Therefore individuals were classified on the basis of their topography 'self-cutting'. Future research should consider whether psychological mechanisms that underlie this topography differ in individuals with different clusters of presenting symptoms. It may be important to consider whether individuals reporting different functions for their behaviour may respond with differential reactivity. A further individual difference that may have an important impact on physiological responding is physical fitness (Myrtek, 2004; Grossman & Taylor, 2007).

*Stimulus selection.* A priori testing of cues was not conducted prior to this study due to recruitment constraints and the DSH cues may not have elicited enough reactivity. Similarly beta testing on control participants would be needed to confirm that neutral cues were truly 'neutral' and that DSH cues were also 'neutral' to controls. Ratings for valence, arousal and urges to self-harm in the presence of each cue should have been established on an independent sample. Alternatively, personalisation of cues may also have enhanced the effect. One possibility would have been to ask participants to provide post-hoc ratings of the stimuli used in this study, in order to ensure that the most appropriate stimuli were selected prior to embarking on further research using these cues.

*Measures.* More stringent criteria for the exclusion and inclusion of GSR responses might have enhanced the specificity of the responses. In this study any positive deflection that during the time window 2-9 seconds post stimulus onset that met the minimum criteria of 0.02 ms was included. La Bar, Cook, Torpey & Welsh-Bohmer (2004) recommend more stringent criteria, for example the SCR latency criterion included only those 1–4 s after onset, of a duration between 0.5–5.0 s, and a minimum SCR amplitude of 0.02 ms.

HR is under the influence of both the autonomic nervous system and the peripheral nervous system, and thus, in addition to responding to basic sensory reflexes is under the influence of cognitive control. This means that responding does not occur in a vacuum; the individuals thoughts and meanings attached to the stimuli, attention to the stimuli and motivation to participate as well as cognitive control strategies such as distraction may all play a role in how that individual responds physiologically.

The subliminal prime was presented for a duration of 1 ms, this is considerably shorter than the 4 ms recommended by Waller and Barter (2005) and may have seriously impeded the capacity of the stimuli to act as a prime. Any change in reactivity may therefore have been in response to the stimuli used to mask the prime. In order to establish whether subliminal presentation supersedes supraliminal presentation of a prime, a fourth condition using a supraliminal interpersonal distress cue could have been incorporated into the study design.

*Design.* This study was designed primarily as a pilot study to elucidate whether psychophysiological approaches can be used to evaluate reactivity to cues in individuals with a history of DSH. The main limitation was the failure to investigate the effect of reinstatement of reactivity by a general prime. Research has indicated that dishabituation may be induced by the presentation of a novel stimulus (e.g., Siddle & Hirschhorn, 1986; Vansteenwegen, 2006). If the priming cue had produced a large effect, a subsequent study could have been conducted in order to elucidate whether the reinstatement of reactivity occurred through presentation of an interpersonal prime, rather than simply the effect of the presentation of a novel stimulus. In this scenario, the study would have included an additional condition, with DSH stimuli preceded by a neutral prime. By including this control priming stimulus, it would be possible to detect whether interpersonal distress enhanced reactivity over and above that induced by the presentation of a novel stimulus.

Furthermore, a cross-over design, or randomisation of cues could have been implemented to control for order effects, as physiological reactivity may not have fully habituated to earlier cues. A more rigorously controlled design is required to establish if individuals with a history of DSH are reactive to cues.

*Analysis.* The analysis of self-reported urges to self-harm was limited by technical difficulties with the chart programme.

### *5.4.5 Future Directions*

The present pilot study was, to the authors knowledge, the first study to use psychophysiological measures to investigate reactivity to specific triggers for DSH. Further research should focus on developing this approach using a more tightly controlled design. The inclusion of a comparison control group and the randomisation of cues would enable the researcher to control for the effects of habituation and identify whether there is differential reactivity to DSH cues in those with a history of DSH. A mixed design that focused on assessing reactivity to DSH and neutral cues across groups might improve on the techniques, piloted in this study.

A larger sample size would also increase the power of the analyses to detect a statistical effect. As described in Chapter I, individuals often reported that they favour a specific implement for self-harm. The pattern of cue reactivity revealed in this study may be further enhanced by the personalisation of both environmental cues and interpersonal primes. Future research and clinical intervention should focus on the identification of personally relevant cues.

Examination of the scripts used by Haines (1995, personal communication) revealed that the interpersonal situations identified as the triggers for DSH by individuals interviewed about their most recent episode, could be categorised as relevant to either loss/abandonment or anger. Future research might consider randomising individuals to receive an abandonment or anger prime.

## 5.5 Summary

This pilot study showed that it is possible to apply the psychophysiological approaches that are used in the addiction field, to investigate DSH. No previous studies in the field have incorporated the use of a subliminal prime. The study identified that in individuals who have engaged in DSH arousal to DSH triggers may not be able to habituate to the same extent as arousal to neutral cues. The effect of a neutral priming stimulus was not tested. Therefore, any cue reactivity could not be unambiguously attributed to the content of the prime. A within subjects design does not allow the effects of cue reactivity and habituation to be disentangled. Self-reported urges did not differ significantly across cue types (although there was a trend). This is of clinical importance and suggests that individuals are not always able to identify when they are at their most vulnerable. Further work to develop methodologies to assess cue reactivity in this population is warranted.

# Chapter VI, Study III: Cue Reactivity to Self-harm Cues

## 6.1 Introduction

### *6.1.1. Chapter overview*

The present study was designed to develop the techniques explored in study II, using a more rigorous design and methodology. To this end a mixed ANOVA design was employed to detect whether specific cue reactivity to DSH cues can be observed despite habituation and whether this effect is limited to those with a history of engaging in DSH. A larger sample size was also recruited.

To elucidate whether specific cue reactivity to DSH cues occurs, first, in this study DSH and neutral cues were randomised. Second, the present study included a control group with no history of DSH to enable the researcher to examine whether the reactivity observed was specific to those who self-harm.

Interpersonal, intrapersonal and environmental cues appear to play a role in the maintenance of DSH (as observed in Study I), but to examine whether their function can be detected via physiological cue reactivity it may be useful to examine them separately. The present study focused specifically on the way that individuals with a history of DSH responded to environmental cues related to DSH, such as: razor blades, knives and broken glass.

### *6.1.2. Aims*

The present study was designed to measure the physiological markers of reactivity to triggers in the environment in individuals who had engaged in DSH. It examined phasic GSR and HR to a series of photographic stimuli associated with DSH (implements used to self-harm, such as a razor) and neutral cues (everyday objects such as a toothbrush). Photographic stimuli were selected because they reflected the real-life experience (Strizke et al., 2004) of those who self-harm but offered no opportunities for DSH. Self-reported ratings of the urge to engage in DSH in the presence of stimuli were also assessed.

### *6.1.3 Research questions*

- Do individuals who engage in DSH differ in their physiological responding to stimuli relating to DSH and neutral stimuli?
- Does this pattern of responding differ from that of control participants?
- Are these psychophysiological differences reflected in the self-report of urges to self-harm?

## 6.2 Method

### *6.2.1 Design*

The study used a mixed (2x2) factorial design with Group (DSH vs control) as the between-groups factor, and Cue Type (DSH vs Neutral) as the within subjects factor. GSR, HR and self-reported urge were the dependent variables.

Owing to the limited availability of previous comparable empirical research into DSH, statistical power analyses could not be conducted. Sample sizes were based on previous research using psychophysiological assessment of cue reactivity in a clinical sample e.g., in alcoholics (Stormark, Laberg, Bjerland, Nordby & Hugdahl, 1995).

### 6.2.2 *Participants*

Participants who took part in Study II were not eligible to participate in the present study. Fifty three individuals over the age of eighteen, participated in the study. Twenty seven were those with a history of DSH. Twenty two of these reported that they were currently engaging in DSH (i.e., they had self-harmed in the 4 weeks prior to recruitment) and 5 reported that they had self-harmed repetitively in the past. Twenty six control participants were recruited, who reported that they had never engaged in DSH. One individual (with a history of DSH) was excluded from the HR analysis due to technical difficulties at the data collection stage. The male: female ratio was 1:26 in the DSH group and 5:21 in the control group. Age ranged from 18-47 years in the DSH group ($M$=25.06, $SD$=6.36) and 19-56 years ($M$=23.21, $SD$=7.43) in controls . Duration of DSH ranged from 1-33 years ($M$=10.37, $SD$=8.73). Nineteen of the 27 participants in the DSH group reported their current frequency of DSH (see Table 19).

Table 19. *Frequency of acts of DSH (total DSH sample).*

| Frequency of DSH | N | % |
|---|---|---|
| Fortnightly | 5 | 21.7 |
| Not reported or abstinent | 8 | 17.5 |
| Weekly | 4 | 17.4 |
| Daily | 4 | 17.4 |
| Monthly | 2 | 8.7 |
| Less than monthly | 2 | 8.7 |
| Several times a week | 1 | 4.3 |
| Several times a day | 1 | 4.3 |

Participants in the DSH group were; a) service users, and b) individuals who self-identified that they engaged in DSH. The latter responded to advertisements placed at the University of Southampton, at local self-help groups, charitable organisations and in newspaper advertisements. Control participants were recruited from the University and offered course credits for participation. Exclusion criteria in the clinical sample included any expression of suicidal intent or a co-morbid diagnosis of psychosis or learning disability.

Service users were recruited from the Intensive Psychological Therapies Service (IPTS), Dorset, and four NHS Services in Southampton and South West Hampshire. Dorset and Southampton NHS LREC and the University of Southampton ethical approval were obtained. Eligible service users were contacted via post, and invited to participate. The letter contained an information sheet containing the particulars of the study. Written consent was obtained and individuals were invited to attend a 1 hour appointment at St Ann's Hospital, Dorset or the University of Southampton. Clinicians involved in the care of the service users were informed of their participation. Non-service users approached the researcher in response to an advertisement and received the same information sheet as the service users.

### *6.2.3 Apparatus*

The physiological recording apparatus used was the same as that used in Study II.

### 6.2.4 *Materials*

*Cues.* As in Study II, experimental stimuli consisted of 10 colour photographs which were 600 pixels x 600 pixels, of DSH-related implements (tools frequently used to self-harm, that were identified in Study I) placed in a neutral context (i.e., kitchen knife and chopping board). Control stimuli consisted of 10 identically sized, appropriately matched neutral stimuli in a neutral context (i.e., cup and packet of biscuits).

*DSH Urge Questionnaire.* Participants in the DSH group were asked to report their urges to self-harm on a seven point Likert scale in response to each stimulus (1=no urge, and 7=strongest urge imaginable).

*Self-harm implement rating form.* This comprised a list of the DSH stimuli that were presented. Participants were required to indicate which of the stimuli were tools that they had previously used to self-harm, and then to rate the three implements they used most frequently.

### *6.2.5 Procedure*

This study was granted ethical approval by the School of Psychology ethics committee, University of Southampton, Dorset NHS Healthcare Trust LREC, North and Mid Hants LREC and Hampshire Partnership Trust LREC.

*Phase I: Preparation.* Participants were requested to clean their hands using an anti-bacterial cleaning wipe prior to preparation for physiological recording. The experimenter then prepared the electrodes using conductance gel.

*Phase II:* A baseline measurement of tonic physiological reactivity (HR and GSR) was recorded for a period of 5 minutes while a blank black screen was presented.

*Phase III: Measurement of phasic psychophysiological responses and self-reported urges.* Phasic reactivity to a series of photographic stimuli presented on a laptop was assessed. Neutral and DSH cues were presented in a pseudo-random sequence with constraints to ensure that not more than 3 DSH and neutral stimuli were presented consecutively. All stimuli were presented on a black screen. Each cue was presented once for 10 seconds. The inter-stimulus interval varied pseudo-randomly (between 30 and 60 seconds) in 5 second steps. After the series of cues was presented, a blank black screen was presented for a further 5 minutes, whilst baseline reactivity was recorded for the second time.

DSH participants rated their urges to self-harm immediately before the start of the presentation, as each cue disappeared from the screen, and at the end of the session. Responses were logged concurrently. Minor adjustments were required in the adaptation of the design. Therefore, analyses were conducted to identify any differences in the results between those participants who took part in the study in the original format and those who participated after the changes were implemented.[1]

*Phase IV: Psychometric testing.* This followed the same procedure as study II.

*Phase V: Data reduction and psychophysiological processing.* The raw GSR and HR data were screened in Chart to remove any noise. As described in Study II, the HR between 2 and 9 seconds after the onset of each cue was extracted. The mean HR is the mean of the beat-to-beat intervals within the

[7] These adaptations included an adjustment to the stimulus duration (from five seconds to ten seconds) and the inter-stimulus interval was altered from fixed to randomised. Because Mann-Whitney test was unable to identify significant differences in GSR between these two procedures, all participants are included in the final analyses. The first trial included 11 DSH participants and 18 Control participants and the second included 16 DSH participants and eight Control participants.

window under consideration 2- 9 seconds post cue (NB: the 2 second window could have 2-4 beats, whereas the 9 second window could have anywhere between 7-20 beats).

The GSR and HR data were scored from the raw waveforms. A C++ program was written to read the raw HR and GSR text data exported from Chart and to display it on the screen. The program read the cue-event channel and allowed the scorer to move quickly through the data record to display the raw data for the 20 seconds around the cue-event. For each DSH and neutral cue the scorer marked the start and peak points of any GSR responses displayed, and these points were then stored in a bespoke binary format in case subsequent scoring was required.

The program calculated the response amplitude which was sorted according to the cue type (DSH or neutral) and exported to an Excel spreadsheet. To avoid double-triggering for those participants with large amplitude, GSR waveforms which were 'clipped' by the recording equipment, the scorer 'seeded' the algorithm by moving a screen cursor to a point which defined a minimum level below which no R-wave occurs. The algorithm detected all the peaks above this level and stored this information for future recall. The algorithm calculated the mean HR for a succession of 'windows' (2 secs pre cue, to 9 seconds post cue) and exported this information in a form suitable for use in Excel. The HR beat to beat intervals were then calculated.

GSR amplitude, measured in microsiemens, is the difference between the pre-stimulus GSR and peak of the post stimulus GSR i.e. the *deflection* that is, amplitude relative to the level prior to response onset. The mean HR across cue types was calculated. In addition, a mean of the early HR response (2-4 seconds post cue onset) and a mean of the late response (5-9 seconds post cue onset) were computed. This served a very crude proxy indication of whether any differences in arousal might be more likely to be associated with immediate orientation or arousal to the cue, or emotional adaptation/habituation. The data of interest were therefore mean amplitude of GSR, frequency of GSR responses (no. of times there was a response to a cue type out of a possible ten times), and Mean HR. Data were entered into an SPSS file (SPSS for Windows, Version 14.0) for analysis. Figure 6 shows a Psychophysiological response to a DSH cue in a participant with a history of DSH. The figure is a screen shot taken from Chart.

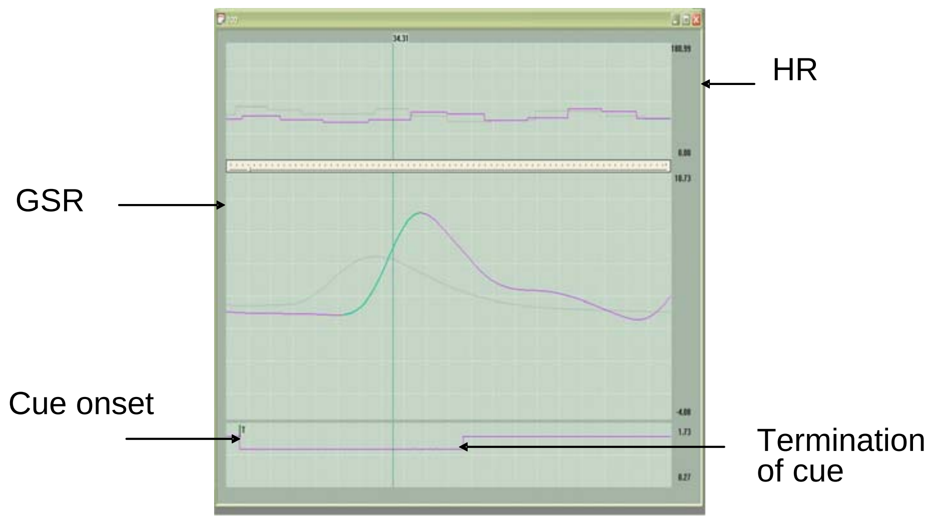


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*Figure 6.* Screenshot taken from chart showing psychophysiological response to a DSH cue.

## 6.3 Results

### *6.3.1 Psychophysiological Analyses*

Exploratory analyses were conducted to investigate normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity. Violations were minimal except for Kolmogorov-Smirnov values implicating skew. Because all data were skewed to approximately the same moderate effect, and negative log transformations computed in accordance with methodology described by Tabachnik (2001) did not correct the skew data were left untransformed (on the recommendations of Tabachnik, 2001).

### *6.3.2 Galvanic Skin Response*

*Mean Amplitude of GSR.* Fifty-three participants were included in the analyses, 27 in the DSH group and 26 controls. A mixed 2x2 Analysis of Variance with Bonferroni adjustment revealed a main effect for Group ($F$ (1, 51)= 6.50, $p$<.001), a main effect for Cue Type ($F$(1,51)=8.72, $p$<.01) but no significant Group x Cue Type interaction ($F$(1, 52)= .827, $p$=.367). Descriptive statistics are included in Table 20.

*Number of GSR responses.* The number of GSR responses refers to the number of times a positive deflection in GSR was made in response to a cue, within a specific time window (between 2 and 9 seconds post cue onset). This would mean that an individual could potentially respond ten times to each type of cue (e.g., to ten neutral cues). A mixed 2x2 Analysis of Variance with Bonferroni adjustment revealed a main effect for Group ($F$(1,52)= 13.96, p<.001), a main effect of Cue Type ($F$(1,52)= 13.37, p<.01) but no significant Group x Cue Type interaction ($F$ (1,52)=.363, p=.549). Descriptive statistics are included in Table 20.

*Table 20. Descriptive statistics for GSR amplitude and frequency.*

| | Neutral stimuli | | DSH group DSH stimuli | | Neutral stimuli | | Control group DSH stimuli | |
|---|---|---|---|---|---|---|---|---|
| Measure | *M* | *S.D.* | *M* | *S.D.* | *M* | *S.D.* | *M* | *S.D.* |
| mean amplitude | 11.58[a] | 16.93 | 16.14[b] | 21.94 | 3.00[a] | 3.26 | 5.42[b] | 6.37 |
| Frequency of response | 5.33[a] | 3.75 | 6.11[b] | 3.70 | 2.23[a] | 1.80 | 3.30[b] | 2.54 |

*Within subject differences; means with different subscripts differ significantly at p<.05.*

### *6.3.3 Heart rate*

Exploratory analyses revealed no serious violations to normality. A mean of the early response (2-4 seconds post cue onset) and a mean of the late response (5-9 seconds post cue onset) were computed. A mixed Analysis of Variance with Bonferroni adjustment was conducted with Group (DSH v Control) as the between groups factor, Cue type (DSH v neutral) as a within subjects factor and Time (early v late) as a within subjects repeated measures factor. The within and between group effects were explored. There was no main effect of Cue type ($F$ (1,51)=0.03, p<.86, $\eta^2$ =.001) but there was a significant main effect of Time ($F$ (1,51)=7.0, p<.05, $\eta^2$ =.123), and a significant main effect of Group ($F$(1,51)=4.79, p<.05, $\eta^2$ =.87). There was a significant interaction between time and group ($F$(1, 51)=14.23, p=.000, $\eta^2$ =.222). There was no significant Cue type x Time interaction ($F$ (1, 51)=.062, p=.81), Cue Type x Group interaction ($F$(1, 51)=1.69, p=.20) or Cue Type x Time x Group interaction (*F* (1, 51)=.49, p=.49). Table 21 includes the descriptive statistics.

Table 21. *Summary of means and standard deviations for HR.*

| Time | Neutral stimuli *M* | *SD* | DSH group DSH stimuli *M* | *SD* | Neutral stimuli *M* | *SD* | Control group DSH stimuli *M* | *SD* |
|---|---|---|---|---|---|---|---|---|
| Early (2-4secs post onset) | 81.03 | 12.00 | 81.46 | 11.61 | 75.08 | 11.68 | 74.68 | 11.88 |
| Late (5-9 secs) | 82.17 | 11.23 | 81.46 | 11.60 | 74.78 | 11.24 | 74.61 | 11.25 |

### *6.3.4 Self-reported urge to self-harm*

Mean ratings of the urge to self-harm for those in the DSH group were computed for DSH and neutral cues respectively. Paired samples t-tests revealed that these participants reported significantly higher urges to engage in DSH in the presence of DSH (*M*=2.0, *SD*=1.26) than neutral cues (*M*=1.16, *SD*=1.06), t(51)=4.74, *p*<.001.

## 6.4 Discussion

The primary purpose of this study was to investigate whether individuals who have engaged in DSH demonstrated differential physiological reactivity in the presence of DSH cues. A secondary aim was to investigate whether, in the presence of these cues, individuals reported increased urges to engage in DSH.

As predicted, participants who have engaged in DSH responded with significantly greater GSR amplitude and frequency to DSH cues than neutral cues and when compared to Controls. There was however, no interaction between the type of cue presented and the group. The biosocial model of DSH (Linehan, 1993) hypothesised the existence of a generalised hyper-arousal in those who engage in DSH. 'Although the present study did not find evidence of cue specific physiological reactivity, there was some indication that there may be generalised hyper-arousal, against which it may be more difficult to measure the more subtle effects of specific cue reactivity. Over the last decade, researchers have attempted to investigate the possibility of physiological hyper-arousal in BPD, however, as discussed in Chapter II, the physiological evidence regarding electrodermal arousal in BPD is both inconclusive and inconsistent. For example although Herpertz et al., (2001), reported hyper-arousal to emotional and neutral cues compared to controls, Herpertz, Kunert, Schwenger and Sass (1999) and Herpertz (2001a) found no significant difference in HR, GSR or startle response to pleasant, neutral and unpleasant emotional cues, or when compared to controls, and Herpertz (2000) reported a lower electrodermal arousal in response to affective and neutral pictures (compared to controls), despite using the same sample. Ebner-Priemer et al, (2005) also found no evidence to support physiological hyper-arousal in BPD. Therefore, it is clear that further methodological refinement is required before a consistent evidence base can be established. Without a comprehensive and consistent evidence base regarding electrodermal arousal in BPD, it may not be possible to delineate cue specific reactivity in the autonomic system.

When grouping HR responses into early and late responses to the cue, there were significant main effects of Cue type and Group indicating that those in the DSH group responded with greater reactivity to all cues, than controls. The main effect of Time, and the interaction between Time and Group revealed that responses to both cue types in the control group, remained constant over time, whereas the responses of those in the DSH increased over time, again suggested a generalised hyper-activity, perhaps reflecting a generalised difficulty in disengaging with cues. The fact that there was not a Cue Type x Time x Group interaction suggested that this pattern of responding was not DSH specific but occurred across cue types.

Consistent with predictions, participants in the DSH group exhibited significantly greater urges to self-harm in the presence of DSH cues, than neutral stimuli. This supports the importance of triggers in DSH identified in Study I by self-report. Differential responding occurred despite using generic rather than personalised cues. This finding, suggests that individuals who self-harm self-report that they are "cue reactive", in line with cue reactivity evidenced in alcohol and nicotine addicts (Childress, Ehrman, Rohsenow, Robbins & O'Brien (1992) and restrained eaters (Overduin, Jansen & Eilkes, 1997). This self-reported cue reactivity does not match the psychophysiological profile observed, which instead indicates that there may be a generalised hyper arousal to all cues.

Further investigation into whether cue reactivity can be established is warranted. This preliminary finding supports previous evidence of an attentional bias to DSH cues in DSH (Bryant, 2007). Herpertz et al. (2001) reported FMRI evidence of enhanced amygdala activity to standardized emotionally aversive and neutral stimuli in those with BPD compared to controls. The authors proposed that this activity may modulate the perceptual cortex leading to increased attention to emotionally relevant environmental stimuli. There may be utility in evaluating whether cue reactivity can be assessed using measures of Central Nervous System reactivity to DSH cues.

### *6.4.1 Limitations*

Although there was a main effect of Group and cue type, there was no significant interaction. The use of a larger sample size might have made it possible to detect any potential interaction. The size of the sample recruited for this study was small in terms of power, although consistent with other studies of DSH (e.g., Bryant, 2007). Although the researcher recruited through all available channels including; NHS services, self-help groups, mental health charities, community samples, newspaper and radio advertisements, self-harm support websites, and the University, the sample size remained limited.

Due to the limited sample size it was not feasible to consider differences in cue reactivity between individuals who were currently engaging in DSH and those who were abstaining. Research into abstinence and relapse in the addiction field may yield some specific predictions, although a guided imagery study of cue reactivity in DSH revealed no differences in psychophysiological response to imagery between those who engaged in DSH frequently and infrequently (Brain, Haines & Williams, 2002).

Furthermore, research in the field of addictions has shown reductions in skin temperature in the presence of substance related cues to be a reliable indicator of cue reactivity (e.g. Robbins et al., 1999). This psycho-physiological index was omitted from this research.

*6.4.2 Future Directions*

This study suggests that individuals with a history of DSH respond with greater reactivity than controls to all stimuli, but, they self-report greater urges to self-harm in the presence of DSH triggers. Further research into cue reactivity in DSH is required. The participants in this study were recruited through a broad range of services as well as advertisements in the community. Patient status and participation in previous therapeutic interventions would be expected to impact on cue reactivity. The use of a clinical sample alone might also have increased the potency of the effect.

Future research should consider specific individual response patterns in order to identify particular arousal patterns that may be relevant to therapeutic intervention, for example as indicated by Study 1, an individual may demonstrate an impaired decay in arousal to specific DSH stimuli. These factors specific to the individual response pattern may identify idiosyncratic therapeutic goals.

This study used a pre-selected set of DSH cues that were photographs of tools identified by participants in study I as those most commonly used to self-harm. Conklin and Tiffany (2001) reported that personalization of imagery scripts used to assess reactivity and craving for cigarettes did not enhance craving beyond that generated by non-personalized scripts. However, the fact that individuals who engage in DSH often favour a particular implement (Briere and Gil, 1998), and that this preference may change over time, suggests that personalisation of cues may be required to tailor intervention to idiosyncratic requirements.

Future research might consider assessing differences in psychophysiological response to emotional stimuli such as the International Affective Picture System. A pilot study might be used to establish whether those with a history of DSH rate that their urges increase in the presence of such emotional pictures. Those pictures that individuals rate to have a high association with self harm urges, might thus be selected as 'self-harm' cues.

Further work is required to delineate specific cue reactivity from generalised hyper-arousal. The present study has suggested that there are changes in Autonomic Nervous System reactivity in the presence of cues. The examination of event related potentials might offer a more sensitive method to examine this effect. The assessment of event-related potentials allows the measurement of changes in cortical electrical activity in response to time-locked events (Polich, 1994). Future research might focus on the development of methodologies to examine whether cue reactivity to DSH cues can be detected as changes in the central nervous system rather than the autonomic nervous system.

### *6.4.3 Clinical applications*

Foa and Kozak (1986) regarded demonstrable physiological or self-reported cue reactivity a pre-requisite for cue exposure based interventions. In this study, participants with a history of DSH showed hyper-arousal to all cues when compared to controls, but reported increased urges to self-harm in the presence of DSH specific cues This preliminary evidence, may suggest that cue exposure with response prevention might be a plausible treatment intervention but further examination of cue reactivity is required.

## 6.5 Summary

Whilst individuals who engage in DSH reported increased urges to self-harm in the presence of DSH cues, the present study was not able to demonstrate physiological cue reactivity to DSH cues. Further work is required to refine methodology and to explore other methods of evaluating cue reactivity before exploring whether cue exposure with response prevention techniques in individuals who engage in DSH is warranted.

# Chapter VII, Study IV Event-related brain potentials as indicators of DSH cue reactivity

## 7.1 Introduction

### *7.1.1 Chapter overview*

Study III identified changes in the pattern of ANS reactivity to both DSH and neutral cues in those with a history of DSH (including a heightened GSR and HR reactivity). This may support a model of generalized psychophysiological hyperactivity in DSH, as proposed by Linehan (1993a).

However, those who self-harm have identified that specific cues are particularly salient to them and trigger individual episodes of DSH (Study I), and Study II identified preliminary empirical evidence to suggest that urges to self-harm increase in the presence of the most powerful of these cues. There has been no previous investigation of the specific pattern of psychophysiological responsivity to DSH cues. This pattern of reactivity might include the orientation or allocation of attention, detection of stimulus intensity or enhanced processing that enables context updating to occur (the activation of working memory processes that enable the incorporation of novel stimuli into current schemas, or belief systems). The use of a more sensitive measure of cue reactivity may enable the detection of these cue specific changes in reactivity. This study considers whether cue reactivity to DSH cues in individuals who engage in DSH can be detected by changes in cortical activity using event-related potentials.

### *7.1.2 Event Related Potentials*

ERPs are the average cortical electrical activity to specific time-locked events or responses. Averaging across a series of ERP responses to the presentation of a stimulus enables the extraction and examination of a waveform with functionally distinct components. These components are identified as either positive or negative deflections, and each such deflection is labelled as such (P or N) followed by the timing (in ms post stimulus onset) at its peak maxima, (e.g., the N100 response is a negative deflection that occurs approximately 100ms post stimulus onset). Of particular interest are; the peak (amplitude), the latency, and the topographical distribution of each ERP component. ERPs offer one way of looking at CNS reactivity and are of particular interest because they have high temporal resolution and, when mapped with behavioural reaction time data, can provide information about brain activation to specific time locked events (Polich, 1994). ERPs are not sensitive to localization, but activity can also be mapped with fMRI data to provide information about topographical distribution (e.g., Due et al., 2002). ERPs can be elicited by standardised behavioural tasks; paradigms that are frequently used are the Stroop task (Stroop, 1935) and the Visual oddball task (e.g., Polich & Comerchero, 2003).

There are three main three main ERP response components of interest; N100, P200 and P300.

*N100.* The N100 is argued to be an indicator of the preconscious allocation of attentional resources (Hillyard, Hink, Schwent & Picton, 1973). This early negative component has been reported to distinguish between responses to alcohol related and neutral pictures in heavy drinkers (Herrmann et al., 2001). As such the N100 may be indicative of a preconscious attentional bias to salient cues. A low

N100 amplitude would indicate that a limited amount of attention was diverted towards the stimuli, and thus might provide information about the motivational characteristics of the participants. It would be expected that an enhanced N100 amplitude and latency to stimuli would be indicative of a preconscious attentional bias.

*P200*. The P200 is an early positive deflection that is thought to reflect early detection of perceived stimulus intensity (Covington & Polich, 1996; Polich, Ellerson & Cohen, 1996). This component of the ERP response is a useful indicator of the salience of a cue, because examination of the P200 indicates how powerful that cue is for the individual. Karl, Malta and Maercker (2006) reviewed the evidence and suggested that by considering the pattern of a P200 response activated by acoustic stimuli, individuals can be classified into augmenters (those who exhibit an increased amplitude as sound intensity increases) or reducers (those who exhibit a decreased amplitude with increasing intensity) and that this might be related to serotonergic activation (Hegerl & Juckel, 1993). It is hypothesised that augmenters seek out increased stimulation from the environment, whilst reducers block out such stimulation. Karl et al. (2006) reported the results of a meta-analysis to suggest that there may be a gender effect, with females, more likely to exhibit an augmenting response. However, when considering females with PTSD, Metzger et al. (2002) identified that augmentation was positively correlated with symptom severity. As described in Chapter I, DSH is associated with impulsivity and sensation seeking, it might be expected that those with a history of DSH would display an enhanced P200 amplitude and faster latency in P200 activation than controls.

*P300.* Polich and Kok (1995) described the P300 as "a large positive EEG deflection elicited approximately 300 ms after stimulus onset that has been described as reflecting the level of tonic arousal and phasic alterations in arousal to specific stimulus events." The P300 is thought to reflect neural activity associated with the processing of information associated with novel events, when attention is engaged (Polich, 1996). The latency of a response might be used to determine speed of stimulus classification (Criado, 2006; Polich, 2004) with shorter latencies being associated with superior cognitive performance and longer latencies associated with difficulties in stimulus discrimination. Latency of the P300 is associated with the allocation of mental resources for stimulus processing, and is inhibited when attention is diverted elsewhere. P300 amplitude might reflect further processing in terms of the updating of mental representations or schemas (Donchin, 1981). There are thought to be two components of the P300 response (Linden, 2005); the P3a that occurs slightly earlier and is associated with automatic attention, and the P3b that is thought to reflect goal-directed attention and memory operations.

### *7.1.3 Relation between ERP and Behavioural Measures*

The Stroop effect (1937) is one of the most robust effects in psychology. The original version of this task required participants to observe a list of meaningless stimuli and names of colours presented in four different colours. Their task was to name the colour of the stimuli as they were presented. For example, the word 'blue' was presented in the colour 'green', while the participant was required to name the colour of the word (green). Stroop (1937) found that participants took longer to respond to words presented in an incongruent than a congruent colour (i.e. the content of the word interferes with colour naming). A more recent variant of the task involved the presentation of emotionally salient stimuli in addition to neutral stimuli. Williams, Mathews and MacLeod (1996) reviewed a range of research studies that revealed that an emotional Stroop task successfully distinguished patients according to their clinical conditions and was able to discriminate between patients and controls. The authors concluded that selective attention to emotionally relevant stimuli may be a marker of psychopathology. For example, Amir, Freshman and Foa (2002) showed that in patients with social phobia, phobic related words interfered with colour naming, i.e., the words elicited an emotional interference effect.

Recently, Thomas, Johnstone and Gonsalvez (2007) suggested that the assessment of ERPs during a Stroop task can provide a cue specific measure of emotional interference effects, identifying the salience of a cue, and its impact on both the processing and allocation of attentional resources, by identifying whether a delay in colour-naming is accompanied by enhanced processing (an enhanced amplitude or longer latency).

It is, however, difficult to distinguish between the deliberate allocation of attentional resources (selective attention) and the existence of an underlying motivational salience for substance related cues. As described in Chapter III, the Incentive Sensitization Theory (Robinson and Berridge, 1993) proposed that, as tolerance develops, critical neuro-adaptations sensitize individuals to cues related to a substance of abuse, and these cues acquire both incentive salience and enhanced attentional properties. This study considers whether such a model is a useful way of looking at DSH specific cues.

Lubman, Allen, Peters and Deakin (1997) utilized a visual oddball paradigm to examine the evidence for an IST account of the motivational salience of opiate related cues in opiate addiction. The visual distracter oddball task typically involves the presentation of three verbal stimuli in a random sequence; two neutral stimuli. One, the target stimulus, occurs less frequently than the other, the standard stimulus. Additionally, a third distracter stimulus (emotionally salient) is presented infrequently (the oddball). During this task, participants are instructed to respond only to the target stimuli.  In the version used by Lubman et al., (2007) photographs were used. The authors hypothesized that opiate addicts would display an enhanced amplitude at approximately 300 ms post stimulus onset (the P300, described below) to opiate related imagery (oddball) when compared to standard and target stimuli and in comparison to controls, and that this would provide an index of the non-volitional motivational salience of the oddball stimuli, because attention would have been deliberately diverted elsewhere- to the target stimuli. In accordance with IST predictions, Donchin (1981) showed that opiate addicts displayed a trend towards enhanced P300 amplitude to opiate stimuli (thought to reflect enhanced context updating), indicating that these cues have enhanced motivational salience despite the active diversion of attention elsewhere (to target stimuli). There were no group differences in behavioural reaction times to identify target stimuli, although the error rate in detection was significantly greater in the opiate group.

This finding is supported by FMRI evidence confirming the functional neuro-anatomy involved in motivational aspects of addictive behaviour. For example, in smokers, smoking cues that predict the availability of the substance of abuse (nicotine), activate the same motivational reward circuits (the meso-corticolimbic circuitry), and visio-spatial attention circuitry, that are activated by smoking (Due et al., 2002). The authors revealed that during a visual oddball task, current smokers (who smoked at least 15 cigarettes a day) who had been deprived of cigarettes for approximately 10 hours processed smoking stimuli in a similar way to rare target stimuli, with enhanced activation in meso-corticolimbic areas. These findings provide evidence to suggest that meso-corticolimbic reward circuits can be activated by drug –related stimuli alone. Ingestion of a substance is not necessary for cue-activated addiction processes to occur. It might be hypothesized that DSH cues would activate a similar reward related process. As described in Chapter III, DSH appears to be maintained by negative and positive reinforcement contingencies. The presentation of cues that predict availability (e.g., razor) or those that establish a change of motivational state, (e.g., intense distressing emotions such as shame and anger) might be expected to activate attentive and appetitive processes (that signal approach or avoidance) in individuals with a history of DSH.

*7.1.4 ERP in diagnosis related pathology research*

Polich (2004) asserted that ERPs (specifically the P300 component) may provide clinically useful information about the allocation of cognitive resources for stimulus processing. Houston et al. (2004) explained that ERPs can differentiate between specific clinical populations and highlight vulnerability to psychopathology. To the authors knowledge there are currently no published empirical studies that use ERP methodologies to investigate reactivity to cues specifically in individuals who engage in DSH. Studies of diagnosis related psychopathology may be useful for locating abnormalities in CNS responding. As described in Chapter I, DSH is a key feature of a presentation of BPD and DSH via cutting is highly prevalent in those who meet the criteria for diagnosis. Two published studies have assessed ERP reactivity in individuals with a diagnosis of BPD. Meares et al. (2005) compared the P300 single trial ERP responses of 17 patients with a diagnosis of BPD, and 17 Controls participants using a two-tone auditory oddball task with target tones presented at 1500 Hz 15% of the time and standard tones presented at 1000Hz, with 85% frequency. The authors identified that those with BPD exhibited distinct patterns of P300 activity to auditory stimuli from control participants, including enhanced P3a amplitude to target stimuli (most pronounced in frontal regions) and a failure in response habituation. There were no group differences in P3b and there was no temporal locking of P3a to P3b in the BPD group, indicating that there may have been difficulties in functionally co-coordinating automatic and goal directed attentive processes. It might be hypothesised that attention is diverted to classically conditioned stimuli that have attention grabbing properties, such as DSH related stimuli, over and above the activation of attention to goal directed activities. Although beyond the scope of the present thesis, a distinction in activation between P3a and P3b might distinguish between 'wanting' and 'liking' for salient cues as predicted by Incentive Salience theory. Those with a diagnosis of BPD did not exhibit the typical age-related decline in P3a amplitude which may reflect a failure of frontal maturation. The fact that responses failed to habituate supports the model of generalized hyperactivity of responding in BPD (Linehan, 1993) but does not rule out that this generalized hyperactivity might be accompanied by concurrent specific cue reactivity to salient stimuli.

De Brujin (2006) identified that those with BPD exhibited reduced P300 amplitudes, after late feedback, and a reduced error negativity (ERN) when compared to a matched control group, on the two-choice forced reaction 'flankers task'. In this task, participants are required to respond to visual stimuli (strings of five letters), pressing a button with their left or right finger in response to the central letter, whilst ignoring the other letters. Stimulus-response mappings are given (e.g. respond with left hand to letter H) and responses are faster when distractor stimuli are congruent (i.e. the same as the central letter). In de Brujin's study, the number of erroneous responses did not differ between groups. The ERN is generated in the Anterior Cingulate Cortex, a neural substrate thought to underlie action monitoring. These findings suggest that individuals with a diagnosis of BPD may exhibit impairments in the ability to monitor their responses and behaviour, and are less able to learn from erroneous responses. Examination of behavioural reaction times also provided support for an impulsive response style in BPD. Together, these findings imply that individuals with BPD may be more likely to act on impulse. The reduced activation of the ERN suggests that those with BPD may be impaired in their ability to detect an error of judgment. This would mean that they may be more likely to engage in risky behaviours such as DSH and place themselves in vulnerable situations without learning from previous mistakes, and with impaired monitoring of the consequences.

Together, these studies indicate that ERP can be used to index differential stimulus response styles within the CNS in those with BPD. These studies provide clinically relevant information about general response styles but they do not provide information about the specific allocation of attention or processing of emotionally or motivationally salient stimuli specific to DSH.

Research using an ERP methodology has however, been used to specifically evaluate the processing of emotionally salient stimuli in those with a diagnosis of PTSD. As described in Chapter II, the presence of a traumatic history is a major risk factor for the development of DSH. The brain circuitries responsible for attentional alterations may be similar between traumatic adaptation and DSH. Van der Kolk (1994) outlined that the neurobiological disruptions that occur post trauma influence affect regulation which may be key to the development and maintenance of DSH. Van der Kolk (1994) described the impairments that might result from a neurological adaptation to trauma, including a hyper-arousal to startle response, and hyper vigilance, and deficits in memory. Other researchers have identified the neural correlates associated with exposure to trauma cues (Bremner, Staib, Kaloupek, Southwick, Soufer & Chaney, 1999). For many individuals there may be a clear link between DSH and post-traumatic adaptation thus a similar neurobiological profile may be expected to underlie DSH. There is evidence to suggest that the dysfunctional cortico-limbic processes that underlie PTSD, are common to BPD (Rogers & Kirkpatrick, 2005), which might be explained by the developmental neuro-adaptations to emotion regulation and reward sensitivity that occur post trauma.

PTSD research has considered the impact of trauma specific cues on ERP reactivity. An enhanced processing of threat stimuli and an attentional bias to trauma related cues may be important factors in maintaining PTSD. Ehlers and Clark (2000) highlighted the importance of exposure with concurrent cognitive re-processing of these cues to incorporate context relevant information) in adaptation post trauma. Understanding the way that individuals with PTSD process these cues, has useful clinical implications, in particular, information-processing models have attributed the intrusive symptoms of PTSD (e.g. flashbacks, nightmares) to re-activation of trauma memories via trauma related cues. Ehlers and Clark (2000) argue that trauma related cues in PTSD elicit avoidance, which maintains PTSD. This research may have useful implications to consider when developing a methodology to evaluate the impact of cues in DSH. It may be that different DSH related cues activate different processes, for example cues that signal availability such as a knife or razor blade might be hypothesized to activate attentional circuits that signal approach, whereas cues that are related to the establishing operations such as words related to feelings of shame or anger, might activate behavioural avoidance, it would, however, be expected that both will elicit enhanced cortical activation over and above that elicited by neutral cues.

Metzger, Orr, Lasko, McNally and Pitman (1997) used an emotional Stroop paradigm in individuals with a current diagnosis of PTSD and healthy controls and reported that although reaction time data supported an interaction between group and RT to traumatic words, contrary to hypotheses there was no group specific or group by stimulus interaction in the P300 amplitude to traumatic and positive words. Instead the P300 amplitude was enhanced in comparison to neutral words across diagnostic groups. This finding may indicate that although in control participants, the presentation of trauma words did not inhibit responding, they responded to these stimuli as threat stimuli at the CNS level. It appears that trauma cues require enhanced processing. The personalized trauma related words used as stimuli in this study had a generic threat value to all participants. In control participants, however, this activation did not interfere with their responding. The trauma related behavioural interference effect is specific to those with PTSD. When considering P300 latency, there was a significant main effect of group, those with PTSD exhibited a delayed P300 activation across all word types, which may reflect a generalized avoidance.

Metzger et al., (1997) only considered P300 activation (reflecting later processing or context updating of stimuli), earlier allocation of attentional resources was overlooked. There may be group specific differences in response to such cues in the earlier components of an ERP waveform (e.g., N100 and P200 components). Blomhoff, Reinvang and Malt (1997) examined the elicitation of the P200, P300 and N100 during participation in an auditory oddball task in a sample of patients with PTSD. Standard and target stimuli were auditory tones and distracter stimuli were words and non-words with positive or negative emotional valence. They identified an increased N100 latency in the PTSD group to standard tones compared to non-patient control participants and an increase in P200 -350 amplitude to both non-words and words than controls. The fact that participants with PTSD exhibited delayed activation to standard stimuli, might indicate an avoidance response style, a clinical characteristic of PTSD as outlined in the DSM-IV criteria for the disorder (APA, 1994) . The finding that all distracter stimuli elicited greater responses in components that may reflect stimulus intensity, implicates a generalized hyper-arousal in PTSD. A similar hyper-arousal might be expected in those who engage in DSH. Together, these research studies indicate experimental paradigms that may enable the exploration of the specific components of reactivity to emotionally or motivationally salient cues and group specific response styles.

### *7.1.5 Functionally relevant ERP research*

As discussed in Chapter II, a functional approach to DSH may have clinical utility. DSH appears to be share many features with addictive behavior including similar antecedents (see Study I for an examination of the triggers) and consequences (Chapter III) and the behavioural presentation (see Study I). Little is known about the underlying neurobiological mechanisms that support DSH, and much further work is required. There is, however, some indication that the neural circuitry underlying BPD may be similar to that which underlies addictive processes. For example, the neurotransmitter dopamine that regulates the limbic system reward circuitry is hypothesized to play a role in BPD (Friedel, 2004). ERPs have been used to identify addicted individuals and to assess cue reactivity in a range of addictive behaviours. Herrmann et al., (2001) demonstrated that differential frontal ERP activity to alcohol cues distinguished between those with alcohol dependency and social drinkers, and Warren et al., (1999) revealed similar group differences in ERP responses to colour pictures of people smoking and 20 neutral pictures depicting nonsmoking themes between smokers and controls. Fehr et al., (2006) used Event Related Potentials as a means to examine cue reactivity to smoking related cues (primary cues; such as cigarette, smoking and ashtray, and secondary cues; party, bus stop, restroom) in nicotine addicts and Namkoong, Lee, Lee, Lee and An (2004) reported an enhanced P3a amplitude to alcohol related versus neutral cues in alcoholics when compared to controls. It is clear that in addicted individuals ERP activation is sensitive to cues associated with the addictive behaviour.

This thesis has thus far identified that some individuals report that interpersonal, intrapersonal and environmental cues may trigger specific episodes of DSH, but little is known about how these might operate to maintain DSH. Therefore the present study is designed to examine responsivity to both primary DSH words (environmental stimuli used to self-harm, e.g., razor blade) and secondary DSH words (intrapersonal cues associated with DSH e.g., shame and guilt). It may be that cues interfere with the processing of other stimuli in the environment making it harder for those who self-harm to divert their attention away from triggers and manage their urges. The study is designed to investigate the emotional interference effect using a Stroop methodology (Stroop, 1937). The Stroop interference effect appears to correspond with cortical activation across frontal (Fz), parietal (Pz) and central (Cz) regions (West & Alain, 1999) and thus in the present study, analyses focused on midline activation at these sites (for example; Ilan and Polich, 1998; Metzger et al., 1997).

Bryant (2007) identified that individuals with a history of DSH exhibited an attentional bias towards lexical but not pictorial DSH stimuli using the Dot Probe Task (MacLeod et al, 1986). In this task, in each set (consisting of 5 practice tasks, then 80 experimental tasks) participants were required to observe two pictoral or lexical cues on a computer screen which were then replaced by an arrow that pointed in a variety of different directions.  Participants were required to respond by pressing an arrow key on the keyboard that corresponded with the direction that the arrow was pointed Vigilance was assessed as the behavioural reaction time taken for participants to respond to the probes. The study was conducted using first 500ms cues and then 100ms cues in order to control for attentional shift. Participants who were currently engaging in DSH showed a greater vigilance (i.e. faster behavioural reaction time) towards DSH than neutral words relative to participants who were abstaining from DSH (had not engaged in

DSH for 6 months) and control participants who had never engaged in DSH. It might be hypothesized that this attentional bias to DSH cues can be explained by the development of a motivational salience towards these cues, which may be appetitive or aversive (see Chapter III). However, IST would predict that those abstaining from DSH would retain their vigilance to DSH cues, despite terminating their DSH behaviour. This study suggested that those individuals who were abstaining from DSH were able to divert their attention away from cues. Individuals who were currently engaging in DSH were unable to divert their attention and thus the cues may have greater salience for this group. This study provided support for the motivational salience of DSH, proposed by IST, but not for the persistence of neuro-adaptations.

It might be hypothesised that those who engage in DSH exhibit an underlying vulnerability towards cue specific activation, which may be associated with reward sensitivity or responsivity, or it may be that they have acquired a conditioned sensitivity to cues that signal reinforcement (reward, or termination of negative consequences). A second aim of the present study was thus to further examine an IST model of DSH, and the impact of DSH cues at the CNS level. To this end, a visual oddball distractor task was used to assess the motivational salience of lexical environmental and intrapersonal DSH cues.

### *7.1.6 Aims*

The present study was designed to elucidate whether the enhanced ANS arousal in the presence of both DSH and neutral cues identified in the previous studies, is complemented by cue specific brain activation in those who engage in DSH. The study considered whether those with a history of DSH experienced: a) an emotional interference effect when presented with DSH stimuli and b) enhanced attention to DSH cues. To this end, participants who were currently engaging in DSH via cutting and a control group with no history of DSH completed an emotional Stroop paradigm and a visual oddball task whilst behavioural (response time, error rate) and brain responses (N100, P200 and P300 ERP components) to DSH stimuli were assessed. The cognitive processes thought to yield the Stroop effect include response inhibition, interference resolution and behavioural conflict resolution. These executive processes are mediated by the frontal lobe (Adleman et al., 2002). It would therefore be expected that there would be non-group or cue specific differential electrode activation with greater activation during the Stroop task in frontal areas.

*7.1.7 Research questions and hypotheses*

1. Is there cue reactivity to DSH cues during the Stroop task? The elicitation of stimulus related N100, P200 and P300 amplitudes will be greater, and latencies will be shorter to primary and secondary DSH stimuli than neutral stimuli at Fz, Pz and Cz.
2. Do these cues operate via an emotional interference effect? Reaction time (RT) and P300 latency to respond to the colour of Primary and Secondary DSH words will be slower than RT and latency to respond to the colour of neutral cues in participants in the DSH group.
3. Is there selective attention to DSH cues? There will be greater N100 and P300 amplitudes and shorter latencies to distracter than target and standard stimuli in the visual oddball task. There will also be a non-group specific

difference in response to target and standard stimuli with greater P300 activation to target cues.

## 7.2 Method

### *7.2.1 Participants*

*Ethics.* Ethics approval was obtained from the University of Southampton, School of Psychology Ethics Committee.

Participants were 14 individuals, seven of these were currently engaging in DSH via cutting (according to the definition given in Chapter I) and had self-harmed in the 4 weeks prior to the study. These participants were recruited through two channels: a) those who had responded to poster advertisements at the University (n=5) and b) those who had participated in previous research studies and had left their contact details because they wished to participate in further research (n=2). Seven control participants were also recruited via poster advertisement and received course credits for their participation. All participants in the DSH group were female, the male:female ratio in the Control group was 1:6. Age ranged from 18-51 years (M=26.83, *sd*=12.42). Five participants in the DSH group had previously received treatment for difficulties associated with DSH, and three participants were currently using prescribed medication. History of DSH ranged from 2-9 years (*M*=5.83, *sd*=2.56). Exclusion criteria were; a diagnosis of Epilsepy, a skin condition, sensitive skin, uncorrected vision problems, or the use of CNS affecting medication for less than 3 months, because these conditions preclude the use of ERP methodology.

*7.2.2 Apparatus for ERP data recording*

Apparatus for recording the ERP waveforms included Synamps amplifiers, a desktop computer with Neuroscan software for data acquisition and recording software (Neuroscan, Advanced Medical Equipment Ltd) and an Easy-Cap™ with 32 sintered Ag/AgCl electrodes. The stimulus presentation equipment included a desktop computer with a standard keyboard and a button box designed specifically for this study with 4 colour coded buttons. The stimulus presentation programs were written in Presentation v 10.1 (NBS) and data was output to Microsoft Excel 2003.

*7.2.3 Stimuli and experimental tasks*

*Task one.* The first task was a manual response emotional Stroop task based on a task developed by Fehr et al., (2006) for use with nicotine addicts. The four primary DSH stimulus words were the names of implements used to self-harm (environmental cues) these were; razor, knife, blade and glass. Four secondary DSH stimuli consisted of emotion words related to DSH (intrapersonal cues); shame, guilt, stress and anger. Four neutral stimuli were: chair, table, ruler and light. Stimulus duration was 500ms and inter-stimulus interval was pseudo-randomised to range between 900 and 1100ms. Each stimulus was presented four times, in four different colours (red, green, grey and blue) to avoid confounding colour x word effects. The primary DSH words were selected from the stimuli reported in study I and intrapersonal words were selected in consultation with experienced clinicians. A modified version of the standard Stroop task (Stroop, 1935) was randomly integrated across the whole trial sequence. Colour words (e.g., green) were presented in either green (in the congruent condition) or another colour (e.g., blue) in the incongruent condition). Twenty-four congruent and 24 incongruent words were presented. A practice trial consisting of five colour words preceded the main task. All cues were presented in one experimental block.

*Task two.* The second task was a DSH version of a visual distracter oddball task (3 stimulus oddball) written in Presentation following procedures developed by Bledowski et al., (2004). The three stimuli included; neutral target stimuli (e.g., kite), DSH related distracter stimuli (e.g., knife) and neutral standard stimuli (e.g., knight), presented with the probabilities of 0.10, 0.10 and 0.80 consecutively. Each participant was shown only one out of a possible three sets of stimuli (see procedure). Constraints were applied so that not more than two of the same stimuli were presented consecutively. Stimulus duration was 500ms, with a randomised inter-stimulus interval ranging between 900 and 1100ms. Each stimulus was presented 350 times and the complete trial lasted approximately 12 minutes. Target stimuli were placed at least 4 seconds apart in 109 times out of a possible 140 times (77.86%). A practice trial consisting of 50 stimuli; 20 neutral target stimuli and 30 standard stimuli preceded the main task.

### *7.2.4 Procedure*

*Introduction to the study*. This study was granted ethical approval by the University of Southampton, School of Psychology Ethics Committee. After recruitment, participants were invited to attend an initial session at the ERP laboratory in the School of Psychology. On attendance they were invited to give written informed consent to participate in the study.

Participants were seated in a comfortable chair, 50 cm from the stimulus presentation screen. An Easy-Cap ™ with 32 electrodes was prepared and placed over frontal, parietal, central, temporal and occipital regions, that included; Fz, Cz, Pz, and CP2. This took approximately 30 minutes. Prior to the task each participant was required to rate which stimulus (knife, glass or razor) most closely depicted the implement that they used to self-harm. Participants were allocated to receive a version of the task containing that stimulus, such that each participant only observed one set out of a possible three sets of stimuli. Participants were instructed verbally and via instructions that appeared on the computer screen that they would shortly participate in two short tasks, the first of which would involve observing a series of words presented on the screen in four different colours. They were informed that they would be asked to respond using the button box to indicate the colour of each word as it appeared as quickly and accurately as possible. For the first task a practice block consisting of five stimulus trials involving only colour words (e.g. the word ‘green’ presented in the colour blue) were presented. Participants were informed that during the second task they would be asked to press one of the buttons only in response to the presentation of a target word. They were then given the target word. For this task a practice block consisting of 50 trials was presented. Practice trials did not include distracter stimuli. Participants were instructed to press a button on a button box with their index finger as quickly and accurately as possible when a target stimulus was presented and to refrain from responding to all other stimuli. Response time and error rates were recorded. The EEG activity was continuously recorded and participants were instructed to look at the centre of the monitor and to avoid extraneous movement.

*Data acquisition.* Continuous electroencephalographic (EEG) activity was recorded at a sampling rate of 500Hz, with a high frequency cut-off of 70Hz, against CP2 and re-referenced offline to linked mastoids, with an impedance of 15kV or less. Additional electrodes were placed at the outer left and right canthus (HEOG) and above and below the right eye to measure electro-ocular (VEOG) activity with a bipolar recording.

*Data reduction and analysis.* Data reduction was conducted using Brain Vision Analyser (Brainproducts). Waveforms were re-referenced and filtered at a frequency of 20 Hz. Segmentation was determined between -100 ms and 500 ms post stimulus onset. Waveforms were averaged off-line sweeps with higher than +- 100 mV amplitude were rejected. Single-trial data were subjected to a semi-automatic ocular correction procedure to remove any remaining artefacts. The data were subject to baseline correction and then averaged according to stimulus type to generate stimulus related epochs. The data were then subject to peak detection procedures to identify local maxima in each pre-identified interval. The P300 component was determined as the peak maxima between 280-450ms post stimulus onset, the N100 between 80 and 180 ms and the P200 as between 180-280 ms post stimulus onset. The waveforms were averaged according to stimulus type; for the Stroop task, waveforms were averaged according to whether stimuli were Primary DSH, secondary DSH or neutral stimuli and for the Oddball task, averages were taken for Standard, Target and Distracter stimuli. Grand averages were calculated according to Group to enable observation of the waveforms. All data were entered into SPSS v 15.0 for statistical analysis.

## 7.3 Results

### *7.3.1 Analysis strategy*

Exploratory analyses revealed no serious violations to homogeneity of variance, however sphericity was not assumed. A series of repeated measures Multivariate analyses of variance with Bonferroni adjustment to reduce the likelihood of Type I error, and Simple contrasts were applied. Post-hoc analyses of variance and paired t-tests were conducted to further investigate further any significant outcomes or trends in the results.

### *7.3.2 Hypothesis 1 (Stroop stimulus data).*

Mauchley's test for sphericity was violated (excluding P300 latency where sphericity was assumed), so Pillai's test was applied. Means and Standard deviations are displayed in Tables 22 to 26. Multivariate effects were explored. Grand averaged waveforms for each stimulus type across groups are displayed in Appendix C. One of the DSH participants was excluded from analysis due to technical difficulties during data acquisition.

Table 22. *Stimulus related N100 elicited during Stroop task.*

| | *Primary DSH* | | *Secondary DSH* | | *Neutral* | |
|---|---|---|---|---|---|---|
| | *Fz* | *Cz* | *Fz* | *Cz* | *Fz* | *Cz* |
| | | | *Latencies* | | | |
| DSH group | | | | | | |
| M | 119.33 | 114.00 | 124.00 | 110.67 | 122.00 | 118.00 |
| SD | 23.79 | 24.88 | 21.32 | 19.70 | 17.48 | 21.43 |
| Control group | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| M | 124.00 | 126.29 | 128.57 | 124.57 | 125.71 | 118.86 |
| SD | 16.81 | 12.19 | 17.19 | 17.80 | 21.65 | 14.92 |
| | | | *Amplitudes* | | | |
| DSH group | | | | | | |
| M | -4.20 | -2.78 | -2.84 | -1.81 | -3.19 | -2.87 |
| SD | 2.97 | 1.93 | 2.26 | 2.64 | 2.73 | 2.90 |
| Control group | | | | | | |
| M | -2.42 | -1.15 | -3.29 | -2.04 | -3.19 | -1.48 |
| SD | 1.49 | 1.06 | 2.17 | 1.79 | 1.82 | 0.72 |

Table 23. *Stimulus related P200 elicited during Stroop task.*

| | *Primary DSH* | | *Secondary DSH* | | *Neutral* | |
|---|---|---|---|---|---|---|
| | *Fz* | *Cz* | *Fz* | *Cz* | *Fz* | *Cz* |
| | | | *Latencies* | | | |
| DSH group | | | | | | |
| M | 200.00 | 204.00 | 212.00 | 203.33 | 202.67 | 209.33 |
| SD | 16.40 | 32.40 | 32.59 | 23.92 | 34.66 | 39.89 |
| Control group | | | | | | |
| M | 200.57 | 203.43 | 210.29 | 220.57 | 219.43 | 217.14 |
| SD | 24.49 | 27.85 | 29.02 | 35.36 | 20.32 | 40.58 |
| | | | *Amplitudes* | | | |
| DSH group | | | | | | |
| M | 4.09 | 5.33 | 4.84 | 6.44 | 5.33 | 5.53 |
| SD | 3.97 | 3.41 | 3.33 | 2.41 | 3.92 | 2.37 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Control group | | | | | | |
| M | 1.97 | 3.24 | 1.48 | 3.16 | 1.71 | 2.30 |
| SD | 1.59 | 1.50 | 2.59 | 1.54 | 2.62 | 1.21 |

Table 24. Stimulus related P300 elicited during Stroop task.

| | *Primary DSH* | | *Secondary DSH* | | *Neutral* | |
|---|---|---|---|---|---|---|
| | *Fz* | *Cz* | *Fz* | *Cz* | *Fz* | *Cz* |
| | | | *Latencies* | | | |
| DSH group | | | | | | |
| M | 366.67 | 364.67 | 376.00 | 360.00 | 379.33 | 408.67 |
| SD | 32.46 | 44.07 | 33.56 | 37.01 | 32.64 | 24.84 |
| Control group | | | | | | |
| M | 375.43 | 373.14 | 385.14 | 379.43 | 379.43 | 369.71 |
| SD | 44.57 | 43.00 | 15.95 | 37.91 | 16.88 | 19.58 |
| | | | *Amplitudes* | | | |
| DSH group | | | | | | |
| M | -1.66 | 2.02 | -0.89 | 1.83 | -1.07 | 1.01 |
| SD | 2.85 | 4.34 | 4.29 | 9.67 | 4.29 | 8.71 |
| Control group | | | | | | |
| M | -0.09 | 4.00 | 1.20 | 4.16 | 0.57 | 3.61 |
| SD | 2.35 | 3.51 | 1.82 | 4.36 | 0.76 | 3.22 |

*N100 amplitude.* There were no significant main effects or interactions (see Table 25).

Table 25. *N100 amplitude Stroop.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|
| Electrode | 2.68(b) | 2.00 | 0.12 | 0.35 | 0.41 |
| Electrode * group | 0.27(b) | 2.00 | 0.77 | 0.05 | 0.08 |
| Word | 0.19(b) | 2.00 | 0.83 | 0.04 | 0.07 |
| word * group | 1.67(b) | 2.00 | 0.24 | 0.25 | 0.27 |
| Electrode * word | 0.11(b) | 4.00 | 0.97 | 0.05 | 0.06 |
| electrode * word * group | 2.19(b) | 4.00 | 0.16 | 0.52 | 0.40 |

*N100 latency.* Pillai's test revealed that an interaction between word and group had a significant multivariate effect on the combined dependent variables (see Table 26). As can be seen from examination of the means presented in Table 22, those in the DSH group responded faster to Secondary DSH cues than Neutral cues whereas Control participants responded faster to Neutral cues than Secondary DSH cues.

Table 26. *N100 latency Stroop.*

| *Effect* | *F* | *Error df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Electrode | 2.22(b) | 2.22 | 0.1 | 0.31 | 0.35 |
| electrode * group | 2.41(b) | 2.41 | 0.14 | 0.33 | 0.38 |
| Word | 0.48(b) | 0.48 | 0.63 | 0.09 | 0.11 |
| word * group | 4.40(b) | 4.40 | 0.04 | 0.47 | 0.62 |
| electrode * word | 1.04(b) | 1.04 | 0.45 | 0.34 | 0.20 |
| electrode * word * group | 0.96(b) | 0.96 | 0.48 | 0.32 | 0.19 |

*P200 amplitude.* There were no significant multivariate main effects or interactions (see Table 27)

Table 27. *P200 amplitude Stroop.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|
| Electrode | 1.35(b) | 2.00 | 0.30 | 0.21 | 0.23 |
| Electrode * Group | 0.41(b) | 2.00 | 0.67 | 0.08 | 0.10 |
| Word | 1.82(b) | 2.00 | 0.21 | 0.27 | 0.29 |
| Word * Group | 2.03(b) | 2.00 | 0.18 | 0.30 | 0.32 |
| Electrode * word | 1.98(b) | 4.00 | 0.19 | 0.50 | 0.37 |
| Electrode * word * Group | 0.11(b) | 4.00 | 0.98 | 0.05 | 0.06 |

*P200 latency.* There was a significant multivariate main effect of word ($F(2,13)=5.50$, $p<.05$*) on the combined dependent variables (see Table 28). Paired t-tests revealed a significant difference in P300 latency to primary and secondary DSH words at Pz sites, and Primary DSH and Neutral cues at Pz sites.

Examination of the means revealed that P200 latency was shorter to Primary DSH words than Secondary DSH cues, and shorter to Primary DSH words than Neutral words (see Table 23).

Table 28. *P200 latency Stroop.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|
| Electrode | 0.14(b) | 2.00 | 0.87 | 0.03 | 0.07 |
| electrode * group | 0.19(b) | 2.00 | 0.83 | 0.04 | 0.07 |
| Word | 5.50(b) | 2.00 | 0.02 | 0.52 | 0.72 |
| Word * group | 0.51(b) | 2.00 | 0.61 | 0.10 | 0.11 |
| electrode * word | 0.25(b) | 4.00 | 0.91 | 0.11 | 0.08 |
| electrode * word * group | 1.05(b) | 4.00 | 0.44 | 0.35 | 0.21 |

*P300 amplitude.* Examination of the multivariate effects (see Table 29) revealed that there was a significant main effect of electrode location ($F(3,10)=9.80$, $p<.01$**) on the combined dependent variables. Examination of the means revealed that P300 activation was greatest at parietal (Pz) sites, then central sites and smallest at frontal sites (see Table 24). Paired t-tests identified that there were significant differences across electrode location in response to Primary and Secondary DSH cues, but not Neutral cues (see Table 21 for descriptive statistics).

Table 29. *P300 amplitude Stroop.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta* | *Observed* |
|---|---|---|---|---|---|

| | | | | Squared | Power(a) |
|---|---|---|---|---|---|
| Electrode | 9.808(b) | 2.00 | 0.00 | 0.66 | 0.93 |
| Electrode * group | 2.214(b) | 2.00 | 0.16 | 0.31 | 0.35 |
| Word | 0.539(b) | 2.00 | 0.60 | 0.10 | 0.12 |
| Word * group | 0.143(b) | 2.00 | 0.87 | 0.03 | 0.07 |
| Electrode * word | 2.894(b) | 4.00 | 0.09 | 0.59 | 0.52 |
| Electrode * word * group | 0.838(b) | 4.00 | 0.54 | 0.30 | 0.17 |

*P300 latency*. There were no significant main effects or interactions (see Table 30).

Table 30. *P300 latency Stroop.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|
| Electrode | 0.40(b) | 2.00 | 0.68 | 0.07 | 0.10 |
| electrode * group | 0.28(b) | 2.00 | 0.76 | 0.05 | 0.08 |
| Word | 1.91(b) | 2.00 | 0.20 | 0.28 | 0.31 |
| word * group | 1.93(b) | 2.00 | 0.20 | 0.28 | 0.31 |
| electrode * word | 1.19(b) | 4.00 | 0.38 | 0.37 | 0.23 |

*7.3.3 Hypothesis 2 (Stroop RT data).*

Kolmogorov-Sminov tests revealed no serious violations to normality, however, examination of histograms suggested that data were positively skewed. Therefore, both parametric tests were conducted and non-parametric tests were conducted to confirm results. A mixed ANOVA was conducted, with RT (ms) as the dependent variable. The between-groups factor was Group (DSH v Control) and the within-subjects factor was Cue type (Primary DSH, Secondary DSH and neutral). There was no significant main effect of cue type ($F(2, 11)=1.64$, $p=.23$), or group ($F(1,11)=.14$, $p=.71$), and no significant cue type*group interaction ($F(2,11)= .18$, $p=.68$). There was no significant difference in reaction time to respond between cue types across the whole sample ($F(2, 11)=1.11$, $p=.37$). Bivariate correlations were conducted between behavioural reaction time data for each cue type and ERP Stroop stimulus data. N100 activation to neutral cues was significantly negatively correlated with RT to Primary(r=-.634, $p<.027$), secondary DSH (r=-.647, $p<.031$) and neutral cues (r=-.630, $p<.028$). There were no other significant correlations.

Three separate Mann-Whitney tests, with groups as the between group factor and each cue type as a dependent variable confirmed that there were no significant differences in reaction time to cues between groups.

*7.3.4 Hypothesis 3 (Oddball stimulus data).*

*Pillai's* correction was applied to all analyses as sphericity was not assumed. Means and standard deviations are displayed in Tables 31 to 33.

Table 31. *Stimulus related N100 elicited during visual oddball task.*

| | *Standard* | | | *Target* | | | *Distracter* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Fz* | *Cz* | *Pz* | *Fz* | *Cz* | *Pz* | *Fz* | *Cz* | *Pz* |
| | | | | | *Latencies* | | | | |
| DSH group | | | | | | | | | |
| M | 129.71 | 125.14 | 111.43 | 140.57 | 138.29 | 125.14 | 136.00 | 134.86 | 138.86 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SD | 28.27 | 41.16 | 28.04 | 34.29 | 39.52 | 43.00 | 24.98 | 28.07 | 40.05 |
| Control group | | | | | | | | | |
| M | 132.57 | 128.57 | 124.57 | 140.57 | 150.29 | 149.71 | 129.71 | 138.86 | 148.57 |
| SD | 19.79 | 19.52 | 39.96 | 14.86 | 23.31 | 48.82 | 17.26 | 22.12 | 43.78 |
| | | | | | *Amplitudes* | | | | |
| DSH group | | | | | | | | | |
| M | -0.81 | -0.97 | -0.41 | -1.79 | -0.77 | -0.26 | -2.06 | -1.85 | -1.30 |
| SD | 2.93 | 2.52 | 1.99 | 3.26 | 2.46 | 4.43 | 2.94 | 2.11 | 1.22 |
| Control group | | | | | | | | | |
| M | -2.71 | -2.31 | -1.72 | -4.57 | -2.59 | -1.99 | -2.75 | -2.45 | -1.61 |
| SD | 2.20 | 1.33 | 1.95 | 3.06 | 2.02 | 1.98 | 2.56 | 1.96 | 1.96 |

Table 32. *Stimulus related P200 elicited during visual oddball task.*

| | *Standard* | | | *Target* | | | *Distracter* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Fz* | *Cz* | *Pz* | *Fz* | *Cz* | *Pz* | *Fz* | *Cz* | *Pz* |
| | | | | | *Latencies* | | | | |
| DSH group | | | | | | | | | |
| M | 205.71 | 202.86 | 188.00 | 220.57 | 225.71 | 223.43 | 199.43 | 192.57 | 198.29 |
| SD | 37.01 | 32.14 | 32.90 | 25.45 | 31.99 | 35.21 | 22.44 | 26.68 | 38.08 |
| Control group | | | | | | | | | |
| M | 202.86 | 212.00 | 221.14 | 208.57 | 228.57 | 237.14 | 213.71 | 204.00 | 225.71 |
| SD | 13.41 | 23.32 | 39.24 | 27.66 | 28.42 | 24.84 | 25.39 | 23.78 | 36.65 |
| | | | | | *Amplitudes* | | | | |
| DSH group | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| M | 3.60 | 3.18 | 4.37 | 7.51 | 7.64 | 7.11 | 4.84 | 5.24 | 4.71 |
| SD | 3.13 | 3.52 | 3.22 | 4.74 | 6.33 | 6.21 | 4.43 | 5.18 | 4.71 |
| Control group | | | | | | | | | |
| M | 1.98 | 2.93 | 3.14 | 2.09 | 3.94 | 3.11 | 3.18 | 3.78 | 3.85 |
| SD | 2.22 | 1.26 | 3.25 | 4.97 | 3.45 | 3.35 | 3.17 | 1.84 | 3.62 |

Table 33. *Stimulus related P300 elicited during visual oddball task.*

| | *Standard* | | | *Target* | | | *Distracter* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Fz* | *Cz* | *Pz* | *Fz* | *Cz* | *Pz* | *Fz* | *Cz* | *Pz* |
| | | | | | *Latencies* | | | | |
| DSH group | | | | | | | | | |
| M | 361.71 | 342.86 | 330.86 | 373.71 | 380.57 | 401.71 | 334.86 | 363.43 | 357.14 |
| SD | 35.62 | 44.04 | 19.00 | 50.96 | 53.39 | 20.25 | 48.37 | 58.12 | 59.85 |
| Control group | | | | | | | | | |
| M | 374.29 | 368.00 | 333.71 | 362.86 | 417.71 | 422.29 | 345.14 | 393.71 | 380.00 |
| SD | 28.46 | 21.17 | 43.93 | 74.47 | 47.88 | 50.38 | 28.73 | 53.91 | 60.40 |
| | | | | | *Amplitudes* | | | | |
| DSH group | | | | | | | | | |
| M | 2.21 | 3.40 | 4.65 | 6.36 | 9.42 | 13.05 | 2.62 | 5.85 | 5.98 |
| SD | 4.44 | 5.25 | 5.34 | 5.85 | 8.51 | 8.72 | 3.88 | 5.82 | 4.11 |
| Control group | | | | | | | | | |
| M | -0.51 | 1.00 | 1.73 | 1.86 | 6.98 | 9.77 | -0.17 | 2.97 | 5.63 |
| SD | 2.28 | 2.16 | 1.94 | 4.87 | 8.49 | 7.57 | 2.39 | 3.48 | 4.47 |

*N100 amplitude.* There were no significant multivariate main effects or interactions (see table 34).

Table 34. *N100 amplitude Oddball.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|
| Electrode | 1.14(b) | 2.00 | 0.36 | 0.17 | 0.20 |
| electrode * group | 0.22(b) | 2.00 | 0.80 | 0.04 | 0.08 |
| Word | 1.23(b) | 3.00 | 0.35 | 0.27 | 0.24 |
| word * group | 0.63(b) | 3.00 | 0.61 | 0.16 | 0.14 |
| electrode * word | 1.82(b) | 6.00 | 0.23 | 0.61 | 0.35 |
| electrode * word * group | 0.31(b) | 6.00 | 0.91 | 0.21 | 0.09 |

*N100 latency.* There were no significant main effects or interactions (see Table 35).

Table 35. *N100 latency Oddball.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|
| Electrode | 0.180(b) | 2.00 | 0.84 | 0.03 | 0.07 |
| electrode * group | 0.85(b) | 2.00 | 0.45 | 0.13 | 0.16 |
| Word | 2.81(b) | 3.00 | 0.10 | 0.46 | 0.50 |
| word * group | 0.12(b) | 3.00 | 0.95 | 0.04 | 0.07 |
| electrode * word | 3.48(b) | 6.00 | 0.06 | 0.750 | 0.62 |
| electrode * word * group | 0.96(b) | 6.00 | 0.51 | 0.45 | 0.19 |

*P200 amplitude.* There were no significant multivariate main effects or interactions (see table 36).

Table 36. *P200 amplitude oddball.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|
| Electrode | 0.78(b) | 2.00 | 0.48 | 0.13 | 0.15 |
| Electrode * group | 0.22(b) | 2.00 | 0.81 | 0.04 | 0.08 |
| Word | 0.94(b) | 3.00 | 0.46 | 0.22 | 0.19 |
| word * group | 1.04(b) | 3.00 | 0.42 | 0.24 | 0.21 |
| Electrode * word | 1.42(b) | 6.00 | 0.33 | 0.550 | 0.28 |
| electrode * word * group | 2.08(b) | 6.00 | 0.18 | 0.64 | 0.40 |

*P200 latency.* There was a significant multivariate effect of the interaction between electrode and word on the combined dependent variables (see Table 37). To identify the source of the interaction, A One way Analysis of Variance was conducted separately for each electrode location, with Word as the repeated measure, collapsed across diagnostic groups. The Green-house Geisser correction was applied as sphericity was not assumed. There was no significant main effect of Word at Fz or Pz sites. There was a significant main effect of Word at Cz. Paired t-tests revealed that P200 activation was significantly faster to distracter cues than target cues (see Table 32).

Table 37. *P200 latency oddball.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Electrode | 1.61(b) | 2.00 | 0.24 | 0.23 | 0.27 |
| electrode * group | 1.81(b) | 2.00 | 0.21 | 0.25 | 0.30 |
| Word | 1.33(b) | 3.00 | 0.32 | 0.29 | 0.25 |
| word * group | 0.24(b) | 3.00 | 0.87 | 0.06 | 0.08 |
| electrode * word | 6.02(b) | 6.00 | 0.02* | 0.84 | 0.87 |
| electrode * word * group | 0.67(b) | 6.00 | 0.68 | 0.37 | 0.15 |

*P300 amplitude.* There were significant multivariate main effects of word and electrode on the combined dependent variables (see Table 38). Examination of the means revealed that P300 amplitude was significantly greater to target words than standard or distracter cues. After collapsing data across groups and considering each electrode location in turn, paired t-tests were conducted to examine differences in activation to word types.

At Fz sites, activation to target cues was significantly greater than activation to standard cues. P300 activation to target cues was also significantly greater than P300 amplitude distracter cues. There were no significant differences in activation between standard and distracter stimuli.

At Cz sites, P300 amplitude to target stimuli was significantly greater than P300 amplitude to standard stimuli and distracter stimuli. P300 amplitude was significantly greater to distracter than standard cues.

At Pz sites, P300 amplitude followed the same pattern, P300 amplitude to target stimuli was significantly greater than P300 amplitude to standard stimuli and distracter stimuli. P300 amplitude was significantly greater to distracter than standard cues. Activation was greatest at Pz, then Cz then Fz sites and these differences were significant across word types.

Table 38. *P300 amplitude oddball.*

| Effect | F | Hypothesis df | Sig. | Partial Eta Squared | Observed Power(a) |
|---|---|---|---|---|---|
| Electrode | 15.64(b) | 2.00 | 0.00** | 0.74 | 0.99 |
| electrode * group | 0.03(b) | 2.00 | 0.97 | 0.01 | 0.05 |
| Word | 4.90(b) | 3.00 | 0.02* | 0.60 | 0.76 |
| word * group | 0.10(b) | 3.00 | 0.95 | 0.03 | 0.06 |
| electrode * word | 1.45(b) | 6.00 | 0.32 | 0.55 | 0.28 |
| electrode * word * group | 1.54(b) | 6.00 | 0.29 | 0.57 | 0.30 |

*P300 latency.* Examination of the multivariate effects (see table 39) showed that an interaction between electrode and word had a significant effect on the combined dependent variables. To identify the source of the interaction, A One way Analysis of Variance was conducted separately for each electrode location, with Word as the repeated measure, collapsed across diagnostic groups. The Green-house Geisser correction was applied as sphericity was not assumed. There was no significant main effect of Word at Fz ; there was no significant main effect of Word at Cz . At Pz there was a significant main effect of word. Paired t-tests revealed that P300 activation was significantly faster to standard cues than target cues and distracter cues. Activation was significantly faster to distracter than target cues.

Table 39. *P300 latency oddball.*

| *Effect* | *F* | *Hypothesis df* | *Sig.* | *Partial Eta Squared* | *Observed Power(a)* |
|---|---|---|---|---|---|
| Electrode | 1.36(b) | 2.00 | 0.27 | 0.20 | 0.23 |
| electrode * group | 0.66(b) | 2.00 | 0.54 | 0.11 | 0.13 |
| Word | 3.38(b) | 3.00 | 0.06 | 0.50 | 0.58 |
| word * group | 0.31(b) | 3.00 | 0.82 | 0.08 | 0.09 |
| electrode * word | 11.12(b) | 6.00 | 0.00 | 0.91 | 1.00 |
| electrode * word * group | 0.860(b) | 6.00 | 0.57 | 0.42 | 0.18 |

## 7.4 Discussion

### *7.4.1 Purpose of study*

The purpose of the present study was to combine an ERP methodology and two behavioural tasks to identify whether; a) triggers for DSH elicit enhanced cue reactivity in those who self-harm, b) whether these cues operate via an emotional interference effect and c) if there is enhanced selective attentional activity indicative of a motivational salience for DSH cues. An emotional Stroop task was used to investigate cue reactivity and to test the hypothesis that DSH stimuli interfere with emotion processing in individuals reporting that they engage in DSH. In order to investigate whether mechanisms of selective attention are involved in DSH cue processing, a three stimulus visual oddball paradigm with DSH distracter stimuli was utilised. It was hypothesized that individuals with DSH would show delayed behavioural reaction times to colour name, longer latencies to respond and higher P300 amplitudes to the DSH stimuli in the emotional Stroop paradigm. It was also expected that they would show increased

N100 and P300 amplitudes to DSH distractor stimuli and delayed reaction times to respond to target stimuli in the oddball task. This was a preliminary study and the first to evaluate ERP activation to DSH cues in individuals reporting that they currently engage in DSH.

*7.4.2 Cue-reactivity assessed by the Stroop task*

Contrary to hypotheses, N100, P200 and P300 amplitude to primary and secondary DSH cues were not enhanced compared to activation to neutral cues, in those who DSH. There were also no differences in amplitude to cues between those who engage in DSH and controls. There was a main effect of electrode; contrary to the hypothesised enhanced activation in frontal areas, P300 activation was greater at Pz than Cz or Fz sites. This suggests that enhanced cue specific reactivity was not identified using measures of cortical activity in those who self-harm. Enhanced parietal activation may simply reflect enhanced visuo-spatial response to cues.

When considering latency of activation, however, there was a significant interaction between word and group in N100 component. Whereas those who engage in DSH exhibited a faster latency in N100 activation to secondary self-harm cues (such as shame and guilt), than neutral cues, those in the Control group exhibited the opposite response pattern, with faster activation to neutral cues. The N100 component is thought to be an indicator of the preconscious allocation of attentional resources. This study provides some preliminary evidence to indicate that those who engage in DSH might exhibit faster allocation of attention towards emotional cues associated with DSH, although this was a weak effect. This suggests that they may be hyper vigilant to such information and that this may be cortically represented. It might also indicate that these cues have motivational salience, although much further work is required. As described in the introduction to this chapter, it is difficult to distinguish between the deliberate allocation of attentional resources (selective attention) and the existence of an underlying motivational salience for cues, and the visual oddball task was employed to this end. However, the N100 component reflects preconscious allocation of attention, and thus activation of this component is non-volitional. This is an important although highly preliminary finding that might reflect an underlying vulnerability in those who engage in DSH, and thus requires further investigation.

There was no corresponding effect of Primary DSH cues (environmental cues that signal availability of DSH) at the preconscious level, emotional or intrapersonal distress cues may enhance an individual's vulnerability to engage in DSH without conscious awareness.

At P200, there was a main effect of word across groups; latency of activation was fastest to primary DSH, then secondary DSH cues, then neutral cues. As the P200 is considered to reflect the detection of the intensity of the stimulus, it may be that DSH cues were more powerful and emotionally evocative stimuli to all participants. Further work might include positive or negative stimuli that are matched for intensity with the DSH cues rather than neutral cues. This may have masked any group differences. Latency of the P300 is associated with the allocation of mental resources for stimulus processing, and is inhibited when attention is diverted elsewhere. There was a significant main effect of electrode in P300 latency. Contrary to hypotheses, responses were fastest at Pz sites, compared to Fz and Cz.

7.4.3 *Emotional interference effect assessed by the Stroop task.*

Contrary to hypotheses and to the findings relating to PTSD reported by Metzger et al., (1997) this study found no difference in RT to DSH and neutral stimuli in individuals reporting that they engaged in DSH, and no differences in RT across groups. There was no evidence for an emotional interference effect. Those who engage in DSH were able to respond as rapidly to task relevant information as controls (P300 activation was greatest to target stimuli). Although this study did not find evidence to support an emotional interference effect for DSH cues, further research is required before this hypothesis can be rejected. N100 amplitude to neutral cues was significantly negatively correlated with RT to primary, secondary DSH and neutral cues. This suggests that the greater the preconscious allocation of attention to neutral cues, the slower the response to all cues i.e. when attention is focused on task relevant stimuli, individuals may be less hyper-responsive to novel or distracting stimuli. Similar to the findings of Metzger (2007) there were no other significant correlations between behavioural RT data and stimulus related ERP amplitudes or latencies. Further investigation into the association between these two measures is required.

It is possible that an attentional bias may exist, independently of an emotional interference effect. Despite robust evidence to support the existence of an attentional bias in anxiety disorders, De Cort, Hermans, Spryt, Griez and Schruers (2007) were unable to elicit an attentional bias in Panic Disorder using an emotional Stroop task. The authors found no group differences in RT to stimuli (panic related threat, threat and neutral stimuli) and no word effect in their sample.

The lack of an emotional Stroop interference effect may be indicative of the clinically reported experiential avoidance in those who self-harm, such that when general arousal is high individuals utilise mechanisms such as avoidance, distraction or dissociation to manage this arousal. These may be maladaptive in the longer-term.

### *7.4.4 Motivational salience assessed by the Oddball task*

The visual oddball task was used to evaluate the attention grabbing properties of DSH cues, testing an incentive salience model of triggers for DSH. There was no effect of word or group on activation at N100 sites (amplitude or latency) suggesting that the oddball task did not identify group specific differences in the preconscious allocation of attention to DSH cues. There were also no group or cue type differences in P200 amplitude, suggesting that the stimuli selected were equally salient to both groups. It might be important to consider using personalised cues to enhance the intensity of the distracter cue. There was, however, an interaction in P200 latency between word and electrode across both groups: central (Cz) activation was faster to distracter than target cues.

There was a main effect of word and a main effect of electrode in P300 amplitude. Across groups, P300 amplitude was greater to target cues, than distracter and standard stimuli. P300 activation to distracter stimuli was greater than standard stimuli at Pz and Cz but not Fz sites. There were the expected differences in activation to target and standard cues.

There was an interaction in P300 latency between electrode and word, with activation fastest to standard then distracter then target cues. This might be expected because with increasing amplitude it would take longer for responses to reach a peak. Shorter latencies in P300 response are related to a faster processing speed which is usually associated with enhanced cognitive functioning (Mertens

& Polich, 1997), indicating the speed in distributing and maintaining attentional resources. Latencies increase with increasing task demands, thus as neutral stimuli require less processing, it might be expected that latencies would be shorter to such stimuli.

### *7.4.5 Limitations*

This study was a preliminary test of the use of ERP methodologies in a DSH sample. The main limitation is the small sample size which will have reduced the power of the statistical tests and made it difficult to observe expected effects. In similar PTSD research Metzger et al., (1997) used a sample size of 19. Replication with a larger sample size would reduce the chance of Type II errors, and would allow for the control of inter-individual differences in activity (particularly in P300 components, Van Beijsterveldt, Molenaar, de Geus & Boomsma, 1998) responsivity and susceptibility to electrical impedances during data acquisition.

Post-hoc power calculations were conducted using GPower 3.0.8. When considering within group differences in P300 amplitude activity during the oddball task, where there is robust evidence to suggest there should have been significant differences in activity to standard and target stimuli, calculations indicated that a sample size of n=54 would have been required to reliably investigate such effects, given the alpha level $\alpha$=0.01, and the observed effect size of $\beta$=.010.

This study failed to find support for an emotional interference effect of DSH cues; however, this may be a function of the limited sample size, with inadequate power to find an effect. However, the fact that such a large sample size would be required to detect an effect indicates that any clinical impact of the reported effects is relatively weak. Due to the possibility that a Type II error occurred, further investigation using this methodology is, however, recommended. As described in previous chapters, this was not possible within the limitations of the research context owing to difficulties recruiting further active self-harmers.

It is also possible that the cues selected were not arousing or salient enough to elicit an effect. A priori testing would have enabled selection of the cues that were most appropriate. It is possible that words such as 'blood' and 'cut' may have greater impact on reactivity than implements such as 'knife', however, beta testing would have enabled these items to be rated for salience, urges to self-harm, arousal etc to ensure that these words were not equally arousing to control participants.

Yamamoto, Morita, Shoji, Nishiura and Maeda (2005) reported that anti-psychotic medication was found to reverse the cognitive deficits associated with psychosis by reducing P300 amplitude and latency to target stimuli presented in the visual oddball paradigm. Participants in the present study reported using a range of prescribed medications and it may be that these enhanced cognitive performance.

It is important to rule out task demand characteristics as cognitive performance may have been influenced by motivation and engagement with the task. Control participants may have been less interested in the task or distracted. Control participants were offered extrinsic reward to participate (course credits) whereas the participants in the DSH group may have been more intrinsically motivated to participate and may have paid greater attention to the task.

There were, however, no between group differences in reaction time to respond to a target. In support of the data presented by Metzger et al., (1997) there does not appear to be a correlation between ERP activation and behavioural reaction time. Further investigation of the relation between the two measures is required. It may be that the assessment of CNS reactivity is a more sensitive measure of response, accessing earlier cognitive processes than behavioural measures.

7.4.6 *Theoretical implications*

This study identified some preliminary evidence that indicated a tendency towards greater reactivity to emotional stimuli in those with a history of DSH (through differences in the preconscious allocation of attention to stimuli). The fact that differences were found when considering preconscious effects needs to be explored further, even though the effects were relatively weak, because individuals who self-harm may be vulnerable to negative emotional stimuli without conscious awareness.

This study failed to find evidence of an emotional interference effect of DSH cues in those who engage in self-harm. It was hypothesised that an emotional interference effect would result in impaired regulation of adaptive responses. There is evidence to suggest that such individuals may exhibit an impulsive response style and an impaired capacity to inhibit such responses and learn from erroneous actions. It has been proposed that a selective attention towards DSH cues would impair the ability to divert attentional resources to other more adaptive ways of regulating distress, thus maintaining DSH. This study failed to find evidence of such an emotional interference effect in DSH, despite indication that there may be a faster preconscious allocation of attention to DSH stimuli, they were able to respond to task demands, indicating that individuals are able to divert attention away from cues, at least in the short-term. It may be that this reflects the use of distraction or avoidance coping techniques in those who self-harm. Further work to consider how such individuals do respond under conditions of distress is required.

De Brujin (1996) identified differential ERN responding, which is associated with ACC activity, in individuals with BPD. There is evidence to suggest that Anterior Cingulate Cortex activation also underlies the Stroop interference effect. It was expected that activation during the Stroop would be greatest in frontal areas, however in the present study, Parietal areas yielded greatest activation. Linden et al., (1999) identified that during the visual oddball task activation was greatest at parieto-central regions. Differential activation during the Oddball task in the present study was as expected.

### 7.4.7 *Future research*

Future research should firstly consider replication of the study with a larger sample size. As there was an indication that preconscious allocation of attention may be important to consider, further work is required to elucidate the motivational salience of cues (Robinson and Berridge, 1993) and whether these signal approach or avoidance. A task that involves more active participation to divert attention might be appropriate. Enriquez and Bernie (2007) identified that RT and response accuracy on a dichotic listening differed between high and low dissociators as identified by the Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986). This task required participants to respond to verbal and emotional stimulus targets successively. As described in Chapter II, Dissociation is commonly found to be associated with DSH. Such a task when mapped with an assessment of N100 and P300 ERP activity might discriminate between differential cortical activity when responding to motivationally salient versus neutral cues.

As this study suggests that reactivity to DSH cues does not operate via an emotional interference effect, future work should consider how these cues do operate. It may be that cues that predict the availability of self-harm ‘safety cues’, signal approach, whereas cues that set the scene for self-harm might trigger approach or avoidance. As indicated by De Brujin (2006) it may be that under conditions of distress, individuals place themselves under conditions in which they are more vulnerable, or expose themselves to further stress, as they are less able to monitor negative consequences. Future research might consider how individuals respond to stressor tasks after exposure to interpersonal distress. future research might focus on developing a greater understanding of the operating mechanisms underlying DSH, perhaps considering methodologies that assess the role of avoidance and the mechanisms by which individuals manage their urges, reactivity and distress.

Contrary to studies two and three, the present study found no evidence of a generalised hyper-arousal in DSH.  There were no differences in reactivity across groups, which may be due to the stimulus mode (words rather than pictures) which may evoke less of a startle response. Autonomic or electrodermal responding may reflect a conditioned orienting reflex whilst cortical activation may reflect stimulus detection and categorization that requires further cognitive processing of a cue. Therefore it might be argued that it would be possible for individuals who engage in DSH to demonstrate a generalised autonomic hyperacvtivity or startle reflex, without an underlying cognitive vulnerability to hyperactivity. Further research to assess hyperarousal to auditory startle paradigms (Turpin, 1986) might delineate whether the ANS hyperarousal is suggestive of an approach/avoidance reflex, which is not supported by volitional or non-volitional cognitive reactivity.

However, further examination of hyper-arousal is required, and the assessment of ERP activity during an auditory oddball task could help to elucidate this further and examine whether there is a generalised hyperactivity in responding, in addition to the cue specific reactivity indicated by the enhanced latency in P200 responding and ANS measures in those who engage in DSH.

Bryant (2007) reported an attentional bias to lexical DSH stimuli but not pictoral stimuli in those with a history of DSH. This study thus focused on lexical cues, further research might consider alternative stimulus modes such as photographs and DSH implements.

As Polich (2004) identified that ERP could usefully discriminate between different pathologies and Williams et al., (1996) identified pathology-related emotional Stroop effects, it is important to have a clear picture of the clinical symptoms and associated pathologies of participants. As those who engage in DSH may experience a range of co-morbid clinical conditions, such as BPD, PTSD and Depression it is important to ensure that cues are personalised and that clinical factors that may impact on cue salience are taken into consideration in future research.

There might be ways of refining the methodology further, for example incorporating a range of distractor stimuli in the oddball task to control for habituation to cues. It might also be important to consider the environmental context of the laboratory and perhaps to incorporate a mood or affect induction procedure. Field et al., (2001) examined the emotional Stroop effect in a sample of individuals with a history of CSA. Those with a recent sexual re-victimization (in the last 6 months) were found to exhibit amplified response latency when compared to those without a recent re-victimization, suggesting a priming effect. As described in Chapter III, It might be hypothesised that; both operating mechanisms that motivate the individual to move from the current state (such as interpersonal distress) and environmental stimuli that signal availability of DSH are required to evoke reactivity to cues that exceeds the enhanced hyper-reactivity to stimuli. A priming procedure using personalised distress scripts might be one such way of eliciting such conditions (Schmahl, Vermetten, Elzinga and Bremner, 2003; Litz, 2005).

## 7.5 Summary

Previous studies identified that those who engage in DSH report that triggers are important in the maintenance of DSH and they also exhibit enhanced ANS reactivity to DSH cues when compared to controls. This preliminary study indicated that those who have a history of DSH may pre-consciously allocate attention emotional DSH cues faster than those without the history of DSH. There was no evidence to support emotional interference or further indicators of an underlying motivational salience for DSH cues. This study provided a preliminary investigation of ERP activity to two behavioural tasks in individuals who engaged in DSH in order to identify the processes by which triggers may operate to maintain DSH. First, this study indicated a slightly enhanced preconscious allocation of attention to emotional cues, providing preliminary indication that there may be a salience towards emotional cues. Second, DSH cues do not maintain DSH via an emotional interference effect and third, that DSH cues were not encoded differently from neutral cues.

This study provides some indication of faster responsivity to emotional cues, but there is no indication of emotional interference, further work that considers how these cues might operate is required. One hypothesis is that when exposed to emotional distress cues individuals who engage in DSH may enhance their vulnerability to engage in DSH by placing themselves under conditions of further stress. The following study considers how such cues operate on tolerance for pain and psychological stress.

# Chapter VIII Study V: Priming and Distress Tolerance

## 8.1 Introduction

### *8.1.1 Chapter Overview*

Because earlier studies failed to show clear evidence of cue reactivity, despite evidence for intrapersonal/environmental triggers based on self-report (Study I), further experimental examination of the establishing operations for DSH is required (see chapter III for a definition). Measures of CNS reactivity indicated that those who self-harm exhibited a faster preconscious allocation of attention towards emotionally distressing cues such as shame and guilt. However, these measures failed to elucidate the specific mechanisms by which such cues elicit reactivity and identified a trend towards a general pattern of hyperarousal in DSH. It may be that interpersonal distress functions as an establishing operation for DSH.

The present study is designed to investigate experimentally how interpersonal distress may enhance vulnerability to engage in DSH. The Biosocial Theory (Linehan, 1993) suggested that individuals who have historically experienced invalidating environments find it difficult to regulate their emotional responses to stressors. Based on this theory, it might be expected that when cued with a distressing interpersonal situation, such individuals are overwhelmed, having neither the resources nor skills to regulate their emotional response effectively, which would in turn reduce the capacity to tolerate later stressors. If interpersonal distress impacts on the way that an individual tolerates physical pain and psychological stress, then interventions that are designed to help an individual to manage their responses to distress would be expected to have clinical utility. Distress tolerance is defined as ‘as an individual’s behavioral persistence in the face of emotional and/or physical distress' (Daughters, Lejuez, Bornovalova, Kahler, Strong &Brown, 2005)

Fundamental underlying difficulties with distress tolerance would make it more challenging for an individual to tolerate therapy. An improved understanding of tolerance for stress, and the conditions under which this is enhanced or diminished, would indicate how therapy could be enhanced to enable individuals to engage with therapy despite such distress and prevent attrition.

The present study was designed specifically to assess how priming people who engage in DSH with a personalised negative interpersonal distress script impacted on the capacity to tolerate two different types of stressor; psychological frustration and physical stress (pain tolerance) as distinguished by Daughters et al., (2005). There is a scarcity of research that explores whether these two have similar or different underlying functional mechanisms.

As described in Chapter II, 50% of individuals who engage in DSH experience no pain during the act (Leibenluft et al., 1987). Individuals who experience analgesia during an act of DSH are also found to persist longer on behavioural tasks that assess pain tolerance, for example, the Cold Pressor Test (CPT) (Russ, Campbell, Kakuma, Harrison & Zanine, 1999). According to the Opiod hypothesis, as explained in Chapter II, DSH may be positively reinforced by the release of beta-endorphins that relieve pain. Repeated exposure to DSH may thus enhance the capacity of an individual to tolerate pain.

For those who do experience pain during DSH, the pain itself may serve a functional purpose. Some individuals who engage in DSH report that they do so in order to end feelings of numbness or dissociation and that the experience of pain makes them feel ‘real’ again. Other individuals describe using such pain to express their feelings of shame, or to self punish (Suyemoto, 1998).

The CPT is a widely used behavioural pain tolerance task that allows the investigation of inter-individual variation. Walsh, Schoenfield, Ramamurthy and Hoffman (1989) presented a normative model for the CPT that revealed a bimodal distribution of tolerance/ persistence on the task. The authors reported that 48% of young male Anglo-Saxons (mean age =25) were able to persist on the CPT, for longer than 60 seconds but only 12% of females were able to persist.

A second device used to experimentally induce physical pressure, or pain, is the algometer (Jensen et al., 1986). This method allows reliable application of pressure of a constant intensity, and tolerance can be assessed via self-report of distress, and time taken to terminate the task.

There is, however, a scarcity of research that considers whether physical and psychological distress tolerance, are functionally equivalent. Recently, behavioural methodologies have been developed to assess psychological distress tolerance. The Mirror Tracing Persistence Task (MTPT-C; Strong, Lejuez, Daughters, Marinello, Kahler & Brown, 2003) has been used to predict treatment outcome (Brandon et al., 2003) whereby pretreatment tolerance on the MTPT positively predicted sustained abstinence throughout the 12 months of follow-up in 144 smokers. Moreover, persistence predicted outcome independent of other significant predictors: gender, nicotine dependence, negative affect, and self-efficacy. This procedure has been used in previous research to increase participants’ frustration, stress, blood pressure, and pulse (e.g., Matthews & Stoney, 1988).

When developing a clinical intervention for DSH there may be clinical utility in the identification of the specific conditions under which individuals are more or less able to tolerate such distress. These conditions might be described as the establishing operations for DSH. If, under specific conditions such as interpersonal distress, individuals are motivated to change their current state and unable to use more adaptive ways to manage these conditions, they make be more likely to use maladaptive responses such as DSH.

It may be that those who engage in DSH are functionally impaired in their ability to tolerate distress and thus are more sensitive to experience stress. Alternatively under conditions of interpersonal distress (e.g., following an argument with a friend) they may be less able to tolerate later stressors (e.g., an exam), such that they feel compelled to respond using maladaptive behaviours such as DSH.

The present study used a two stage design. First, the present study involved an examination of differences in the ability to tolerate a physical stressor (CPT) between those with a history of self-harm and a group of controls. Second, each group was divided into two subgroups. Each group was allocated to either the distress or neutral condition, whereby they received either a personal neutral or personalised distress script, thus creating four conditions, before exposure to physical or psychological stressor tasks. A script driven imagery approach was used. Personalised interpersonal scripts generated from individual interviews were presented as a priming stimulus. Schmahl, Vermetten, Elzinga and Bremner (2003) used a similar script-driven imagery approach to study the neural correlates of memory reactivation in individuals with a diagnosis of BPD. Scripts featured loss, rejection or abandonment experiences that reflected the theme of interpersonal violation. The authors reported that participants with a BPD demonstrated increased dorsolateral prefrontal cortex activation and decreased anterior cingulate cortex activation when listening to an abandonment script. The script generation procedure followed that developed by Peter Lang (e.g., Lang & Cuthbert, 1984), and adapted by Pitman, Orr, Forgue, de Jong, and Claiborn (1987), Keane et al., (1998), and Levenson, Carstensen, Friesen and Ekman (1991). Such scripts were designed to maximize the emotional response (interpersonal distress) by depicting the events in a salient, emotion-focused form in second person, present tense (Litz, 2005, personal communication).

### *8.1.2 Aims*

The present study was designed to investigate whether interpersonal distress enhances the vulnerability to DSH by affecting an individual's capacity to tolerate psychological and physical stressor tasks. First, this study was designed to evaluate whether individuals who have engaged in DSH exhibited differential physical distress tolerance from Controls prior to a priming procedure. Second, the study investigated whether tolerance for physical and psychological stressors was altered as a function of priming with distress or neutral interpersonal scripts.

### *8.1.3 Hypotheses*

1) The DSH group will be able to persist significantly longer on the Cold Pressor Test, although there will be no significant difference in the time to report discomfort between those with a history of DSH and Controls.

2) Participants with a history of DSH who are placed in the Distress condition, will exhibit a reduced tolerance for psychological stress. Specifically they will terminate the MTPT task significantly sooner than Controls in the distress condition. There will be no between group differences in the neutral condition.

3) Individuals with a history of DSH who are placed in the Distress condition, will exhibit a greater tolerance for physical pain than Controls. Specifically they will take significantly longer to report pain and terminate the algometer task than Controls in the Distress condition.

## 8.2 Method

### *8.2.1 Design*

The present quasi-experimental study consisted of two research stages, with 2 phases in each. The first research stage used a between-groups design to evaluate between group differences in CPT tolerance. The between groups factor was Group (DSH v Control). The dependent variables were reported discomfort and time to termination (removal of hand from the water) of the CPT task.

The second stage of the study used a 2 x 2 factorial ANOVA design. Independent factors were Group (DSH v control) and script condition (distress v neutral). Dependent variables were; reported discomfort and time to termination of the MTPT and time to report pain and time to termination of the algometer task.

*8.2.2 Participants*

*Ethics.* Ethics approval was obtained from the University of Southampton, School of Psychology Ethics Committee and the University of Maryland Internal Review Board.

Participants included 173 individuals (98 Controls and 75 individuals who had a history of engaging in DSH by cutting or burning). These participants in this group included both those currently engaging in DSH and those abstaining. Mean age was 20 years (SD= 2.63) and the Female: Male =125:48. In the DSH group there were 50 females and 25 males, in the Control group there were 75 females and 23 males. Participants were required to attend two sessions, some participants failed to do so, 122 participants (65 in the Control group and 57 in the DSH group) returned for the second session and were thus included in the second set of analyses. Participants were recruited through two channels: 1) through a larger screening sample, comprising undergraduate students at the University of Maryland, and 2) through poster advertisements around the same University. Participants completed a screening questionnaire (see Appendix D) and all participants received $10 payment or course credits. The experimental group included those with a history of engaging in DSH via cutting or burning. The Control group included only those individuals who reported that they had never engaged in DSH or participated in other impulsive/risky behaviours such as binge drinking, and smoking.

*8.2.3 Apparatus*

*Cold Pressor Test (Worthington, 1987).* The Cold Pressor Test is a physical challenge task designed to assess physical distress tolerance. The apparatus consisted of a container of ice water (at approximately 33 ± 1 Fahrenheit), with a screen, and time to termination was assessed using a stop watch.

*Mirror-tracing persistence task (MTPT-C; Strong, Lejuez, Daughters, Marinello, Kahler & Brown, 2003).* The MTPT requires participants to hand-trace geometric figures. The test-retest reliability for this task was .92 (Matthews & Stoney, 1988). A computerised version of the task was used in this study, whereby individuals were instructed to trace a series of geometric shapes using a computer mouse (see procedure). The actions of the mouse are reversed, e.g., if the participant moves the mouse towards the right, the cursor will move to the left. To enhance frustration, any movement away from the line, or if the participants failed to respond for more than 2 seconds, resulted in the return of the red dot to the starting position. The computerised version of the task used in this study, consisted of five different tracing trials. The first and last trials were relatively easy whereas the second, third and fourth trials were extremely difficult and are rarely successfully completed. Participants were instructed to proceed to the next trial if they either successfully completed a trial or had given up on completing a trial. Psychological distress tolerance was measured as the total time (in seconds) to termination of the task.

*Algometer.* A hand-held algometer was used to measure pain thresholds obtained from pressure in the region of the hand (Jensen et al., 1986). The algometer gives a well-defined pressure at a constant rate that shows a small inter-individual variation (Jensen et al., 1986) and high reliability between and within examiners (Reeves et al., 1986). The pressure is applied with a pressure algometer

(Somedic) with a 1.0 $cm^2$ circular round-edged aluminium contact surface. Time (in ms) to self-report discomfort and time to termination of the task are recorded.

*8.2.4 Materials.*

*Demographic Questionnaire.* Participants provided basic demographic information including age, gender, education level, occupation, home occupancy, and socio-economic status.

*Semi-structured interview for interpersonal situations.* A protocol developed by Litz et al. (2005) was adapted to generate scripts involving both: (a) a recent, distressing interpersonal interaction, and (b) a recent neutral interpersonal interaction (see Appendix E). This semi-structured interview formed the basis of a script-generation procedure. Specifically, the interviews were used to elicit a personal narrative describing each event, with participants asked to recall the recent events in detail, including their feelings and thoughts about the event. The interview was audio-recorded and, later, used to generate a brief (one minute), and personalized, interpersonal script (see procedure) that was recorded onto a tape by a female researcher. This recording was used as part of a priming paradigm (see Appendix F for an example).

*Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004).* The AAQ is designed to assess willingness to accept undesirable thoughts and feelings while acting in a way that is congruent with values and goals. A 7-point Likert scale, ranging from 1 *(never true*) to 7 (*always true*), is used to rate responses. Higher scores indicate greater psychological acceptance. The AAQ has been found to have adequate internal consistency ($\alpha$ = .70), and adequate convergent, discriminant and concurrent validity (Hayes et al., 2004). The AAQ has been found to be moderately correlated with measures of related constructs such as cognitive avoidance and avoidant coping, but has demonstrated a unique relationship to symptom/outcome measures beyond these other measures (Hayes et al., 2004).

*Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004).* The DERS is a multidimensional assessment scale that is designed to assess difficulties in the regulation of emotion. The scale is a 36 item self-report questionnaire and respondents are asked to indicate how often a series of statements apply to them on a 5 point Likert scale, with 1 indicating almost never (0-10% of the time) and 5 indicating almost always (91-100% of the time). Questionnaire items compose six subscales as follows; 1) Non-acceptance of emotional responses (NONACCEPTANCE), 2) Difficulties engaging in goal directed behaviour (GOALS), 3) Impulse control difficulties (IMPULSE), 4) Lack of emotional awareness (AWARENESS), 5) Limited access to emotion regulation strategies (STRATEGIES), 6) Lack of emotional clarity (CLARITY). Psychometric properties are available for a non-clinical population and indicate that the scale has good internal consistency (.16-.96) and good construct validity as associated with the Negative Mood Regulation Expectancies Scale (NMR; Catanzaro & Mearns, 1990) and a measure of experiential avoidance. Three of the subscales were negatively correlated with emotional expressivity. The DERS successfully predicted DSH in men and women, and partner abuse in men. NONACCEPTANCE and IMPULSE subscales were significantly associated with frequency of DSH among men. An example item is; ‘I experience my emotions as overwhelming and out of control’.

*8.2.5 Procedure*

This study was granted ethical approval by the School of Psychology, University of Southampton ethical committee and the Institutional review board at the University of Maryland, USA. Participants were recruited through two channels. The first approach involved administering a screening questionnaire to the psychology participant pool at the University of Maryland[1]. Those fulfilling the inclusion criteria (see Participants) were contacted via telephone and invited to attend two appointments on separate days at the Center for Addictions, Emotion and Personality research (CAPER). The second approach involved poster advertisements designed to recruit participants to take part in a study on 'stress and emotion', and potential participants responded via telephone for further information. These candidates were selected and allocated to group via completion of the screening questionnaire over the telephone. Research stage I was conducted at a first appointment session, stage II was conducted by the researcher after the session, and stage III at a second appointment on a separate day (see Figure 7 for procedural flow chart).

*Research stage I: Phase I.* At an initial appointment, after receiving an information sheet and completing consent forms, participants were asked to complete the demographics questionnaire, the AAQ and the DERS.

*Research stage I: Phase II.* A researcher interviewed each participant in accordance with the protocol developed by Litz and colleagues (2005) to assess responses to a recent interpersonal situation. The protocol was slightly amended to generate scripts involving; a) a recent, distressing interpersonal interaction, and b) a recent neutral interpersonal interaction. This semi-structured interview formed

[8] The author was awarded a grant from the Economic and Social Research Council to fund a 3 month placement at the Center for Addictions, Personality at Emotion Research at the University of Maryland, during which this study was completed.

the basis of a script-generation procedure. Specifically, the interviews were used to elicit a personal narrative describing each event. Participants were asked to recall the recent events in minute detail, including their feelings and thoughts about the event. Participants were asked to recall the events and their feelings at the time, as vividly as possible, bringing the specific event to mind. During the recall, the interviewer prompted for specific details such as; temporal aspects, rating of intensity, and visual aspects of the imagery. The interviewer probed for information regarding the actual events, the way that the participant responded, and somatic and psychological aspects of the emotions experienced. The interview was audio recorded.

*Research stage I: Phase III.* Following the interview participants were asked to take part in a physical distress tolerance task (the Cold Pressor Test). They were asked to submerge their non-dominant hand into a bucket of ice water up to a specified point marked by the examiner. Participants were instructed to keep their hand still, with their fingers pointed towards the bottom of the container. They were instructed to keep their hand submerged under the water for as long as they could, but that they could remove it at any time that they wished (there was a five minute limit on the task after which participants were instructed to remove their hand). They were asked to indicate at which point that they felt uncomfortable, by raising their non-submerged hand in the air and to report their discomfort verbally to the researcher. After doing so, they then continued the task for as long as possible. At the point when participants felt that they could not continue the task any longer, they removed their hand from the water the task was terminated. Persistence was defined as latency in seconds to removing the hand from the water. Participants were then invited to schedule the second laboratory session. The experimenter used a stopwatch to time the duration from submersion to reported discomfort, and from submersion to removal of the hand from the water.

*Research stage II*: *Phase IV.* After the first session, scores on the AAQ and DERS were combined into a composite emotion regulation score (total AAQ and DERS score were added and a median split was conducted). This was used to randomly assign participants to the Neutral or Distress condition for the next session, enabling approximately equal allocation of high and low scorers in each condition.

The audiotapes of interviews from the first assessment appointment were transcribed and from this, a script lasting approximately 1 minute was generated according to Litz's (2005) protocol. The script was subsequently used as a priming script in the second session of the study.

*Research stage III: Phase V.* At a second appointment on a separate day, participants were told that they would be asked to listen to a script generated from their previous interview, and that after this they would be asked to complete two tasks. Participants were seated, asked to close their eye if they felt comfortable to do so, and were given headphones through which to listen to an audio-recording of their script. During this procedure, a one-minute rest period was followed by the presentation of the particular script to which the participants were randomly assigned (i.e., distressing vs. neutral). Following the script presentation, participants were asked to close their eyes and imagine the event taking place, in real-time, for one minute in order to enhance the vividness of the mood induction procedure.

*Research stage III: Phase VI.* Immediately after presentation of the script, participants were asked to complete the Mirror Tracing Persistence Task (MTPT-C; Strong et al., 2003). The time that they persisted on each trial was recorded. After 5 minutes for each trial, the computer program gave instructions to participants to move on to the next trial. The dependent measure was the total time to termination of the task.

*Research stage III: Phase VII.* The MTPT-C was followed by a brief assessment of physical distress tolerance, the algometer task. This involved the application of pressure to the fingertip using the algometer. This pressure was increased manually by the experimenter at a constant rate. Participants were asked to tell the experimenter when they felt that the pressure had turned into a feeling of pain and then to continue the task for as long as possible. They had the option of terminating the task at any time, simply by notifying the experimenter.

*Research stage III: Phase VIII.* At the end of the study, the participants were debriefed and provided with information about skills for managing distress and coping with emotions. Support was offered post study. A trained and experienced Clinical Psychologist was in hand at all times, and the availability of the University Counselling and Psychotherapy service was made explicit. Individuals were also offered the opportunity to receive a 60 minute mindfulness/acceptance session designed to alleviate any adverse effects associated with exposure to a stressor.

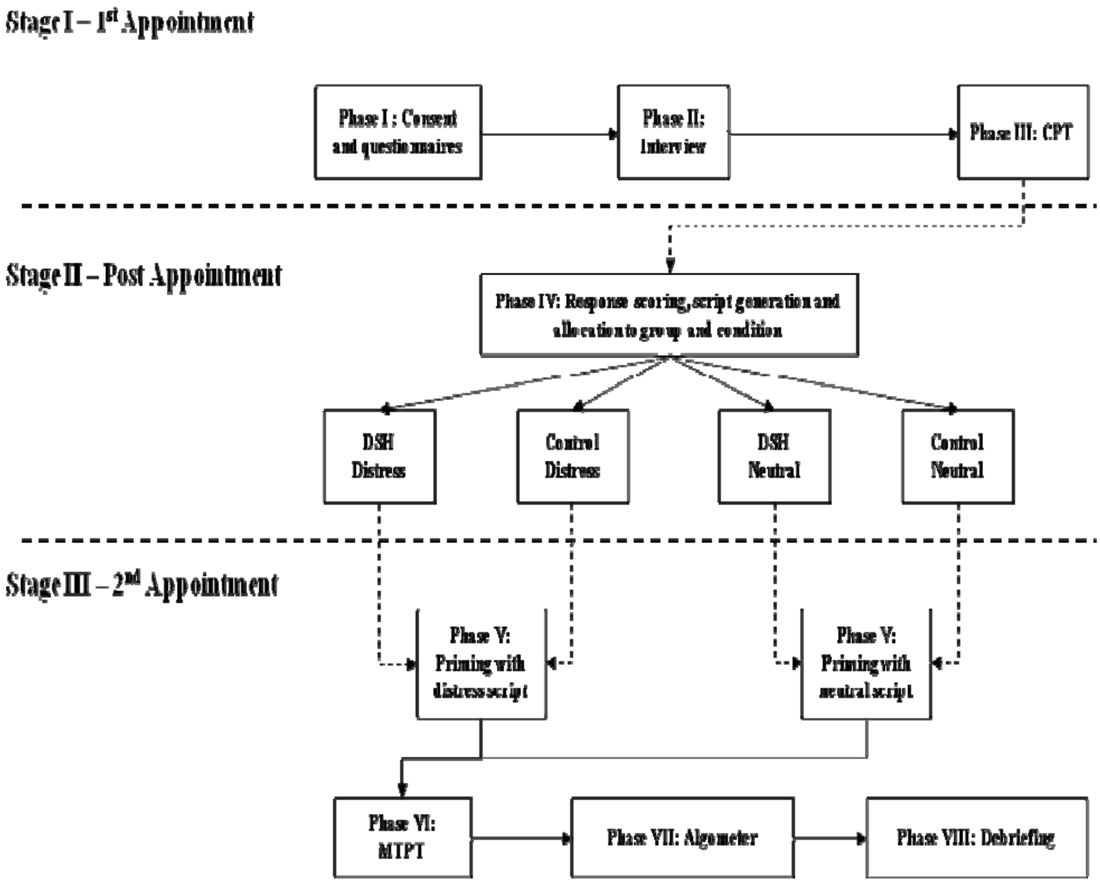



*Figure 7*. Study V procedural flow-chart.

## 8.3 Results

### *8.3.1 Statistical analysis strategy*

Statistical analyses addressed two main issues. First, between group analyses were conducted to evaluate differences in physical distress tolerance (on the CPT) between those with and without a history of DSH. Second, mixed analyses were conducted to evaluate the impact of Script condition (Distress v Neutral) and Group (DSH v Control) on Physical Distress Tolerance (algometer) and Psychological Distress Tolerance (MTPT).

*8.3.2 Cold Pressor Test*

As exploratory analyses revealed that the data were positively skewed. However, as parametric analyses are deemed to be relatively robust, and are more statistically powerful and less open to Type II error than non-parametric tests, which are more commonly used on small samples i.e., where the N per group <20, (Pett, 1997; Vickers, 2005), these were applied. Independent samples t-tests were used to evaluate between group differences on time to report discomfort on the CPT, and then on time to terminate the CPT task (remove hand from the water). There were significant between group differences on both discomfort (t(166)=-3.6, *p*<.01**) and termination (t(168)=-6.57, *p*=.000***). Examination of the means revealed that those in the DSH group took significantly longer to report discomfort (*M*=30.89, *sd*=30.95) than the Control group (*M*=16.83, *sd*=19.45). The DSH group also persisted with the task for significantly longer (*M*=129.28, *sd*=106.77) than the Control group (*M*=49.78, *sd*=46.72). This finding was supported when non-parametric analyses were used (Mann-Whitney U test).

*8.3.3 Mirror Tracing Persistence Task*

Exploratory analyses revealed that the data were not normally distributed. However, as explained previously, parametric analyses were applied. A 2x2 factorial analysis of variance was performed on total time to termination, on the MTPT. Independent variables were Group (DSH and control) and Condition (distress and neutral). Total n was 122.

There was a significant main effect of group (F(1,121)=4.191, *p*<05), but no main effect of condition (F(1,121)=.001, *p*=.971), p<.01) and no significant Group x condition interaction (F(1,121)=.678, *p*=.412).

Examination of the means revealed that individuals with a history of DSH who were allocated to the distress group persisted longer on the MTPT(*M*=337.14, *SD*=124.43) than those allocated to Neutral conditions (*M*=317.66, *SD*=132.37). Controls allocated to the Distress condition persisted for a shorter duration (*M*= 266.11, *SD*= 148.50) than those allocated to the Neutral condition (*M*=287.38, *SD*=136.26).

*8.3.4 Algometer*

A 2x2 factorial Analyses of Variance was performed on time to report pain, and then termination of the algometer consecutively. Independent variables were group (DSH and control) and condition (distress and neutral) and the Dependent variables were time to report pain and time to termination of the task. SPSS ANOVA was used, and the order of entry for the IVs was Group then Condition. Bonferroni correction was applied.

*Pain.* There was no significant main effect of Group ($F(1,121)=.09$, $p=.77$) or Condition ($F(1,121)=1.56$, $p=.22$) on time to report pin, and no significant group x condition interaction ($F(1,121)=1.12$, $p=.29$).

*Persistence.* There was a significant main effect of Group ($F(1,121)=3.25$, $p<.01$** but no significant main effect of Condition ($F(1,121)=3.25$, $p=.07$) on time to termination. There was no significant group x condition interaction ($F(1,121)=.323$, $p=.571$).

Examination of the means revealed that participants with a history of DSH who were allocated to the distress condition (*M*=9.98, *SD*=5.11) and neutral condition (*M*=8.47, *SD*=3.32) persisted significantly longer than Controls (*M*=7.89, *SD*=3.14 and *M*=7.11, *SD*=2.42 respectively).

## 8.4 Discussion

### *8.4.1 Purpose of the study*

This study was designed to investigate the impact of interpersonal distress on tolerance for physical and psychological stressor tasks in those with a history of DSH. Contrary to hypotheses, state induced interpersonal distress did not reduce tolerance for a stressor in those who have engaged in DSH.

Instead, the study revealed significant between group differences in pain tolerance. Individuals with a history of DSH were able to persist with painful tasks for significantly longer than Controls. This supports findings relating to analgesia in DSH (Russ et al., 1993). This study also revealed significant between group differences in tolerance for psychological stress suggesting that individuals who engage in DSH persisted during behavioural stressor tasks whether or not they had experienced state induced interpersonal distress. When under conditions of interpersonal distress these individuals continued to persist significantly longer with tasks than controls. This information provides valuable information about that way that individuals who engage in DSH respond to distress.

This unexpected increased tolerance for distress may be founded in mechanisms such as those observed in individuals with a diagnosis of Borderline Personality. Linehan (1993a) suggested that individuals who have been exposed to challenging or distressing events will have an increased propensity to put themselves in situations which further enhance distress. As such it appears that when distressed, individuals who engage in DSH may attempt to regulate their responses to such distress, by remaining in conditions that may make them more vulnerable. Exposure to such conditions may decrease self-esteem and self-worth and make such individuals more likely to employ maladaptive mechanisms to manage their emotional responses. These results suggest that state distress does not decrease tolerance for pain and frustration. Interpersonal distress may be an establishing operation for the occurrence of DSH, but once DSH is maintained, there may be other triggers that predict the likelihood of an episode of DSH.

An alternative explanation for the increased tolerance for distress may be that it serves to fulfil an important function of self-punishment (Lunch et al., in press). Rosenthal, Cukrowicz, Cheavens and Lynch (2006) reported that self-punishment (e.g. shouting at oneself) accounted for a significant amount of the variance in BPD symptomatology over and above the contribution of negative affectivity. Therefore, it is likely that when under conditions of distress, individuals prone to self-punishment may actually exacerbate their difficulties by remaining in situations that would be deemed intolerable to others. Taking a self-verification theory approach (Swann & Read, 1981), it might be argued that this self-punishment also serves to confirm the individual's self-conception, for example of someone who is vulnerable, that is exposed to intolerable situations, that others may be demanding etc (see Arntz, (2004) for a review of core beliefs that may be important for those with BPD). This may be perpetuated by the development of an identity of someone who is a 'self-harmer'.

Researchers have suggested that individuals who have engaged in DSH have a lower threshold emotional stress (Chapman et al., 2005), or at the least, reporting it. This study provides evidence to the contrary. There were no significant between groups differences in when individuals reported discomfort. This information is useful to consider when tailoring therapeutic intervention, and when tackling the stigma associated with DSH. Those who engage in DSH do not simply over-report distress, to the contrary, despite experiencing negative interpersonal distress, they were found to persist at challenging, painful and frustrating stressor tasks.

It might be hypothesised that persistence on the psychological stressor task may represent the use of distraction techniques or experiential avoidance, which may appear adaptive in the short-term but, have maladaptive long-term consequences. Findings regarding persistence were robust, despite the fact that difficulties with emotion regulation and experiential avoidance were controlled for by randomising groups to condition according to scores on the DERS and AAQ highlights that these findings are specific to DSH rather than a function of a more generic tendency towards experiential avoidance or maladaptive emotion regulation.

There was no significant effect of Group or Condition on the time to report pain during the algometer task. All individuals reported discomfort relatively quickly. This suggests that the task adequately assessed response to pain.

The two tasks designed to assess physical stress (CPT and algometer) produced a similar pattern of results regarding tolerance, the DSH group persisted significantly longer than Controls. On the algometer task, those with a history of DSH persisted on the task despite reporting discomfort, suggesting that these differences in pain tolerance are robust. The fact that there was no main effect of script condition on pain tolerance suggested that there are fundamental differences in pain (or physical stress tolerance) between those who engage in DSH and Controls, that are found despite state changes in affect.

According to IST, repeated exposure to an addictive behaviour, enhances the attentional salience and ‘wanting’ associated with such stimuli, and that there are significant neuro-adaptations that occur. It may be these neuro-adaptations, or biologically addictive qualities, perhaps to the beta-endorphins produced to relieve pain that sustain the behaviour and may enhance pain tolerance.

These findings identify that tolerance for physical and psychological stressors may have different underlying mechanisms. Interpersonal distress did not alter psychological persistence or pain tolerance, once established this appeared to be robust across conditions, providing preliminary support for an Opiod hypothesis of DSH, described in Chapter II.

### *8.4.2 Limitations*

The study included participants who are currently engaging in DSH and those who were abstaining. Those who have a history of DSH included individuals who have self-harmed via cutting and burning. A larger sample size would have enabled analyses to consider these groups separately.

It might be argued that the distress scripts were not sufficiently evocative to induce interpersonal distress. However, the procedures followed closely those used by Litz et al., (2005) to induce interpersonal distress in a sample of trauma survivors.

### *8.4.3 Future directions*

In the short-term, the capacity to persist at a stressor task, despite distress, has clearly adaptive functions for an individual. Future research might consider the impact of such tolerance in the long-term. Research should consider the functional operating mechanisms, to elucidate how this increased tolerance for physical pain, as well as stressful situations contributes to the maintenance of the DSH.

## 8.5 Summary

This study revealed fundamental differences in the way that those who have engaged in DSH and those who have not, tolerated and managed their responses to psychological distress and physical pain. It appears that state-induced interpersonal distress alone does not impact on tolerance for distress and pain. Interventions designed to help individuals to manage their emotional reactions to stressful interpersonal situations may only have clinical utility when used in the presence of environmental triggers for DSH. Interventions such as Mindfulness that are designed to help individuals to manage these responses (physiological sensations, emotions, thoughts and behaviours) in the presence of environmental cues may be of great clinical value.

Individuals may benefit from an intervention that focuses on enhancing adaptive responding in the presence of triggers, including the ability to:

- Label and identifying specific sensations, thoughts and experiences,
- Notice and observe such sensations, without reacting,
- Identify triggers and stressful situations at the earliest stage to prevent relapse
- Pay attention to the present moment rather than focusing on the past or future
- Increase the repertoire of responses available

The following study will focus on the application of such an intervention in an individual with a longstanding history of DSH.

## Chapter IX Study VI Cue Exposure with Response Prevention for DSH

### 9.1 Introduction

*9.1.1 Chapter overview*

Treatment interventions that directly target the management or minimisation of DSH are scarce. A growing evidence base suggests that DBT (Linehan, 1993) may be effective but the active components of this therapy are as yet undetermined and NHS waiting lists for DBT exceed availability. If easily applied, time limited, cost-effective and evidence based interventions that directly target DSH urges were available, the capacity of health professionals to help treat DSH would be increased. Where there is evidence that individuals are cue reactive to triggers for a range of addictive behaviours, cue exposure with response prevention has shown clinical utility. The present chapter describes the development of a cue exposure approach to the management of urges to self-harm.

*9.1.2 Treatment Components*

The intervention that was developed in the present study drew from several evidence based approaches including: exposure with response prevention, ACT, DBT and Mindfulness. I shall describe each of these approaches and how they might contribute to treatment for DSH.

Exposure with response prevention for phobias is aimed at reducing the avoidance of stimuli or experiences and subsequently may reduce the associated physiological arousal, for substance addictions, exposure targets the approach towards these stimuli. Importantly, however, exposure interventions are not designed to extinguish the internal response (i.e. physiological arousal, or distress in the presence of a stimulus) but rather to facilitate learning of new coping skills.

Those who engage in DSH find it difficult to manage their distress in an adaptive way. Anecdotal reports suggest that attrition rates for therapy are high. It may therefore be beneficial to introduce coaching in skills to help with engagement in therapy as well as skills to manage distress effectively. Given that DSH is considered to be a form of experiential avoidance (Chapman et al., 2004), teaching clients to accept their difficult private experiences, distressing emotions and urges to self-harm may be of particular utility. Such techniques are explored in DBT (Linehan, 1993) and ACT (Hayes et al., 2004).

DBT is a behaviour therapy that operates using the core dialectic of acceptance versus change. It draws on both operant and classical conditioning principles to expose clients to previously avoided events and coach them in adaptive skills to manage any associated distress. To this end, DBT uses cue exposure with response prevention techniques in an informal manner, to expose individuals to both internal and / or environmental events that may ‘set the scene’ for DSH, whilst blocking responses associated with self-harm. An example would be exposure to an imaginal personalized emotion-laden scene that induces unsupported guilt (shop lifting, hurting a friend etc). Linehan does not, however, advocate any systematic or formal exposure to implements used to self-harm and to date no attempt has been made to evaluate cue exposure with response prevention in this context. Nevertheless, because cue exposure orientation is therefore compatible with DBT, the development of a more formal intervention for DSH incorporating techniques to manage emotional dysregulation in the presence of implements might be expected to have considerable clinical utility.

As a ‘third wave’ behavioural therapy (Hayes, 2004), DBT incorporates a range of techniques to enhance the traditional behavioural approach. These include; acceptance, mindfulness and developing a commitment to engaging in therapy in the service of personal values.

Gratz (2006) integrated techniques from ACT and DBT to develop a treatment intervention for clients with emotion regulation difficulties. The two approaches are compatible and many of the general principles overlap. Preliminary evidence suggested that this intervention reduced DSH.

It might be expected that some of the components of the protocol developed by Gratz (2006) (see Chapter I) would enhance an intervention designed to manage responses in the presence of both interpersonal distress and environmental cues. These include: a) identifying the function of DSH, b) focusing on increasing emotional awareness and clarity, improving emotional regulation skills, identifying the function of primary emotions, c) emphasising behaviour change, teaching new strategies to enhance the behavioural repertoire in response to a stimulus and d) the identification of values.

ACT (Hayes et al., 2004) offers an alternative approach. Acceptance is defined as: “actively contacting psychological experiences -directly, fully, and without needless defense -while behaving effectively.” (Hayes, Wilson, Gifford, Follette & Strosahl, 1996, p1163). ACT also incorporates acceptance, defusion and a commitment to values but there is a greater focus on acceptance of the present state rather than change in the service of values.

Cue exposure with response prevention, when combined with acceptance techniques, directly targets conditioned emotional and behavioural responses that may occur in situations and contexts that have particular meaning for clients (i.e., in the presence of triggers for DSH). If psychophysiological reactivity to DSH cues can be reduced by behavioural exposure, then the incorporation of acceptance and defusion techniques may be a way of delivering this therapy in a way that is purposeful and meaningful, and thereby more acceptable to the client. Incorporating techniques from ACT and mindfulness therapies may help with engagement. On example of this, may be that, framing exposure within the context of working towards values identified by the client, rather than as aversive experiences 'controlled' or determined by the therapist, can help he client to pay attention to, and 'stay with' the experience. An acceptance stance to exposure changes the focus of the therapy, to enhancing quality of life rather than reducing an undesirable behaviour. This is explicitly set out as a continual process rather than a goal that can be explicitly achieved or failed.

Being mindful of the experience of the client during the exposure intervention, means that the therapist is able to acknowledge and validate the distress that the client is feeling in the moment. The client is therefore encouraged to test out how they will manage their experiences in a safe environment where they have built a therapeutic relationship.

Because the focus is directed towards the experiences that occur ‘in the moment’ during exposure, this encourages the client to reflect, and describe and label sensations, thoughts and feelings, as they occur. This present focus helps the client to remain with the exposure, rather than using methods of avoidance such as distraction such or thought suppression.

Strosahl and Chiles (2004) developed an intervention for suicidal patients that used a specific ACT approach. Some of their techniques could also have clinical utility for those who engage in DSH. These include: a) ‘Containing and refraining’ and making contact with the cost of high risk behaviour (i.e., identifying that the behaviour is <u>not</u> adaptive in the long-term), b) attacking the patient’s fusion with the story (i.e., identifying that although the events in the past may have contributed to the development of an identity as a ‘self-harmer’, that it is possible to change the way that you choose to live in the future), c) addressing barriers to change (i.e., identifying what is preventing you from abstaining from DSH) and d) making contact with values and engaging in patterns of committed action (identifying what is important for you, in your life and how can you commit to living that life). The main difference between the two approaches is that Gratz (2006) explicitly incorporated strategies to promote change and the development of skills, whereas Strosahl (2004) focused on acceptance of the present state and the identification of values. According to an ACT approach an individual could experience urges to self-harm <u>and</u> choose not to act on these urges <u>and</u> live a life of worth and personal meaning. These principles were an important consideration in the development of the  intervention used in the present study.

Follette and Orsillo (2004) identified that acceptance techniques could have utility in enhancing cue exposure.  Orsillo, Roemer and Holowka (2005) emphasised the particular value in using acceptance to address concerns about willingness to participate particularly where clients are highly avoidant or present as complex cases with a multitude of co-morbid conditions. The authors argued that the use of acceptance explicitly connects exposure therapy to enhancing quality of life. This means that commitment to therapy is given in the service of values. This would be expected to greatly enhance engagement and motivation for therapy, providing a focus and rationale for the client who finds that therapy raises difficult and painful experiences or sensations, or the client who may find it challenging to commit to regularly attending therapy (Eifert & Forsyth, 2005; Levitt & Karelka, 2005).

Baer (2003) explained that; “mindfulness may promote exposure to previously avoided internal experiences, lead to cognitive change or a change in attitude about one’s thoughts, increase self-observation and management, and produce a state of relaxation, or increase acceptance”.  Lynch et al (2006) also argue that mindfulness may function as a form of behavioural exposure. Baer and Krietemeyer (2006) argued that *mindfulness* is a method of directing attention. A range of different clinical techniques can be used, but mindful attention necessarily involves a stance of compassion, interest, friendliness and open-heartedness towards the experience observed in the present-moment, regardless of how pleasant or aversive it may be (Kabat-Zinn, 2003). Thus, mindfulness would be expected to enhance the orientation of attention to an avoided stimulus.

Clinical observation reveals that often those who engage in DSH report that it is their only method of reducing their anger or distress. *Cognitive defusion* techniques (Masuda, Hayes, Sackett & Twohig, 2002) are aimed at broadening the available behavioural repertoire with respect to conditioned stimuli. Thoughts are 'de-literalized' and the individual is able to observe the content of the thought without linking that thought to a conditioned behavioural response. Defusion techniques are designed to change the stimulus-response contingencies, altering the individual's relationship with the thought, rather than the thought itself.

In the present study, the acceptance techniques of mindfulness and defusion were used to connect the exposure intervention to values and life goals by: a) enhancing motivation and b) providing tools to manage urges and psychological and physical distress. Techniques were taken from both ACT and DBT but the focus on the identification of values rather than goals draws more strongly on an ACT approach.

In the context of DSH, it might be expected that when experiencing intolerable emotions, mindfulness techniques would help individuals to attend to the present moment, without automatically acting impulsively to reduce the aversive tension. It would be expected that individuals with a history of engaging in DSH would still experience urges to self-harm in the presence of triggers, but that they would be better equipped with a broadened repertoire of behavioural responses, to enable them to choose options other than DSH to manage their urges.

*9.1.3 Methodological issues*

The present study was designed as a single case experiment to evaluate the implementation of a cue exposure intervention for the management of urges to self-harm.

The single case approach enables isolation of the mechanisms of change, and the development of new procedures through combining effective elements (Bergin & Stroop, 1970; Kazdin & Tuma, 1982). It is particularly useful for generating hypotheses to be evaluated further, which is vital when developing an ongoing therapeutic programme, guided by response to previous clinical challenge. The single case approach functions differently from large scale RCTs or field effectiveness evaluations. It is often viewed as a precursor to such evaluations. Generalization might proceed from the use of clinical case replication of the same treatment in individuals with similar characteristics first, or from one specific behaviour of interest to another. In single case research, the intra-subject variability that is considered a weakness in group comparisons is seen as an advantage, it enables meaningful clinically relevant behavioural changes within an individual to be observed and recorded.

Applied clinical research requires the use of a methodology that is capable of determining both the effects of an intervention and the reasons for these effects (Barlow, Hayes & Nelson, 1984). Single-case design affords that opportunity. According to Barlow, Hayes and Nelson, (1984); ‘A properly constructed clinical replication series, even without single case experimental analysis, can rule out most or all threats to internal validity and contribute to causal statements on the effectiveness of an intervention'. Single case design allows rigorous control of conditions to be applied, with direct investigation of potent treatments, producing rapid changes in behaviour, in carefully designed research studies (Parry and Watts, 1996). The assumption is that behaviour is caused by events preceding it, and through identifying and isolating the determinants of an individual's behaviour, individual generalisation is made possible. It is precisely this individual variability in functional relationships that forms the basis of a behavioural response, and single case design allows the assessment and intervention at each stage of the functional response, allowing the development of new treatment interventions.

One specific single case design, the multiple baseline approach, allows for the simultaneous control of internal and external validity without requiring treatment withdrawal. Typical baseline designs involve measurement across person, behaviours or settings. The multiple probe across baseline design (Horner and Baer, 1978) is a variant of the multiple baseline approach that enables assessment under circumstances in which repeated measurement would alter reactivity (for example changes in physiological reactivity). The multiple probe across baseline approach involves a) an initial probe session to evaluate initial performance on each targeted variable, b) exposure to the intervention to each targeted variable in turn, c) after each targeted variable a further probe after each step of after a previously set criterion is reached and d) baseline assessment of each targeted variable prior to introduction of the intervention at each step.

The present study used a single case design (N=1) with multiple baseline components including a series of probes. The design requires that the experimental conditions were adjusted on the basis of responses made by the participant during the experiment. Analyses were conducted via visual inspection of graphical data, a method long recommended appropriate to single-case data (Katochwill & Levin, 1991).

*9.1.4 Aims*

The present study was designed to systematically expose a client with a history of DSH to a series of three stimuli that were identified as having increasing salience in relation to DSH, whilst measuring psychophysiological reactivity (HR and GSR) and self-reported urges to self-harm. The techniques of mindfulness and defusion described above were also incorporated into treatment sessions.

*9.1.5 Design*

This study used a single patient case series design (Parry & Watts, 1996) with multiple baseline components (Baer, Wolf & Risley, 1968; Barlow & Hayes, 1984; Horner & Baer, 1978).  The dependent variables were; HR, GSR and self-reported urges to self-harm. The aim of the multiple probe design was to sequentially expose the client to three stimuli of increasing salience (photograph of a knife, observation of a knife and holding the knife- exposure sessions). After each exposure, physiological reactivity and self-reported urges to DSH in response to all three stimuli was assessed during a probe session.

The multiple baseline procedure specifically involved a) a probe session to assess initial reactivity to all stimuli, b) systematic exposure to each of the stimuli in turn, and c) a probe to test reactivity to all three stimuli, after exposure to each of the stimuli. This method was designed to evaluate whether reactivity to a stimulus reduced only after that specific stimulus had been the object of exposure.

Although this design is not primarily a hypothesis testing approach, it was expected that exposure with response prevention would reduce urges to engage in DSH and psychophysiological reactivity (mean HR and mean level of GSR) in the presence of cues associated with DSH. For each exposure, reduced reactivity to probes was expected to be confined to only the cue or cues that have previously been exposed.

This reactivity was expected to be reinstated by the presentation of a distressing priming script, and that following further intervention, reactivity would diminish.

## 9.2 Method

### *9.2.1 Participant*

*Ethics.* Prior to recruitment, Dorset LREC approval and approval from the University of Southampton, School of Psychology Ethics Committee was obtained. Careful attention was paid to the identification and provision of precautionary measures to mitigate and alleviate risk, both to the client and the researchers involved. This included obtaining commitments from the client, asking her to identify specific self-report markers of distress and importantly continuous clinical observation.

*Current presentation.* Kate[1] was an 18 year old, white female with a 4 year history of DSH via cutting. Kate presented with current DSH, depression, suicidal thoughts, low self-esteem and self-worth, violence and severe anger outbursts. She had a diagnosis of Borderline Personality Disorder and was on medication for her depression (Sertraline). An independent assessment conformed this diagnosis, and revealed that she also met the diagnostic criteria for; Avoidant Personality Disorder, Depressive Personality Disorder and Paranoid Personality Disorder. Kate reported that her urges to self-harm increased when emotionally dysregulated and in the presence of implements used to self-harm and she provided examples of these triggers including using a kitchen knife to cut vegetables and seeing a razor blade in the bathroom.

*Initial presentation of problem.* Kate attended the initial assessment session with her Mother. Kate looked and related much younger than her years. As she spoke she rubbed her hands and wrung her fingers, held her head down and offered limited replies to questions. She spoke with tension in her voice and appeared tearful. Kate said that she had been experiencing difficulties with managing her emotions, specifically her anger, and that she had found it increasingly difficult to cope with her urges to self-harm. She reported being emotionally labile, with her emotions quickly alternating between feeling quite low and upset to extreme levels of anger where she punched out at people and threw things. Her mood lability was enhanced under the influence of alcohol. Kate presented as a bright and articulate. She showed none of the problems that might be expected from her educational history. Kate had attended a school for children with learning disabilities, although, there were no neuro-

[9] Name and identifying features have been changed to protect anonymity.

psychological assessment reports to indicate that any formal diagnosis had been made.

*History of presenting complaint.* Kate reported experiencing a series of traumatic events (see Appendix G). Kate first began cutting at the age of 14 years, using knives, scissors and glass. She described experiencing intense feelings of fear and anger, which were relieved by cutting her arms until she could see the blood running. At the point of assessment, Kate reported cutting herself almost daily. She noted that the longest period of time that she had abstained from DSH was one week. Kate reported that her urges to engage in DSH increased when experiencing intense emotions and in the presence of implements previous used to self-harm, such as kitchen knives. For this reason, Kate avoided preparing food with kitchen knives. At the age of 18, Kate sought help from her GP as she feared her increasing difficulties in managing her urges to self-harm. This led to her current referral to the IPTS.

Although Kate avoided DSH implements, she explained that although this worked in the short term, her urges increased until she had to cut to relieve the tension. At the time of assessment Kate was unable to use kitchen knives to prepare food. Kate hoped to find new ways of managing her intense emotions. Her goals were to stop cutting, and return to work. Her values included being a good partner and daughter and eventually being a good wife and mother.

*Reason for referral.* Kate was 18 years old when she asked her GP for help with her increased self-harming. Kate was referred to the Intensive Psychological Therapies Service (IPTS) for an assessment and her name was placed on the waiting list to receive DBT. As part of the routine clinical audit at the IPTS, Kate completed a series of measures; MCMI-III-R and SCL-90-R (see Measures) and were delivered by an independent clinician. Kate was referred to the present study as she had identified that triggers in the environment increased her urges to engage in DSH and had expressed a desire to find ways to help her to manage her urges to self-harm prior to participation in a DBT program.

*Formulation and provisional hypotheses.* After considering the available information, the following formulation was proposed. Kate's history of traumatic experiences and an absence of a stable/supportive environment to help her to develop the skills to effectively manage her distress, had contributed to her emerging reliance on DSH. Her cousin Jane who was her only constant source of social support continued to model DSH as an effective mechanism to deal with emotional distress. Kate's urges to engage in DSH were maintained by negative reinforcement contingencies- the emotional relief that she experienced on cutting. Cues that reliably predicted the occurrence of DSH were: interpersonal triggers (e.g., arguments with her partner), intrapersonal triggers (e.g., uncontrollable feelings of anger) and environmental cues (e.g., observing a kitchen knife by the sink). These acted as classically conditioned stimuli that elicited increased urges to self-harm, and also psycho-physiological arousal, which Kate reported as sweating palms, her heart racing and 'bubbles' in her stomach. Her attempts to prevent herself from engaging in DSH involved avoiding cues associated with DSH (e.g., kitchen knives, Kate relies on others to prepare food for her) and this avoidant behaviour is negatively reinforced by the temporary escape from the urges to self-harm. Kate's desire to manage her urges and her ability to identify clear values and life goals may be powerful modifiers for her DSH.

### *9.2.2 Apparatus*

*Psycho-physiological recording equipment.* Physiological recording apparatus included; a ML785 Powerlab/8SP with a ML 305 Pod Expander and GSR ML116 GSR Amp, a HR MP100 Pulse Transducer, and a ML309 Thermistor Pod attachments to measure GSR and HR. A Highgrade Notino laptop (C2000) was used for data collection via acquisition software (Chart v5.2.1 for Windows, ADI Instruments, 2004).

*Experimental setting.* The intervention took place in two therapy rooms at the IPTS. The experimental setting including factors such as, the room location, location of equipment within the room, lighting and seating was varied across sessions to promote generalisation and prevent context dependent habituation (Rodriguez, Craske, Mineka & Hladek, 1999).

*Exposure stimuli. These* consisted of a glossy colour photograph of a kitchen knife on a chopping board (sized 6” x 4”) and the same kitchen knife used in the photograph (a black handled ‘Kitchen Devil’ with a 5” blade), see Figure 8.

*Priming Script.* A 60 second personalised priming script detailed the most recent episode of DSH prior to the assessment, and the events leading up to it, including the emotions and thoughts experienced, and the behavioural and psychophysiological responses. This script (see Appendix H) was written in accordance with the protocol devised by Haines (1995) and was generated from a transcribed chain analytic procedure (see Procedure for details). The script was read aloud by the therapist.

*Figure 8*. Photograph used as exposure stimulus.

*9.2.3 Measures.*

*Psychophysiological measures.* Psychophysiological measures included mean GSR and heart rate (average no. of beats per minute).

*Millon Clinical Multiaxial Inventory-III Revised (MCM-III-R, Millon, 1994).* The MCM-III-R is a 175 item self-report questionnaire used to identify the DSM-IV related Axis I and II personality disorders and clinical syndromes. Clinical symptoms and personality patterns are identified across 26 scales. The scale has strong test-retest reliability and good internal consistency (Groth-Marnat, 1999). This scale relies on actuarial base rate data rather than standardised scores and thus scores reflect the true prevalence rate of symptomatology across the population. The inventory includes 14 Personality Disorder scales, 10 Clinical Syndrome scales and three correction scales (to detect inaccurate responding). The major scales are divided in four ranges: normal (0-60), tendency (61-75), trait (76-85), and personality disorder (86-115).

*Symptom Checklist 90-Revised (SCL-90-R; Derogatis, 1993).* The SCL-90-R is a 90 item self-report inventory that assess clinical symptoms across nine dimensions; Somatization, Obsessive-Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation and Psychoticism. The measure provides outcomes on three global indices of distress; Global Severity index, Positive Symptom Distress Index and Positive Symptom Total. The scale has good internal consistency (ranging from 0.77 to 0.90) and good test-retest reliability (0.78 to 0.90) (Derogatis, 1993). Published norms on psychiatric outpatients suggest that the clinical range for the SCL-90 Global Severity Index (GSI) is between 0.58 and 1.94 (1 SD above and below the psychiatric outpatient mean of 1.26).

*Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004).* See Chapter VIII) . Norms taken from Gratz and Roemer (2004) indicate that total DERS in normal undergraduate females *M*=77.99, *SD=20.72).* Normed scale scores for a female undergraduate population are; Nonacceptance (*M*=11.65, *SD*=4.72), Goals (*M*=14.41, *SD*= 4.95), Impulse (*M*=10.82, *SD*= 4.41), Awareness (*M*=14.34, *SD*= 4.60), Strategies (*M*= 6.16, *SD*= 6.19) and Clarity (*M*= 10.61, SD= 3.80).

*The Deliberate Self-Harm Inventory (DSHI; Gratz, 2001).* The DSHI is a 17-item, behaviourally based, self-report questionnaire that assesses lifetime history of deliberate self-harm. The DSHI is based on the conceptual definition of DSH used in this thesis (see Chapter I). This measure is designed to assess various aspects of DSH including frequency, duration and type of self-harming behaviour (including cutting, burning, carving, bone-breaking, biting and head-banging among others). The DSHI has high internal consistency ($\alpha = .82$), adequate construct, convergent, and discriminant validity and adequate test-retest reliability (Gratz, 2001).

*Dissociative Experiences Scale-II (DES-II; Bernstein & Putnam, 1986).*The DES-II is a 28 item self-report questionnaire. The scale has good psychometric properties in terms of reliability and validity (Carlson, 1994; Carlson & Armstrong, 1994; Carlson & Putnam, 1993; Carlson et al., 1993) with excellent construct validity. Respondents are asked to circle a percentage value ranging from 0% to 100% in accordance with the percentage of time that a particular experience happens to them. A total DES score is the mean of all responses with higher scores indicating how likely an individual is to have Dissociative Identity Disorder. The DES-II has been used in a variety of clinical populations in order to estimate prevalence of a variety of dissociative disorders. An example item is; 'Some people have the experience of feeling that other people, objects, and the world around them are not real. Circle a number to show what percentage of the time this happens to you'. Studies also indicate that most individuals in good mental health and psychiatric patients in general score below 20, so scores higher than 30 may be used for screening Dissociative Identity Disorder (Lipsanen, et al., 2003).

*Acceptance and Action Questionnaire (AAQ-18; Hayes et al., 2004).* Hayes et al., (2004) reported clinical norms for the AAQ ($M$=32.2, $SD$= 7.4). A higher AAQ score suggests greater acceptance. This measure is described in Study V.

*Structured Clinical Interview for DSM-IV Axis II (SCID-II, Spitzer, Williams, Gibbon & First, 1990).* The SCID-II is a combined self-report screening tool and clinician administered interview that identifies symptoms associated with diagnostic criteria for Personality Disorders. The screening tool requires respondents to complete 119 forced choice response (true or false) questions. Example items include; “have you hurt or killed yourself or threatened to do so?” and “Are there many people you can’t forgive because they did or said something a long time ago?” The screening questions correspond with items on the Structured Clinical Interview. The interview consists of 13 subscales that reflect different principal axis II (Personality Disorder) DSM-IV diagnoses (APA, 1994): Avoidant, Dependent, Obsessive-Compulsive, Passive-Aggressive, Depressive, Paranoid, Schizotypal, Schizoid, Histrionic, Narcissistic, Borderline, Antisocial and Not Otherwise Specified. Together these subscales are comprised of 148 items rated on a Likert scale of 0-3 which reflect the absence, subthreshold, presence or inadequate information to code a trait.

*Dialectical Behaviour Therapy diary card* (Linehan, 1993). The diary card is designed for the daily report of maladaptive behaviours that are often associated with DSH and interfere with effective therapy, including alcohol consumption, drug, prescription medication and over the counter medication use, suicidal ideation, misery and DSH urges and acts. Respondents were asked to rate the number of times that they engage in a particular behaviour, and rate their mood and urges on a scale of 0-10.

*Homework sheets.* Homework sheets included: the Valued Living Questionnaire (Wilson, 2002) the Suffering Inventory, the ‘Pain is Gone’ exercise (Hayes, 2005) and Mindfulness exercises (Eifert, Mckay & Forsyth, 2006; Hayes, 2005).

*9.2.4 Procedure*

The present study comprised five treatment phases, with several sessions in each phase (see Figure 9).

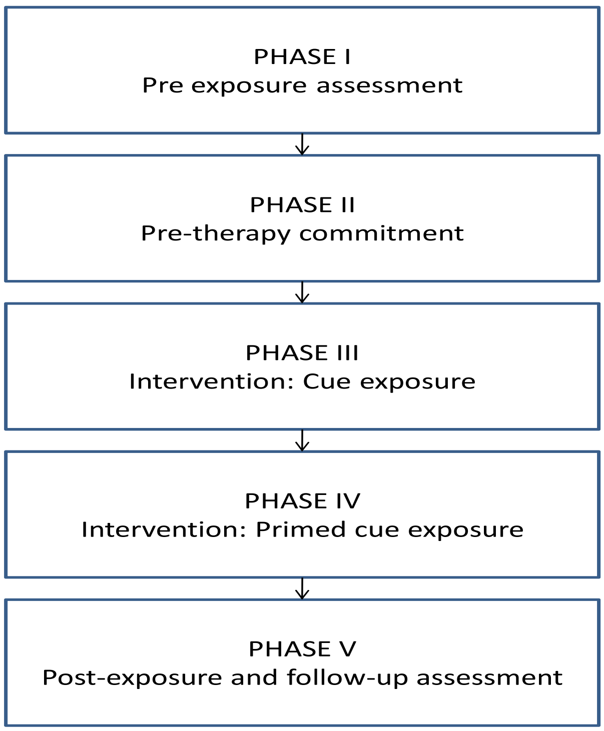



*Figure 9.* Flow-chart depicting treatment phases.

A timetable of these sessions is provided for ease of interpretation (see Table 40).

Table 40. *Timetable of attendance to sessions and components of intervention.*

| Date of session | Week of intervention | Phase | Session no. | DNA no. | Cancelled session no. | Type of assessment | Session activities |
|---|---|---|---|---|---|---|---|
| **28/06/2006** | | 1 | | | | AUDIT | |
| **03/11/2006** | 1 | 1 | 1 | | | | |
| **07/11/2006** | 2 | 1 | 2 | | | | |
| **14/11/2006** | 3 | 1 | 3 | | | SCID-II | |
| **21/11/2006** | 4 | 2 | 4 | | | | |
| **28/11/2006** | 5 | 2 | 5 | | | | |
| **08/12/2006** | 6 | 3 | 6 | | | | |
| **11/12/2006** | 7 | 3 | 7 | | | | |
| **12/12/2006** | 7 | 3 | 8 | | | | |
| **19/12/2006** | 8 | | | 1 | | | |
| **21/12/2006** | 8 | | | 2 | | | |
| **04/01/2007** | 9 | | | 3 | | | |
| **11/01/2007** | 9 | | | 4 | | | |
| **15/01/2007** | 10 | | | 5 | | | |
| **18/01/2007** | 10 | 3 | 9 | | | | C |
| **23/01/2007** | 11 | | | 6 | | | |
| **24/01/2007** | 11 | | | | 1 | | |
| **08/02/2007** | 13 | 4 | 10 | | | | C |
| **15/02/2007** | 13 | 4 | 11 | | | | E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **19/02/2007** | 14 | | | 7 | | | |
| **27/02/2007** | 15 | 4, 5 | 12 | | | | C, A |
| **01/03/2007** | | 5 | 13 | | | SCID-II | A |
| **19/03/2007** | | 5 | | | | AUDIT | A |
| **04/06/2007** | | 5 | | | | FOLLOW-UP | A |

*Phase I: Assessment.*

*Clinical session.* The aim of phase I was to assess appropriateness for intervention. This phase included clinical sessions, and psychometric and physiological assessments. Kate was invited by letter, to attend an initial assessment session with Consultant clinical psychologist SC and the researcher CH. She attended this session with her Mother. A brief clinical interview was conducted in which Kate described her experiences of self-harm.

Kate reported that she experienced a constant background craving to engage in DSH that she rated at around 4 on a scale of 1-10. When experiencing intense emotions (such as anger) or in the presence of cues that she associated with self-harm Kate's urges would increase up to 10. She believed that she would be compelled to act on her urges when they reached 8/10.

*Psychophysiological reactivity.* In order to evaluate whether the intervention might be effective, this part of the session aimed to establish whether or not Kate was psychophysiologically responsive to cues. This assessment, which followed the procedure used in Study II, involved exposing Kate to a series of photographic stimuli presented on the computer and monitoring her GSR, HR and self-reported urges to self-harm. The stimuli were 10 neutral stimuli, followed by 10 DSH cues and then the same 10 DSH cues that were presented with the subliminal presentation of a priming word (angry) followed by a mask (xxxxx) (see Study II for further details). However, because Kate reported that she was most vulnerable to engage in DSH when she was angry, the word *angry* replaced the word *lonely* as the prime. This procedure identified that Kate was physiologically reactive to DSH cues and that she reported increased urges in the presence of these stimuli. Indeed the reactivity was so intense that Kate requested that the session be terminated after 5 out of the ten DSH cues had been presented as she was distressed and tearful. Appropriate support was offered. Shortly after this Kate decided that she would like to commit to learning skills to help her to manage her urges and emotional response in the presence of such triggers.

*Chain analysis.* Kate attended a second session with her Mother, but asked her Mother to wait outside the therapy room. She was asked to identify her most recent cutting event and to describe on a moment by moment basis the events that led up to and followed it. The therapist constructed a behavioural chain analysis that identified occasions when she was most vulnerable, the precipitating cues (triggers) and the events that immediately followed the self-harming behaviour. Kate was asked to provide a description of both the environmental events and her behavioural, cognitive, emotional and physiological reaction to these events. She was also asked to identify the extent to which the scenario described was typical of her self-harming behaviour. The interview was audio-recorded and later transcribed and used to develop a ‘personalized imagery script’ in accordance with a protocol developed by Haines (1995).

The imagery script was composed of both response and stimulus information. Only those elements reported by Kate during the interview were included in the scripts in the wording that she used. This was so that Kate was not directed to experience reactions that she had not previously recalled.

The imagery script was divided into three discrete stages;

1. Setting the scene (description of the environment and behaviours at the onset of the events leading up to the cutting episode).
2. The approach of the behaviour (description of the events leading up to the incident and the reactions to those events).
3. The actual incident (a description of the behaviours and reactions associated with the cutting episode).

*Psychometrics.* Kate was given the DERS, DES-II, AAQ and the DSHI to complete in her own time.

*SCID-II.* An appointment was made for Kate to participate in a structured clinical diagnostic interview (SCID-II) that was administered by an independent clinician who was experienced in the administration of SCID-II. This identified that at the point of assessment, Kate met the diagnostic criteria for; Avoidant Personality Disorder, Depressive Personality Disorder, Paranoid Personality Disorder and Borderline Personality Disorder.

*DBT diaries.* Kate completed a daily diary of DSH urges and acts, suicidal ideation, medication use and alcohol and drug use and was then asked to complete this diary through the treatment, to record her experiences during the intervention.

*Phase II: Pre-Exposure Commitment.*

This phase was designed to introduce the intervention and obtain commitment to engage in the therapy. Kate received two, 2 hour sessions focussing on pre-therapy commitment work. These sessions were based on techniques adapted from both ACT and DBT. They were designed to orientate Kate to the functions (tension reduction) and costs of DSH, identify her life goals and valued direction and link the reduction of DSH to these ends. In addition, Kate was orientated to the demands of the intervention and provided a verbal and written consent to participate. In the first session, Kate described a strong sense of shame concerning her DSH, the physical scars that she carried and the impact of DSH on both her self-esteem and relationships. She also identified a strong desire to gain paid employment, get married, and have children and a stable family life. Kate was introduced to mindfulness and defusion skills. The need to develop the ability to experience urges to self-harm together with associated thoughts, emotions and bodily sensations, and yet not act on these urges was linked to her goals.

The second session involved a review of her homework. Kate identified further values as being a loving woman and good daughter, and the goal of being able to choose whether or not to act on her distress or self harm urges. Mindfulness skills were further coached and practiced during the session and linked to Kate’s values.

The two sessions were used to validate the functions and costs of self-harm, strengthen Kate's commitment to life goals and a valued direction and make links between Kate's DSH and other problematic behaviours (excessive alcohol use, cannabis use, aggressive and other impulsive behaviours). Metaphors and experiential exercises were used to these ends. For example, the 'man digging a hole' metaphor (Hayes et. al., 1996) was used to illustrate the ineffectiveness of attempts to control or eliminate distress by avoidant strategies. Kate was encouraged not to think a particular thought ('yellow jeeps') in order to demonstrate the paradoxical effect of thought suppression. As an alternative, Kate was introduced to the possibility of just noticing thoughts, emotions, bodily sensations and urges, rather than engaging with her thoughts or acting on them. Mindfulness skills were described and practised during the sessions and set as home-work practice, together with a task to strengthen her identification with life goals and values (Hayes & Smith's [2004] 'The pain is gone, now what?' exercise).

*Phase III: Cue Exposure.*

This intervention phase consisted of three components: probe sessions, exposure sessions and homework tasks. There were thirteen sessions in total. Each session denotes a separate appointment at the IPTS. On occasions these sessions were conducted on the same day (see table 40).

*Probe sessions.* Three stimuli were selected as targets for exposure and these represented a graded hierarchy of emotionally evocative stimuli: 1) holding a photograph of a kitchen knife, 2) observing a kitchen knife held by the therapist and

3) handling the kitchen knife. During the five probe sessions, each stimulus was presented in turn for 60 seconds whilst psychophysiological responses (GSR and HR) and self-reported urges to self-harm were assessed. The stimuli were always presented in the same order: photograph of a knife (S1), observation of therapist holding knife (S2) and then Kate holding the knife (S3). After the presentation of a stimulus, the next stimulus was presented only when the GSR reached 50% of the initial reactivity and when action urges had also reduced to pre-stimulus levels (i.e., the inter-stimulus interval was determined by the half-life of the reactivity).

*Exposure sessions.* Prior to exposure Kate was asked to make a commitment that if she experienced urges to engage in DSH that became unmanageable, that she would communicate this to the therapists and the session would be terminated. The previously taught mindfulness and defusion techniques were practised together before each exposure session, to help Kate to focus on the skills. Each exposure session first involved a baseline recording of psychophysiological reactivity for 5 minutes to stabilize responses, and then exposure to one of the stimuli. Kate was then asked to attend to S1 and asked to remain focussed on that stimulus whilst her psychophysiological responses (HR and GSR) were assessed. During the recording, Kate was asked to rate her urges to engage in DSH on a 1-10 scale at random intervals. She was asked to focus on S1 until her psychophysiological responses and self-reported urges to self-harm returned to pre-exposure baseline levels. This exposure procedure was repeated a second time, on a second occasion to extinguish any remaining reactivity. Subsequent exposure sessions involved exposure to S2 and S3. During each exposure Kate was encouraged to use the mindfulness and defusion techniques in the presence of the DSH triggers. Similarly, she was encouraged to label her experience (e.g., “I'm having the thought that...” or “I'm noticing an urge to...” or “I'm noticing that my heart is racing....”) and just notice or observe how these experiences were transient. Kate also practiced the Gestalt techniques of describing her sensations in terms of their shape, colour, etc.

*Homework.* During Phase III, homework tasks were set. These were designed to promote skills generalisation, to enhance self-efficacy and engagement. They were practiced in session and included: 1) practising mindfulness to sounds, thoughts and bodily sensations, 2) observing and describing sensations in terms of physical features such as colour, shape, weight and speed, 3) completion of a valued living questionnaire and 4) using daily diaries to record urges to self-harm, DSH behaviour, and mindfulness practice.

*Phase IV Primed Exposure.*

Because Kate had reported that her urges to self-harm increased both in the presence of triggers and when emotionally dysregulated, a second series of probes and exposure sessions were conducted. These were designed to evaluate the impact of exposure to the personalised distressing priming script (described previously) on GSR, HR and self-reported urges to self-harm. This fourth phase of the study was designed to evaluate whether exposure could reduce reactivity to triggers when Kate was experiencing high levels of emotional arousal (an analogue for the occasions when Kate most likely to experience urges). In a probe session, SC read the personalised priming script to Kate to elicit high levels of emotional arousal. Kate was asked to close her eyes and place herself back in the distressing situation, imagining in detail her thoughts, feelings and sensations experienced at the time. The three stimuli were then presented in turn whilst psychophysiological responses and self-reported urges to self-harm were assessed. A second exposure session followed, during which Kate was primed with the script and exposed to S3 whilst psychophysiological responses and self-reported urges to self-harm were assessed. A final session involving a probe to all stimuli followed this exposure session.

*Phase V: Post-Exposure assessment.*

Immediately after this intervention, Kate completed the psychometric measures described above. An appointment was made for Kate to participate in a SCID-II interview with the independent experienced clinician. Kate was asked to respond to questions with regard to how she had felt since the previous assessment, over the past three months.

*Repeat clinical Audit.* The routine clinical assessment was re-administered as described previously.

*Four month follow-up.* At four months post intervention the psychometric measures administered at the final treatment session were re-administered to Kate by post.

*Attendance.* Kate made 21 appointments to attend therapy. She attended 13 of these, cancelled seven in advance, and failed to attend (without prior cancellation) one session (not including audit and follow-up sessions). Over one four-week period, Kate cancelled five sessions (between exposure to S3 and the final probe session of

Phase III). This period of poor attendance was precipitated by Kate experiencing a sense of progress and wellbeing. Without consulting either her GP or the research team, she made the decision to stop taking her medication. This was followed by a series of stressful events and a marked deterioration in mood. The intervention (excluding audits and follow-up sessions) was conducted over a period of 15 weeks.

*Psychophysiological Processing and Analysis.*

Psychophysiological data was extracted and processed using the same procedure as Study II. The data of interest were taken from the probe sessions. These were the mean amplitude of GSR and mean HR over each 1 minute stimulus related interval (i.e. mean GSR to S1, S2 and S3 across probes).

## 9.3 Results

### *9.3.1 Psychophysiological data*

Figures 10 and 11 display the psychophysiological response to the three probe stimuli across the five probe sessions. Each set of three probes, is referred to as a probe block.

*Exposure phases.* Figure 12 shows the results of the exposure intervention on GSR to each of the stimuli across probes. The staggered vertical line indicates the point at which the intervention was implemented for each stimulus. The results indicate that GSR to each stimulus did reduce across probes, however, the change in reactivity to a stimulus was not consistently time-locked with exposure to that specific stimulus. In addition, there was a great deal of variability across sessions. There was an increase in GSR to all stimuli in the third probe block. Thus there is no clear reduction in GSR following exposure.

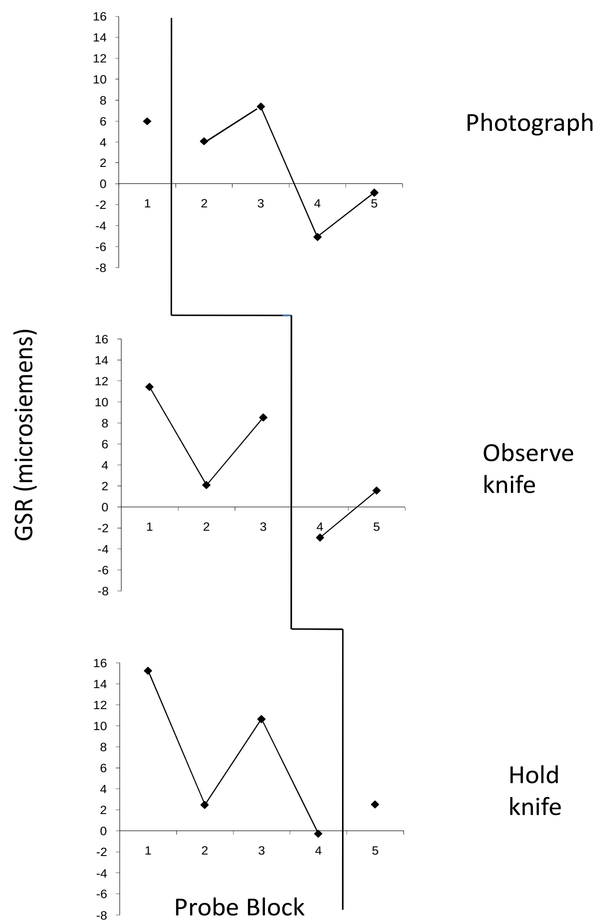



*Figure 10.* Mean GSR to stimuli across probes.

Figure 11 shows the results of the implementation of the exposure intervention on HR to each of the stimuli across probes. The results indicate that HR fluctuated across sessions but did not decrease during exposure.

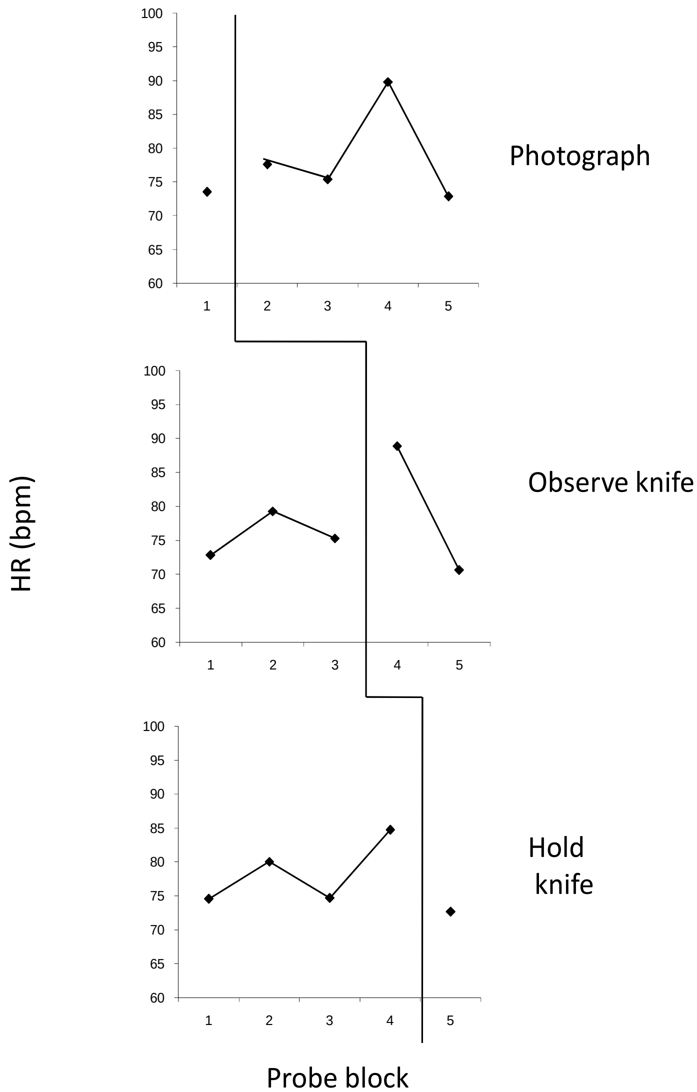



*Figure 11.* HR to stimuli across probe blocks.

Figure12 shows the results of the implementation of the exposure intervention on self-reported urges to each of the stimuli across probes. The results indicate that self-reported urges decreased to all stimuli with immediate effect from the start of the intervention.

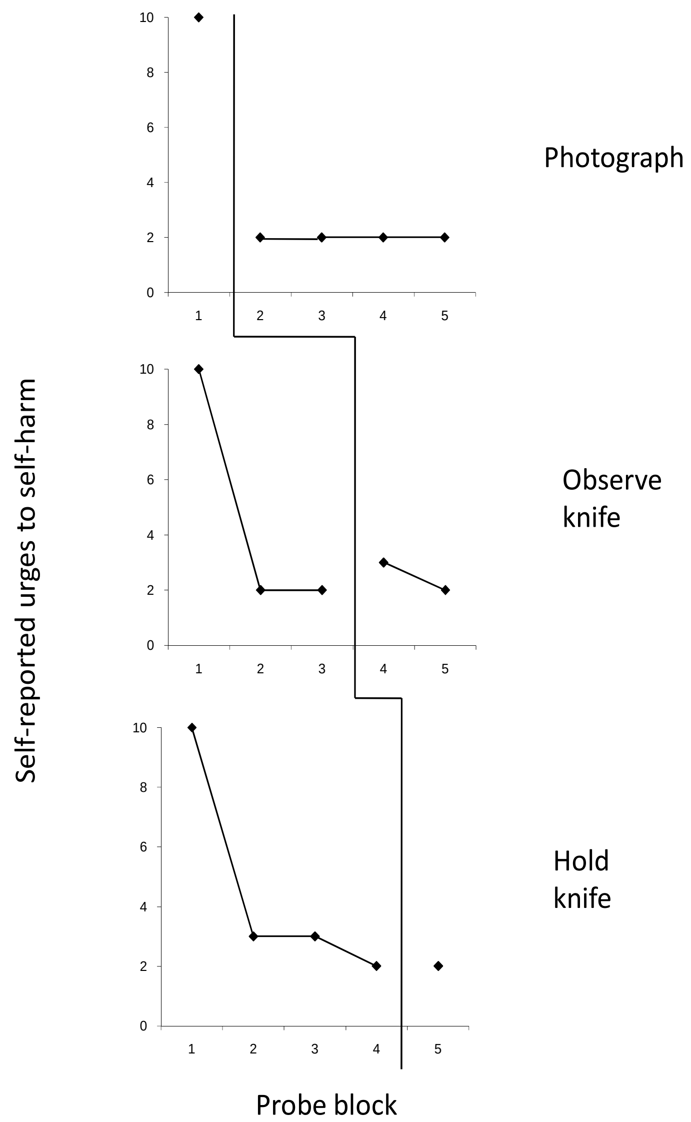



*Figure 12.* Self-reported urges to stimuli across probe blocks.

*Primed exposure phases*. Figure 13 shows three graphs and includes data collected across three separate sessions. The top graph shows the final probe session (5) of phase III of the research (exposure); the central graph shows the probe sessions (pre exposure) in phase IV during which the client was exposed to a priming script before exposure. The lower graph shows the probe session post primed exposure.

The data revealed that priming with a distress script reinstated the GSR reactivity that had diminished after the initial exposure intervention. This reactivity was then reduced after exposure training with the script and S3 (lower graph).

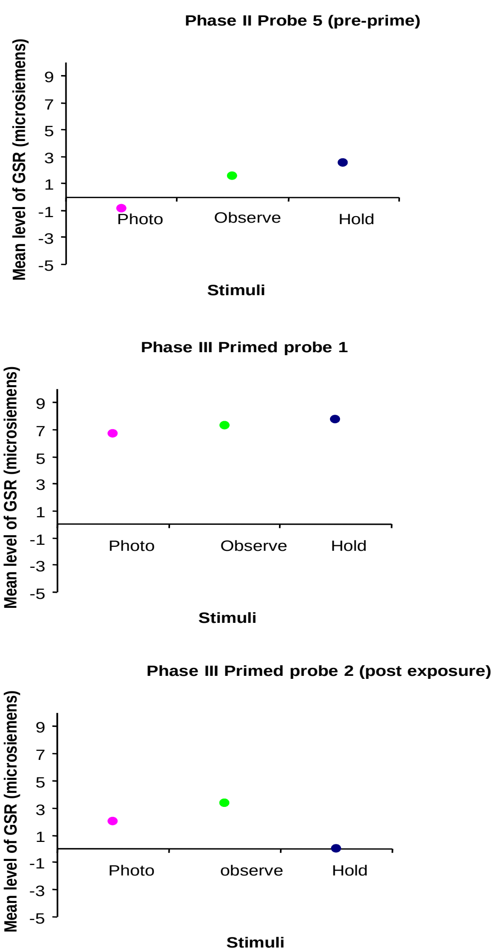



*Figure 13.* Mean level of GSR to probes in Phase III (primed exposure).

*9.3.2 Psychometric Data.*

*Diagnostic criteria*. The psychometric data are summarized in Table 41. Prior to therapy, Kate met the clinical diagnostic criteria for four Personality Disorders (assessed via the administration of the SCID-II by an independent clinician). These were: Avoidant Personality Disorder, Depressive Personality Disorder, Paranoid Personality Disorder and BPD. At the post therapy assessment, Kate met the clinical diagnostic criteria for BPD alone. She no longer met criteria for Avoidant Personality Disorder, Depressive Personality Disorder and Paranoid Personality Disorder.

*Emotion Regulation (DERS).* Kate failed to complete the DERS at post therapy assessment, but her total score reduced between pre-assessment and 4 month follow-up. At pre-assessment her scale scores indicated particular deficits in her ability to identify strategies to regulate her emotions (scale score=36), and her tendency towards impulsivity (30). At follow-up her use of strategies (scale score= 29) and reliance on impulsivity (24) had improved.

*Dissociation (DES-II).* Kate's use of dissociation reduced between pre-and post assessment. This was maintained at 4 month follow-up.

*Acceptance (AAQ).* Kate's total AAQ score increased pre-post therapy, but this was not maintained at follow-up.

*Symptom severity (SCL-R-90).* Kate's global symptom severity index reduced from within the inpatient range at pre-therapy audit, to below the clinical outpatient mean from published norms at post-therapy audit. Her positive symptom distress index increased between pre and post therapy audits and correspondingly her positive symptom total reduced.

*Clinical profile (MCMI-III-R).* At the pre-therapy clinical audit Kate had presented with trait symptoms on 19 of the 26 scales of the MCMI-III-R, with eight of these at the most clinically severe Personality disordered level. At the second clinical audit, Kate no longer presented with clinically severe personality disordered symptoms. Only depression, anxiety and major depression remained a concern at the trait level (see figures 14 and 15).

*Clinical risk.* A risk assessment conducted at the first clinical audit identified that Kate was at a significant risk of suicide- short and medium term and a significant risk of harm to others short and medium term. At the second clinical audit Kate was independently observed to be of no risk of suicide or harm to others.

Table 41. *Psychometric data.*

| *Measure* | *Clinical audit 1* | *Pre-therapy* | *Post-therapy* | *Clinical audit 2* | *4 month Follow up* |
|---|---|---|---|---|---|
| DERS | | 160 | | | 131 |
| DES | | 116 | 105 | | |
| AAQ | | 63 | 93 | | 57 |
| SCL-90-R (Global | | | | | |

| | | |
|---|---|---|
| severity Index) | 2.53 | 1.12 |
| (Positive symptom distress index) | 1.55 | 2.20 |
| (Positive symptom total) | 75 | 46 |

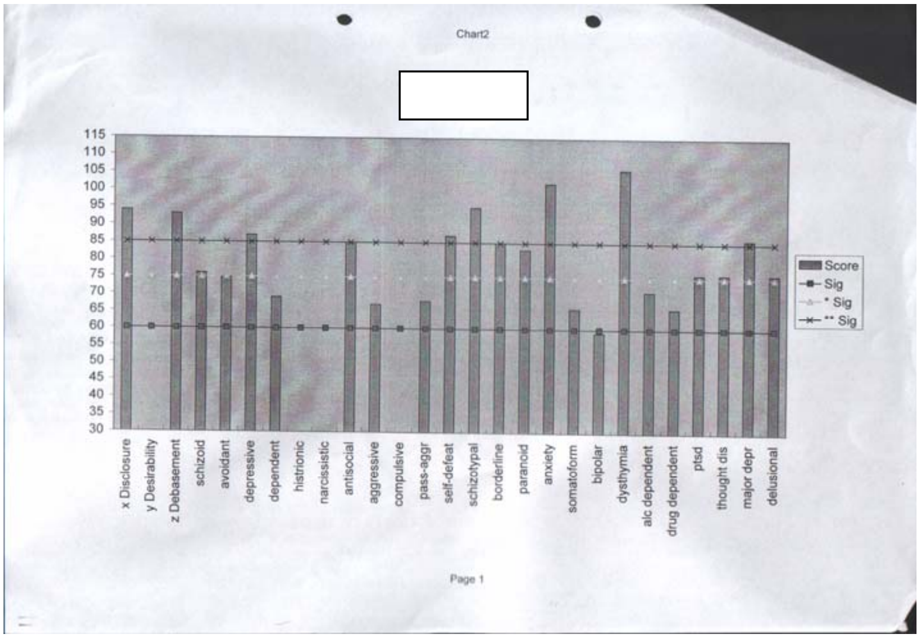



*Figure 14.* Millon profile pre therapy clinical audit.

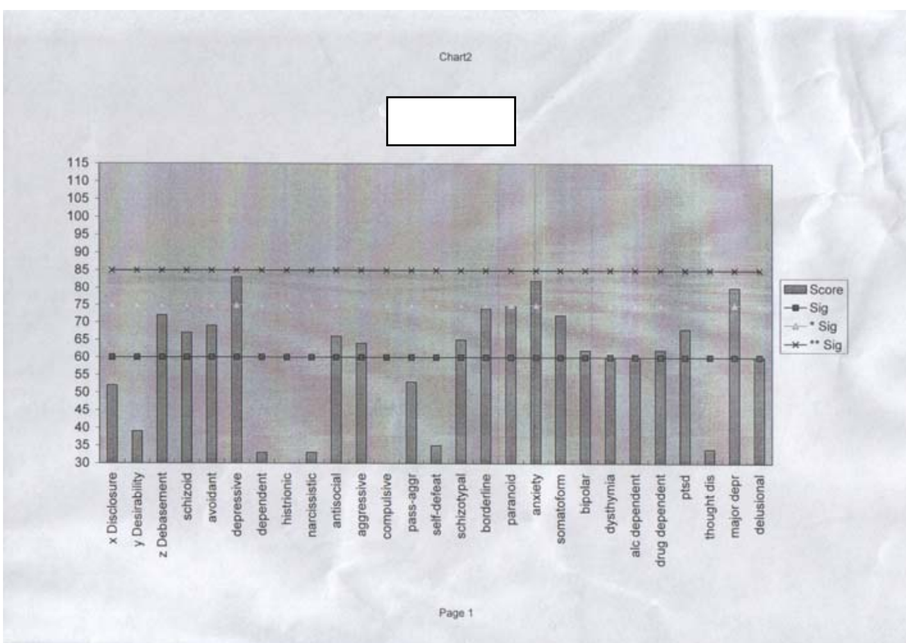



*Figure15.* Millon profile post therapy clinical audit.

*9.3.3 Urges to self-harm and acts of DSH.*

Kate completed daily diaries of her urges to DSH, and her acts of DSH for a week after the first therapy appointment and post therapy, and over 4 weeks during therapy. After the first appointment her urges were at a daily average rating of 5/10, post therapy her urges were rated at an average of 3/10. Average weekly ratings over the six weeks are presented in Table 42.

At the first appointment, Kate had reported that she engaged in DSH daily. During the first assessment week, and post therapy, Kate reported that she did not act on her urges to engage in DSH. During the period of non-attendance in therapy when experiencing high emotional dysregulation, Kate reported that she cut herself on two occasions. These episodes were the only reported episodes of DSH during therapy.

Table 42. *Average weekly ratings of the urge to self-harm.*

| Date | Mean urge rating |
|---|---|
| 07/11/06 (rating of previous week) | 4.71 |
| Week beginning 06/11/06 | 1.86 |
| Week beginning 08/12/06 | 1.86 |
| Week beginning 07/02/07 | 3.57 |
| Week beginning 21/02/07 | 6.71 |
| Week beginning 28/02/07 | 2.71 |

## 9.4 Discussion

### *9.4.1 Purpose of study*

This study was designed as a preliminary investigation of the effectiveness of delivering formal systemic cue exposure as an intervention for managing urges to self-harm in the presence of DSH cues.

### *9.4.2 GSR and HR*

The clinical case design revealed that over the course of therapy, GSR to personally salient and emotionally arousing DSH stimulus probes reduced.  However, the multiple baseline data indicate that this reduction was not closely linked to exposure to specific cues. Arousal whilst observing and handling the object also reduced. Heart rate reactivity, to probes remained relatively stable over the course of therapy.

### *9.4.3 Self-reported urges*

At the initial assessment session, Kate reported that she experienced both a background urge to self-harm that remained consistently at around 4 out of 10, she also reported that when distressed her urges to self-harm rose to between 8 and 10 (intolerable levels). Despite physiological arousal and clinically observed distress, reported urges to self-harm remained consistently low throughout the course of therapy.

*9.4.4 Priming*

When primed with a distressing personalised script depicting the events leading up to the most recent episode of DSH, the reactivity was re-instated, paralleling the findings of Study II. This reactivity was reduced after exposure.

*9.4.5 DSH*

Prior to the study, Kate reported that she engaged in DSH by cutting herself daily. During the course of the study Kate self-harmed on only two occasions, once when she believed her fiancé was going to leave her, and once when her cousin's child was taken into the care of Social Services, events which she described caused her unmanageable levels of anger and emotional distress. At the same time, she missed several therapy sessions, and ceased to take her medication. At 4 month follow-up, Kate reported that she had not cut herself since that date, 5 months previously. During participation in the exposure intervention Kate ceased to engage in DSH.

*9.4.6 Clinical Outcomes*

The data from the first clinical audit and the pre therapy assessment data revealed that Kate presented with a multitude of problem behaviours, clinical symptoms and difficulties. Prior to the study she met diagnostic criteria for four different personality disorders, presented with clinically significant symptoms on 19 of the 26 scales of the MCMI-III-R, with eight of these at the most severe level and was at a significant risk of suicide and harm to others. She presented with high levels of emotion dysregulation and low levels of acceptance. At the post therapy assessment she met the diagnostic criteria for one personality disorder (BPD) and at the second clinical audit, was no longer rated as clinically severe in her symptoms as rated by the MCMI-III-R (she presented with significant difficulties on 11 of the symptoms) and was no longer assessed as at risk of suicide or harm to others. Kate reported that her emotion dysregulation and dissociation had reduced, and acceptance increased over the course of the intervention. The changes in emotion dysregulation, and dissociation as well as the reduction in DSH behaviour were maintained at follow-up.

*9.4.7 Limitations and theoretical implications*

*Stimulus generalisation.* The data provided evidence indicating improvements in self-reported urges to self-harm, no. of acts of DSH and global clinical presentation. There were psychophysiological changes over the course of the therapy, but, neither these, nor the clinical changes observed, could be specifically attributed to the exposure components of the therapy. Baer, Wolf, and Risley (1986) asserted that the experimenter can only be assured that improvements are due to intervention when a change in behaviour occurs if and only if the treatment has been applied to the specific target variable. In this study, the multiple baseline components did not produce specific habituation to probes, there appears to have been a generalisation of the effect. Generalization is often desirable as it enables learning to occur without specific exposure to every stimulus-response contingency. However, in this design stimulus generalisation means that the effectiveness of the intervention cannot be discriminated. The stimulus generalisation may be due to the fact that the probes were not dissimilar enough to elicit differential reactivity, or that the generic skills teaching enabled the client to manage urges non-specifically.

The research design used in this study assumes that each observed behaviour/response is distinct and is shaped by reinforcement of environmental contingencies. Generalisation across probes might be more likely would be expected in individuals who have the developmental cognitive capacity to use language. Where language has developed stimulus contingencies are shaped by both environmental changes and rule-governed processes. For an individual who has developed the capacity to use language, the stimulus contingencies are thus less clear cut. An individual has the capacity to observe experience, use self-talk with regards to the observed experience and thus predict changes before they have occurred in the environment. Therefore it would be expected that with language development comes the capacity to change responses to a range of different stimuli in the same stimulus class, after observing environmental changes and making the stimulus-response links that are made clear by language. In this case, the fact that Kate observed that her physiological experiences were changing in response to the photograph of a knife, would predict that they would also change when she observed a real knife, and then when she held the knife herself, because ‘knife’ falls into the same stimulus class. Donahoe and Palmer (1994) defined a stimulus class as a ‘common set of responses based on physical or functional similarity among the stimuli contained within that class’.

*Rule-governed behaviour*. Operant behaviour is subject to both informational as well as motivational factors. As a result of previous associations with a variation in the probability that a particular behaviour will be reinforced, particular contexts gain informational value, that is, it becomes apparent under which situations (time, location, and environment) a behaviour is more or less likely. This contextual control over discriminative stimuli is observed as conditioned relations as is expressed as verbal rules about behaviour. Skinner (1963) identified that the operant behaviour of humans is directly shaped by reinforcement contingencies but that also much human behaviour is rule-governed behaviour, that is behaviour is subject to the verbal rules (both instructional and self-instructional) that mediate between the environmental contingencies and the behaviour. This has two important implications, verbal rules may directly influence the relationship between the contingency and performance, and secondly, these rules may lead to inaccurate or ineffective performance. Rule-governed behaviour has a tendency to make people insensitive to any changes in the actual contingencies in behaviour and may be less sensitive t change via exposure paradigms. Once a rule is learned, for example that DSH provides tension relief, the behaviour may be maintained even in the absence of the reinforcer.

The use of verbal rules enhances the capacity for generalisation of information. Thus, extinguishing a specific learned response such as DSH may not be as simple as learning a new rule in those specific circumstances, because a new context or retrieval of an old memory, may re-trigger those links. Verbal rules may become fixed and rigid over time when they are repeatedly reinforced. This may begin to explain why DSH is maintained, despite the fact that over time the reinforcing consequences may no longer be present. Exposure to the triggers for DSH is designed, not only to address the behavioural relationship between the trigger and the event, but also to offer the opportunity for new learning to occur, enabling the individual to cognize that there are situations when the trigger (e.g., anger, shame, or an argument) is present, and yet the action (DSH) can be prevented.

In the current study, therapy was provided across several contexts, and homework was used to promote generalisation. However, this may be limited because the original association may be re-triggered not only by context, but also by a thought.

*Active components of therapy.* Because the multiple baseline data did not show that the therapeutic gains were time-locked to the specific exposure to each stimulus, the active components of the intervention described are not known. It might be hypothesised that non-specific therapeutic factors influenced outcome, for example the therapeutic alliance, the provision of a supportive, accepting environment, or a place to practise skills.

It might be hypothesised that skills training in mindfulness techniques may have elicited improvements alone, or that observation and monitoring of DSH and emotion management elicited social desirability effects. Alternatively there may have been spontaneous remission. The use of Mindfulness and acceptance techniques may help with engagement because the focus of the therapy is explicitly tied to the values identified by the client, rather than goals set by the therapist, service or referrer. The therapy is targeted explicitly at enhancing quality of life and this is set out to be a continual process rather than a goal that can be achieved or not achieved. The client is encouraged to reflect, and describe sensations, thoughts and feelings, which helps him or her to remain 'in the moment' with the exposure, rather than using avoidance or other methods of distraction.

Gunderson (1996) suggested that DBT may be particularly effective for this client group because of the 24 hour nature of support. In the present study, telephone coaching was available to the client 24 hours a day, and although this was only used on two occasions, the availability of this supported might have had a 'containing' effect on the urges to self-harm. To the client, knowing that this support was available may have had an impact on the urge to self-harm.

*Treatment adherence.* Treatment adherence in the present study might have been impeded by a number of factors, particularly given the nature of the specific difficulties that are often experienced by this client group, including: a chaotic lifestyle, difficulties in maintaining interpersonal relationships and a lack of adaptive skills to regulate emotions. Bornovalova and Daughters (2007) also emphasised that a lack of motivation for change, difficulties maintaining a therapeutic relationship, and difficulties in tolerating distress might also impede treatment adherence in clients with BPD.

Although there were concerns with treatment adherence, the present study provides a clear example of how intervention for DSH might look in an applied setting, thus reflecting a true evaluation of the 'effectiveness' of the intervention.

*Outcome measures.* The outcome measures of physiological reactivity that were selected were the mean levels of GSR and HR recorded during exposure to the stimulus probes. A more rigorous measure of reactivity might have included analysis of the change from pre-stimulus levels to post stimulus onset levels. However, owing to the sensitive nature of the sessions and the importance of responding to clinical needs the client was verbally prepared prior to the presentation of each stimulus, so pure scores rather than change scores were used.

Further work is required to identify whether heart rate is a useful indicator of responsivity as there is less scope for variance in this measure. It may be that averaging over the duration of the probe (60 seconds) masked any change in HR. Consideration of the change in HR pre-post onset of the probe might be a more appropriate measure of HR however, as discussed in the limitations section this was not practicable in the present study.

A further limitation is that a tonic measure HR to cues was assessed whereas phasic GSR was assessed. A phasic measure of GSR was used because GSR amplitude can only be computed when there is a response (i.e., frequency of responses impacts on cue specific measures of amplitude). For Studies II and III, mean GSR amplitude was considered in relation to the number of times a response was made to a cue. For the purposes of this study, however, as only three cues are used in a probe block, and potentially there may not have been time-locked GSR reactivity, in the present study the mean level of GSR reactivity recorded during a probe session, across sessions, was assessed to provide a general index of reactivity. In contrast, it is possible to look at HR beat to beat intervals that are time-locked to cues because the availability of this data is constant.

It might also have been useful to have collected psycho-physiological data at the 4 month follow-up. However, it was deemed inappropriate to deliver this assessment without concurrent clinical support and this was not feasible due to practical considerations.

The SCID-II results must be interpreted with caution, because this measure assesses the lifetime prevalence of a range of behaviours. Therefore data at pre-assessment represents the true lifetime prevalence, but at post-therapy the measure represents occurrence of these symptoms over the previous 6 months.

Despite these limitations, the present study provided an example of how a cue exposure intervention may fare in a real-world setting, taking into consideration environmental context, individual variables and the difficulties experienced by this client group. The study reflects the anecdotally reported high attrition rate in this population and identifies where challenges in the delivery of an exposure therapy may lie.

### *9.4.8 Future Research*

The preliminary findings presented in this chapter suggest that further replication of a cue exposure intervention is warranted. Future research should focus on developing the study in more tightly controlled conditions, perhaps comparing exposure plus ACT to exposure alone to begin to elucidate the active components of therapy.

Replicating the design over a larger sample, and using a range of therapists would identify whether the intervention can be generalised and whether inter-individual differences impair its efficacy. After further replication, larger group based designs such as an RCT might be considered.

It is important to identify a range of probes that are both personally specific and elicit initial reactivity but are also discrete. Further research should continue to focus on the identification of the most appropriate triggers and the conditions under which reactivity is enhanced and diminished is required.

Future research might also consider the assessment of heart rate variability (HRV), which refers to the beat to beat intervals in HR (Malik, 1998). As a dynamic marker of load, HRV appears to be sensitive and responsive to acute stress, however lengthier time intervals of measurement are required (HRV is typically assessed manually by calculating mean beat to beat interval and its standard deviation measured on short-term (e.g., 5 minute) electrocardiograms).

There was little diversity in self-reported reactivity to cues over the course of the therapy, and self-report data did not reflect psychophysiological reactivity. There may be alternative ways of assessing reactivity to cues that are appropriate for use in a clinical context but that do not rely on self-report for example Nock and Banaji (2007) recently reported that a behavioural measure of pre-attentive processing (The Implicit Association Test, Greenwald et al., 1998) reliably identified adolescents at risk from engaging in DSH by assessing reaction times to DSH and negative self referent words. A similar approach might enable identification of cues that implicitly trigger urges to engage in DSH beyond conscious awareness. In this thesis, pre-conscious presentation of stimuli has been found to enhance reactivity to cues. Individuals appear to be vulnerable to both explicit, identifiable triggers in the environment and also to operating mechanisms that be pre-consciously processed.

Pre-attentive measures of reactivity to cues might provide a clinically appropriate tool for use in evaluating therapeutic outcome.

A recent review paper has discussed the advantages of using the single case research design for the development of interventions for DSH (Rizvi & Nock , 2008). The single case approach used in the present study, has much to offer for future research in this field.

## 9.5 Summary

Those who engage in DSH, report that it is triggered by: a) emotion dysregulation-establishing operations and b) environmental cues that signal the behaviour. Treatment intervention for DSH is limited at present. Whilst DBT and ACT approaches have informally utilised exposure approaches, this study has provided the first examination of a formal systematic approach to cue exposure with response prevention to specific DSH cues. The present single case study was unable to identify that exposure to specific stimuli associated with DSH whilst observing and accepting the sensations experienced, reduced physiological reactivity to such triggers, enhanced the ability to manage urges to act on these impulses and improved clinical and behavioural outcomes. Psychophysiological reactivity and urges did reduce, but independent of intervention. The active components of the intervention are yet to be identified and the design requires further development and methodological control. Further development and a greater understanding of reactivity to triggers is required to establish whether a formal cue exposure intervention for DSH warrants further investigation.

Appendix A.*DSM-IV criteria for Borderline Personality Disorder*

1. Frantic efforts to avoid real or imagined abandonment (do not include suicidal or self-mutilating behaviour covered in criterion 5).
2. A pattern of unstable and intense interpersonal relationships characterised by alternating between extremes of idealization and devaluation.
3. Identity disturbance: persistent and markedly disturbed, distorted or unstable self-image or sense of self (e.g., feeling like one does not exist or embodies evil).
4. Impulsiveness in at least two areas that are potentially self-damaging (e.g., spending, sex, substance abuse, shoplifting, reckless driving, binge eating- do not include suicide or self-mutilating behaviour covered in criterion 5).
5. Recurrent suicidal threats, gestures, or behaviour, or self-mutilating behaviour.
6. Affective instability: marked reactivity of mood (e.g., intense episodic dysphoria, irritability or anxiety) usually lasting a few hours and only rarely more than a few days.
7. Chronic feelings of emptiness.
8. Inappropriate, intense anger or lack of control of anger (e.g., frequent displays of temper, constant anger, recurrent physical fights).
9. Transient, stress-related severe Dissociative symptoms or paranoid ideation.

Appendix B. *Internet Questionnaire*

**Welcome to the on-line Self-Harm questionnaire**

**Information**

***Please following about history of answer the questions your self-harm***

**Investigating deliberate self-harm**

- We would like you to participate in a research project that will help us to understand deliberate self-harm (DSH). Here is some information to help you decide whether or not to take part. Please take your time to read it carefully.
- Self-harm can be defined as 'any deliberate act of self-injury or self-poisoning where the intention is to cause injury, but not death'.
- If you are over the age of eighteen and are currently repetitively self-harming (i.e. more than once every two months), or have self-harmed repetitively in the past but are now abstaining, we would like you to participate in our research.
- Although the study will not bring you any direct benefit, the information provided will help to improve our understanding of self-harm so that professionals can respond in more helpful ways.
- If you decide to participate, you will be asked to give consent. You will be free to withdraw at any time and no-one will mind.
- All information you provide will be kept and anonymised so that you can't be identified.
- Please take some time to decide whether or not you wish to participate.
- Thank you.

**In conjunction with the University of Southampton, Dorset Healthcare Trust is currently conducting research into self-harm. If you are interested in taking part in this research please contact Claire a PhD student on 02380 594594 or crh102@soton.ac.uk to receive a password that you will need to enter in order to complete this questionnaire. Thank you for your time.**

**password**

| | | |
|---|---|---|
| **What is your age?** | | |
| **Do you currently engage in self-harm?** | ☐ Yes | ☐ No |
| **At what age did you first self-harm?** | | |
| **How long is it since you last self-harmed?** | | |
| **Have you ever tried to give up self-harm?** | ☐ Yes | ☐ No |
| **How long have you abstained from self-harm?** | | |

**How frequently do you engage in self-harm?**

| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|---|---|---|---|
| Less than once a year | Once a year | 2-5 times per year | 6-11 times per year | 1-3 times per month | 1-3 times per week | 4-6 times per week | Once a day | More than once a day |

**Please specify the implements that you most frequently use to self-harm.**

| | Implements |
|---|---|
| Cutting | |
| Burning | |
| Other | |

**Have you previously received treatment for any of the following?**

| | **Pharmacological (drugs)** | | **Counselling** | | **Psychotherapy** | |
|---|---|---|---|---|---|---|
| **Self-harm** | Yes | No | Yes | No | Yes | No |
| **Alcohol** | Yes | No | Yes | No | Yes | No |
| **Drugs** | Yes | No | Yes | No | Yes | No |
| **Eating disorders** | Yes | No | Yes | No | Yes | No |
| **Other mental health problems** | Yes | No | Yes | No | Yes | No |

***Please answer the following questions by clicking on the yes or no button***

**Please answer these questions about what has happened since you started to self-harm. Either describe your current experiences or your experiences in the**

past.

| |
|---|
| **Despite my attempts to control it, the frequency or severity of my self-harm has increased over time**<br>☐ yes ☐ no |
| **Despite recognising that there are negative consequences, I continue to self-harm**<br>☐ yes ☐ no |
| **If I stop self-harming I feel tense**<br>☐ yes ☐ no |
| **I have tried to stop myself from self-harming in the past**<br>☐ yes ☐ no |
| **I have neglected social activities because of self-harming**<br>☐ yes ☐ no |

| |
|---|
| **In order to achieve the same effect as I used to, I have increased the frequency I self-harm**<br>☐ yes ☐ no |
| **In order to achieve the same effect as I used to, I have increased how severely I self-harm**<br>☐ yes ☐ no |
| **Self-harm takes up a lot of my time**<br>☐ yes ☐ no |
| **I experience withdrawal symptoms if I do not self-harm**<br>☐ yes ☐ no |

***Please answer the following questions about***

***your early experience of self-harm***

| |
|---|
| *Early episodes* |

**Please think back to when you first started to self-harm. Some people find that it is difficult to resist the urge to self-harm in situations that involve close relationships, or when thinking about close relationships. Which of the following situations describe your <u>early</u> experiences of self-harm? You may click as many buttons as are applicable.**

| | |
|---|---|
| **Experiencing frustration or anger associated with others e.g. hostility, aggression.** | ☐ |
| **Experiencing other conflict associated with others e.g. anxiety, fear.** | ☐ |
| **Direct social pressure e.g. being urged to self-harm by others.** | ☐ |
| **Indirect social pressure e.g. observing others engaging in self-harm.** | ☐ |
| **Enhancement of positive motivational states e.g. pleasure, celebration, freedom.** | ☐ |

*Early episodes*

**Please think back to your early experiences of self-harm. Some people find that find that it is difficult to resist the urge to self-harm in situations that <u>DO NOT INVOLVE CLOSE RELATIONSHIPS</u>. Which of the following situations describe your early experiences? You may click as many buttons as are applicable.**

**Experiencing frustration/anger e.g. hostility or aggression.** ☐

**Experiencing other negative emotional states e.g. fear, anxiety.** ☐

**Experiencing physical states associated with prior substance abuse e.g. withdrawal symptoms.** ☐

**Experiencing other negative physical states, e.g. pain, illness.** ☐

**Enhancement of positive motivational states, e.g. pleasure, celebration, freedom.** ☐

**Testing personal control, e.g. testing willpower.** ☐

**Giving into temptations or urges in the presence of cues associated with self-harm, e.g. razor blades, candles.** ☐

**Giving into temptations, or urges in the absence of cues associated with self-harm.** ☐

*Early episodes*

**What kinds of situations were stronger triggers for self-harm?**

situations that involve close relationships. Yes ☐ No ☐

situations that do not involve close relationshops. Yes ☐ No ☐

*Early episodes*

**When you first started to self-harm did you experience pain? Please rate the severity of your first experience.**

| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| No pain | | | | | | High pain |

*Early episodes*

**Please think back to the first time that you self-harmed. Please rate how strong your urge was to self-harm on the scale below. An urge is defined as 'a strong desire, especially one which is difficult or impossible to control'.**

| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| No urge | | | | | | High urge |

***Please answer the following questions about your recent patterns of self-harm***

*Recent episodes*

**Do you often find that you self-harm in the absence of any obvious triggers?** ☐ Yes ☐ No

*Recent episodes*

**Some people find that it is more difficult to resist the urge to self-harm when facing situations that INVOLVE CLOSE RELATIONSHIPS, or when thinking about close relationships.**

**Which of the following situations describe your experience? You may mark as many situations as are applicable.**

**Coping with frustration or anger associated with others e.g. hostility, aggression.** ☐

**Coping with other conflict associated with others e.g. anxiety, fear.** ☐

**Direct social pressure e.g. being urged to self-harm by others** ☐

**Indirect social pressure e.g. observing others engaging in self-harm.** ☐

**Enhancement of positive motivational states e,g, pleasure, celebration, freedom.** ☐

*Recent episodes*

**Some people find that it is more difficult to resist the urge to self-harm in situations that DO NOT involve close relationships.**

**Which of the following situations describe your experiences? You may mark as many situations as are applicable.**

**Coping with frustration or anger associated with others e.g. hostility, aggression.** ☐

**Coping with other negative emotional states e.g. fear, anxiety.** ☐

**Coping with physical states associated with prior substance abuse e.g. withdrawal symptoms.** ☐

**Coping with other negative physical states, e.g. pain, illness.** ☐

**Enhancement of positive emotional states, e.g. pleasure, freedom, celebration.** ☐

**Testing personal control, e.g. testing willpower**. ☐

**Giving into temptations or urges in the presence of cues associated with self-harm, e.g. razor blades, candles.** ☐

**Giving into temptations, or urges in the absence of cues associated with self-harm.** ☐

*Recent episodes*

**What kinds of situations were stronger triggers for self-harm?**

| | | |
|---|---|---|
| situations that involve close relationships. | Yes ☐ | No ☐ |
| situations that do not involve close relationships. | Yes ☐ | No ☐ |

*Recent episodes*

**This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in**

**the space next to that word. Use the following scale to record your answers.**

**Please indicate what emotions you were experiencing immediately <u>before</u> your last experience of self-harm.**

| Before self-harm | very slightly or not at all | a little | moderately | quite a bit | extremely |
|---|---|---|---|---|---|
| interested | ☐ | ☐ | ☐ | ☐ | ☐ |
| distressed | ☐ | ☐ | ☐ | ☐ | ☐ |
| excited | ☐ | ☐ | ☐ | ☐ | ☐ |
| upset | ☐ | ☐ | ☐ | ☐ | ☐ |
| strong | ☐ | ☐ | ☐ | ☐ | ☐ |
| guilty | ☐ | ☐ | ☐ | ☐ | ☐ |
| scared | ☐ | ☐ | ☐ | ☐ | ☐ |

| Before self-harm | very slightly or not at all | a little | moderately | quite a bit | Extremely |
|---|---|---|---|---|---|
| hostile | ☐ | ☐ | ☐ | ☐ | ☐ |
| enthusiastic | ☐ | ☐ | ☐ | ☐ | ☐ |
| proud | ☐ | ☐ | ☐ | ☐ | ☐ |
| irritable | ☐ | ☐ | ☐ | ☐ | ☐ |
| alert | ☐ | ☐ | ☐ | ☐ | ☐ |
| ashamed | ☐ | ☐ | ☐ | ☐ | ☐ |
| inspired | ☐ | ☐ | ☐ | ☐ | ☐ |

| Before self-harm | very slightly or not at all | a little | moderately | quite a bit | Extremely |
|---|---|---|---|---|---|
| nervous | ☐ | ☐ | ☐ | ☐ | ☐ |
| determined | ☐ | ☐ | ☐ | ☐ | ☐ |
| attentive | ☐ | ☐ | ☐ | ☐ | ☐ |
| jittery | ☐ | ☐ | ☐ | ☐ | ☐ |
| active | ☐ | ☐ | ☐ | ☐ | ☐ |
| afraid | ☐ | ☐ | ☐ | ☐ | ☐ |

| numb | ◻ | ◻ | ◻ | ◻ | ◻ |
|---|---|---|---|---|---|
| **Before self-harm** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **Extremely** |

*Recent episodes*

**This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Use the following scale to record your answers.**

**Please indicate how you felt the last time immediately <u>after</u> you self-harmed?**

| After self-harm | very slightly or not at all | a little | moderately | quite a bit | Extremely |
|---|---|---|---|---|---|
| interested | ◻ | ◻ | ◻ | ◻ | ◻ |
| distressed | ◻ | ◻ | ◻ | ◻ | ◻ |
| excited | ◻ | ◻ | ◻ | ◻ | ◻ |
| upset | ◻ | ◻ | ◻ | ◻ | ◻ |
| strong | ◻ | ◻ | ◻ | ◻ | ◻ |
| guilty | ◻ | ◻ | ◻ | ◻ | ◻ |
| scared | ◻ | ◻ | ◻ | ◻ | ◻ |
| **After self-harm** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **Extremely** |
| hostile | ◻ | ◻ | ◻ | ◻ | ◻ |
| enthusiastic | ◻ | ◻ | ◻ | ◻ | ◻ |
| proud | ◻ | ◻ | ◻ | ◻ | ◻ |
| irritable | ◻ | ◻ | ◻ | ◻ | ◻ |
| alert | ◻ | ◻ | ◻ | ◻ | ◻ |
| ashamed | ◻ | ◻ | ◻ | ◻ | ◻ |
| inspired | ◻ | ◻ | ◻ | ◻ | ◻ |
| **After self-harm** | **very slightly** | **a little** | **moderately** | **quite a bit** | **Extremely** |

| | or not at all | | | | |
|---|---|---|---|---|---|
| nervous | ☐ | ☐ | ☐ | ☐ | ☐ |
| determined | ☐ | ☐ | ☐ | ☐ | ☐ |
| attentive | ☐ | ☐ | ☐ | ☐ | ☐ |
| jittery | ☐ | ☐ | ☐ | ☐ | ☐ |
| active | ☐ | ☐ | ☐ | ☐ | ☐ |
| afraid | ☐ | ☐ | ☐ | ☐ | ☐ |
| numb | ☐ | ☐ | ☐ | ☐ | ☐ |
| **After self-harm** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **Extremely** |

*Recent episodes*

**Sometimes people find it hard to distract themselves from self-harm when they are experiencing negative emotions such as anger, sadness, guilt, frustration.**

**I find it most difficult to distract myself from self-harm when I am experiencing negative emotions that are;**

☐ Low

☐ Moderate

☐ High

*Recent episodes*

**Some people find it difficult to think about alternative ways of coping when experiencing these negative emotions.**

**Do you find it most difficult to think about alternative methods of coping when levels of these emotions are?**

☐ Low

☐ Moderate

☐ High

*Recent episodes*

**Some people find it difficult to weigh up the pros and cons of self-harming think when experiencing these negative emotions. I find it most difficult to**

**weigh up the pros and cons of self-harming experiencing levels of emotions that are;**

- ☐ Low
- ☐ Moderate
- ☐ High

*Recent episodes*

**Do you experience pain when you self-harm?**

| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| No pain | | | | | | High pain |

*Recent episodes*

**Please think back to the last time that you self-harmed. Please rate how strong your urge was to self-harm on the scale below. An urge is defined as;**
**'a strong desire, especially one which is difficult or impossible to control'**

| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| No urge | | | | | | High urge |

*Recent episodes*

**What kinds of situations were stronger triggers for self-harm?**

| | | |
|---|---|---|
| situations that involve close relationships. | Yes ☐ | No ☐ |
| situations that do not involve close relationships. | Yes ☐ | No ☐ |

*Recent episodes*

**This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Use the following scale to record your answers.**

**Please indicate what emotions you were experiencing immediately <u>before</u> your last experience of self-harm.**

| **Before self-harm** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **Extremely** |
|---|---|---|---|---|---|
| **interested** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **distressed** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **excited** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **upset** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **strong** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **guilty** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **scared** | ☐ | ☐ | ☐ | ☐ | ☐ |

| **Before self-harm** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **Extremely** |
|---|---|---|---|---|---|
| **hostile** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **enthusiastic** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **proud** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **irritable** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **alert** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **ashamed** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **inspired** | ☐ | ☐ | ☐ | ☐ | ☐ |

| **Before self-harm** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **Extremely** |
|---|---|---|---|---|---|
| **nervous** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **determined** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **attentive** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **jittery** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **active** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **afraid** | ☐ | ☐ | ☐ | ☐ | ☐ |
| **numb** | ☐ | ☐ | ☐ | ☐ | ☐ |

*Recent episodes*

**This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Use the following scale to record your answers.**

**Please indicate how you felt the last time immediately <u>after</u> you self-harmed?**

| After self-harm | very slightly or not at all | a little | moderately | quite a bit | Extremely |
|---|---|---|---|---|---|
| interested | ☐ | ☐ | ☐ | ☐ | ☐ |
| distressed | ☐ | ☐ | ☐ | ☐ | ☐ |
| excited | ☐ | ☐ | ☐ | ☐ | ☐ |
| upset | ☐ | ☐ | ☐ | ☐ | ☐ |
| strong | ☐ | ☐ | ☐ | ☐ | ☐ |
| guilty | ☐ | ☐ | ☐ | ☐ | ☐ |
| scared | ☐ | ☐ | ☐ | ☐ | ☐ |

| After self-harm | very slightly or not at all | a little | moderately | quite a bit | extremely |
|---|---|---|---|---|---|
| hostile | ☐ | ☐ | ☐ | ☐ | ☐ |
| enthusiastic | ☐ | ☐ | ☐ | ☐ | ☐ |
| proud | ☐ | ☐ | ☐ | ☐ | ☐ |
| irritable | ☐ | ☐ | ☐ | ☐ | ☐ |
| alert | ☐ | ☐ | ☐ | ☐ | ☐ |
| ashamed | ☐ | ☐ | ☐ | ☐ | ☐ |
| inspired | ☐ | ☐ | ☐ | ☐ | ☐ |

| After self-harm | very slightly or not at all | a little | moderately | quite a bit | extremely |
|---|---|---|---|---|---|
| nervous | ☐ | ☐ | ☐ | ☐ | ☐ |

| | | | | | |
|---|---|---|---|---|---|
| determined | ☐ | ☐ | ☐ | ☐ | ☐ |
| attentive | ☐ | ☐ | ☐ | ☐ | ☐ |
| jittery | ☐ | ☐ | ☐ | ☐ | ☐ |
| active | ☐ | ☐ | ☐ | ☐ | ☐ |
| afraid | ☐ | ☐ | ☐ | ☐ | ☐ |
| numb | ☐ | ☐ | ☐ | ☐ | ☐ |
| **After self-harm** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **extremely** |

*Recent episodes*

**This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Use the following scale to record your answers.**

**Please indicate how you felt the last time that you really wanted to self-harm but were blocked from doing so?**

| **Blocked self-harming** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **extremely** |
|---|---|---|---|---|---|
| interested | ☐ | ☐ | ☐ | ☐ | ☐ |
| distressed | ☐ | ☐ | ☐ | ☐ | ☐ |
| excited | ☐ | ☐ | ☐ | ☐ | ☐ |
| upset | ☐ | ☐ | ☐ | ☐ | ☐ |
| strong | ☐ | ☐ | ☐ | ☐ | ☐ |
| guilty | ☐ | ☐ | ☐ | ☐ | ☐ |
| scared | ☐ | ☐ | ☐ | ☐ | ☐ |

| **Blocked self-harming** | **very slightly or not at all** | **a little** | **moderately** | **quite a bit** | **Extremely** |
|---|---|---|---|---|---|
| hostile | ☐ | ☐ | ☐ | ☐ | ☐ |
| enthusiastic | ☐ | ☐ | ☐ | ☐ | ☐ |
| proud | ☐ | ☐ | ☐ | ☐ | ☐ |
| irritable | ☐ | ☐ | ☐ | ☐ | ☐ |
| alert | ☐ | ☐ | ☐ | ☐ | ☐ |
| ashamed | ☐ | ☐ | ☐ | ☐ | ☐ |
| inspired | ☐ | ☐ | ☐ | ☐ | ☐ |

| Blocked self-harming | very slightly or not at all | a little | moderately | quite a bit | extremely |
|---|---|---|---|---|---|
| nervous | ☐ | ☐ | ☐ | ☐ | ☐ |
| determined | ☐ | ☐ | ☐ | ☐ | ☐ |
| attentive | ☐ | ☐ | ☐ | ☐ | ☐ |
| jittery | ☐ | ☐ | ☐ | ☐ | ☐ |
| active | ☐ | ☐ | ☐ | ☐ | ☐ |
| afraid | ☐ | ☐ | ☐ | ☐ | ☐ |
| numb | ☐ | ☐ | ☐ | ☐ | ☐ |
| Blocked self-harming | very slightly or not at all | a little | moderately | quite a bit | extremely |

*Recent episodes*

**Sometimes people find it hard to distract themselves from self-harm when they are experiencing negative emotions such as anger, sadness, guilt, frustration.**

**I find it most difficult to distract myself from self-harm when I am experiencing negative emotions that are;**

☐ low

☐ moderate

☐ high

*Recent episodes*

**Some people find it difficult to think about alternative ways of coping when experiencing these negative emotions.**

**Do you find it most difficult to think about alternative methods of coping when levels of these emotions are?**

- [ ] low
- [ ] moderate
- [ ] high

*Recent episodes*

**Some people find it difficult to weigh up the pros and cons of self-harming think when experiencing these negative emotions. I find it most difficult to weigh up the pros and cons of self-harming experiencing levels of emotions that are;**

- [ ] low
- [ ] moderate
- [ ] high

*Recent episodes*

**Do you experience pain when you self-harm?**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| No pain | | | | | | High pain |

*Recent episodes*

**Please think back to the last time that you self-harmed. Please rate how strong your urge was to self-harm on the scale below. An urge is defined as;**
**'a strong desire, especially one which is difficult or impossible to control'**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| No urge | | | | | | High urge |

## Debrief

Thank you for your time. The study that you have just completed investigates the development and emerging pattern of an individuals experiences of self-harm. This information will be used to inform healthcare professionals about how different people experience self-harm, and will be used to develop a treatment intervention to help individuals who engage in this behaviour.

If you would like any further information please contact Claire on crh102@soton.ac.uk.

We will be conducting a series of studies regarding self-harm. If you are happy to leave your details in order that we can contact you will further information about these studies then please enter your name and e-mail address and press submit now. Your responses to this study will remain completely anonymous and confidential.

**Name**

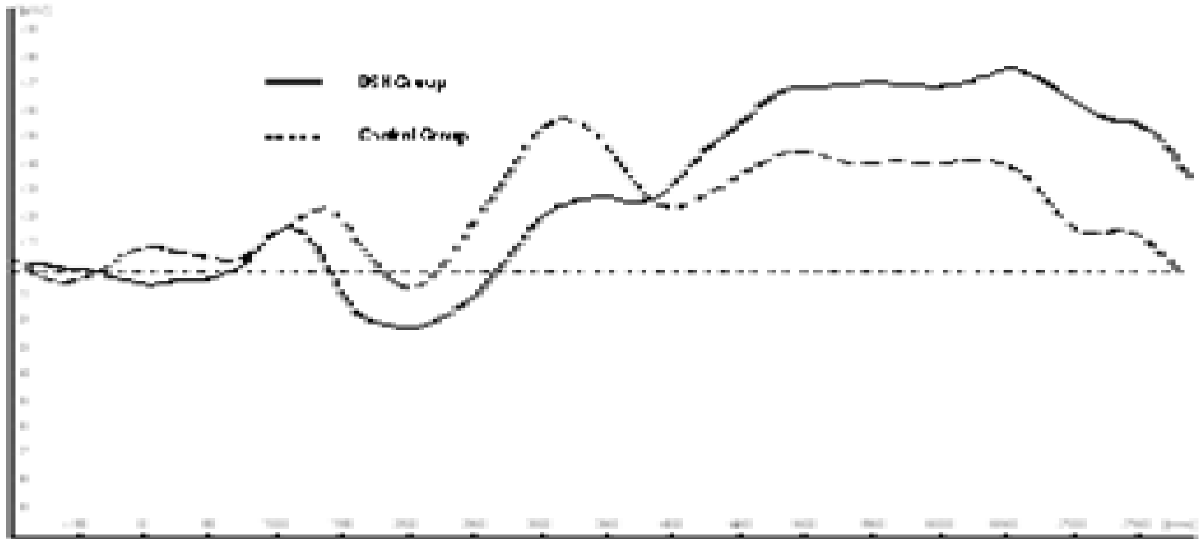
**Email**

Submit

Appendix C. *Grand averaged waveforms*

Stroop data

The first three graphs depict grand averaged waveforms at Fz, the second three at Cz and the final three at Pz sites. In each set, the top graph depicts activity to primary DSH cues, the central to secondary DSH cues and the lower graph to neutral cues.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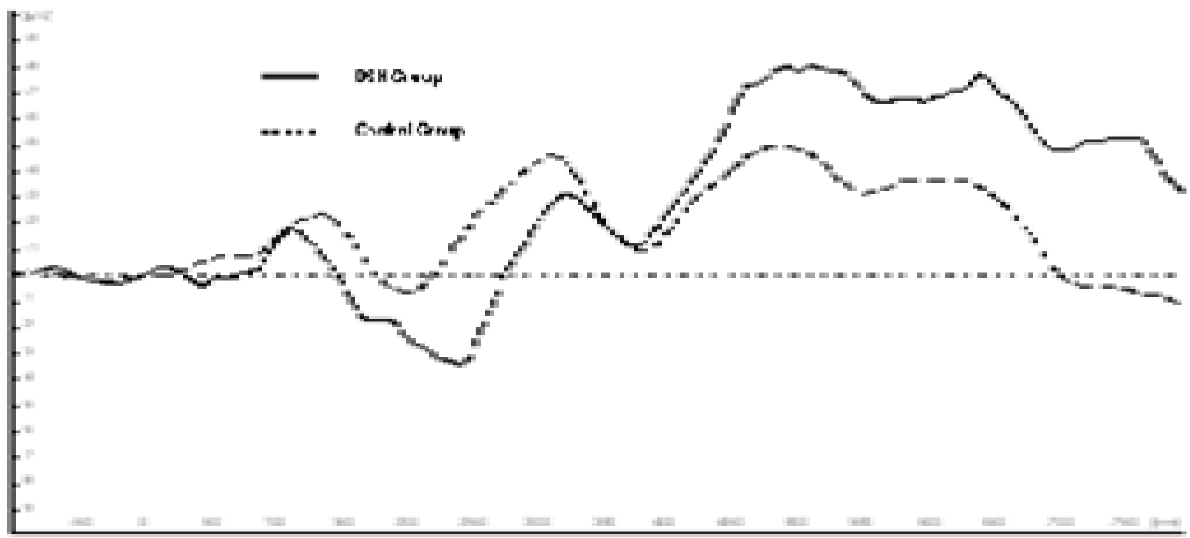
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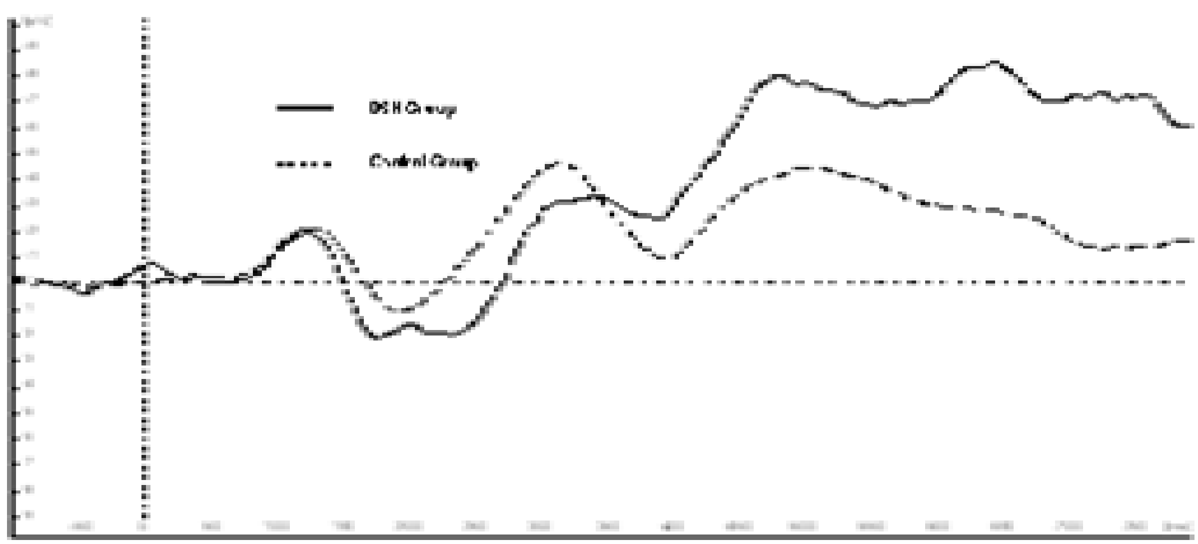
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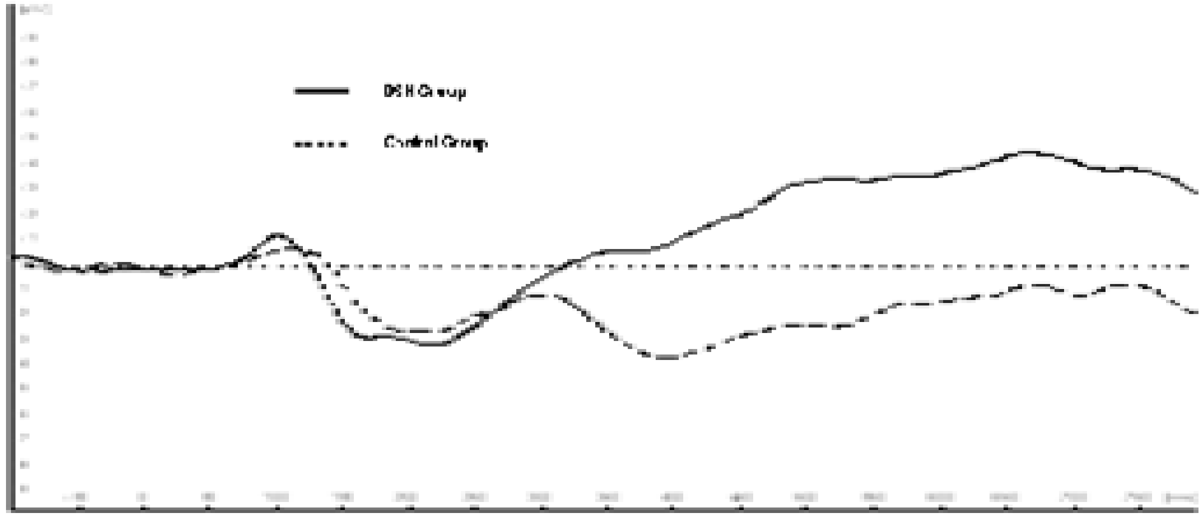
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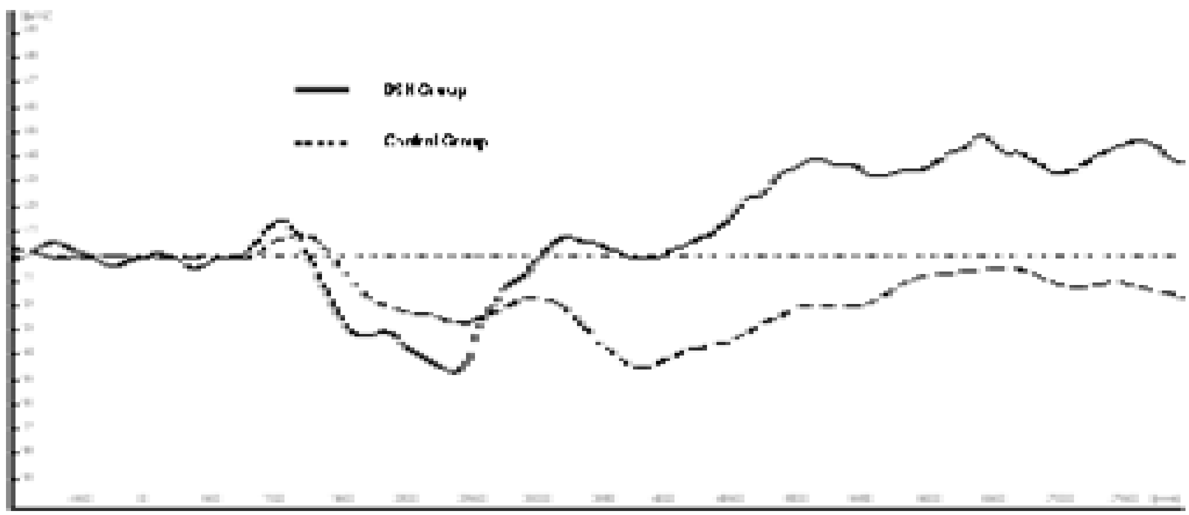
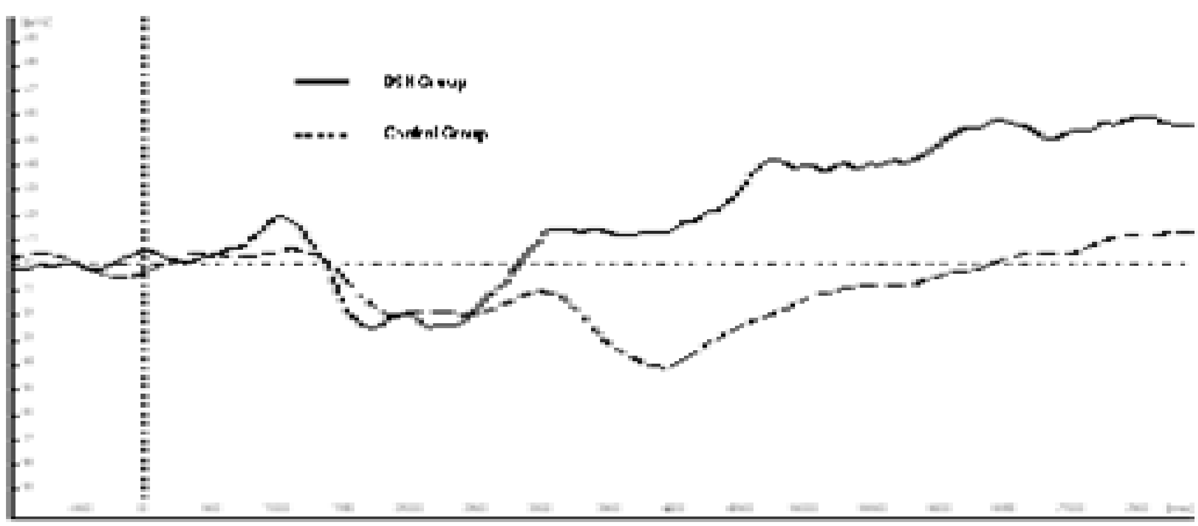
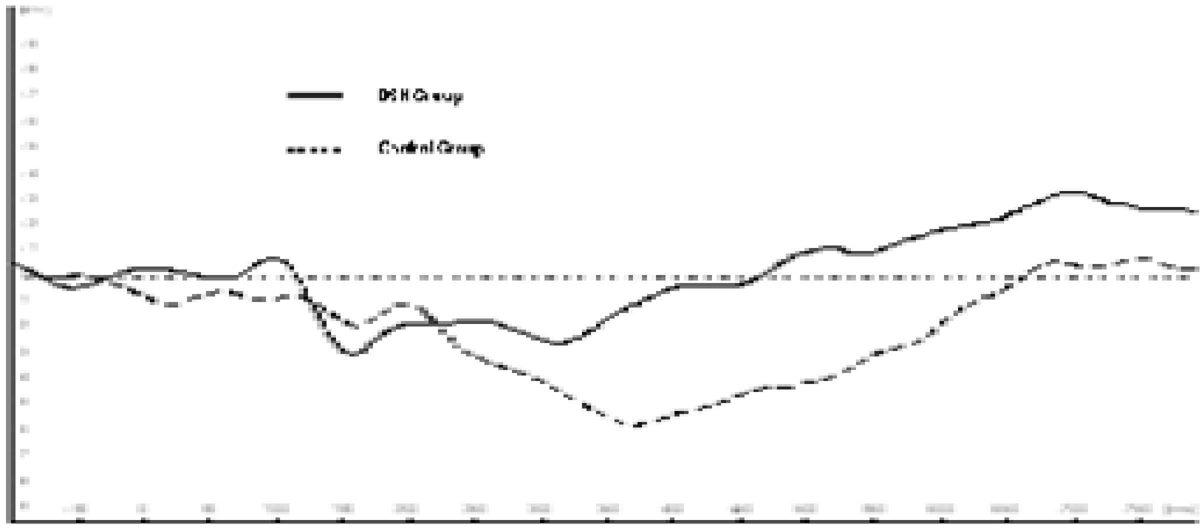
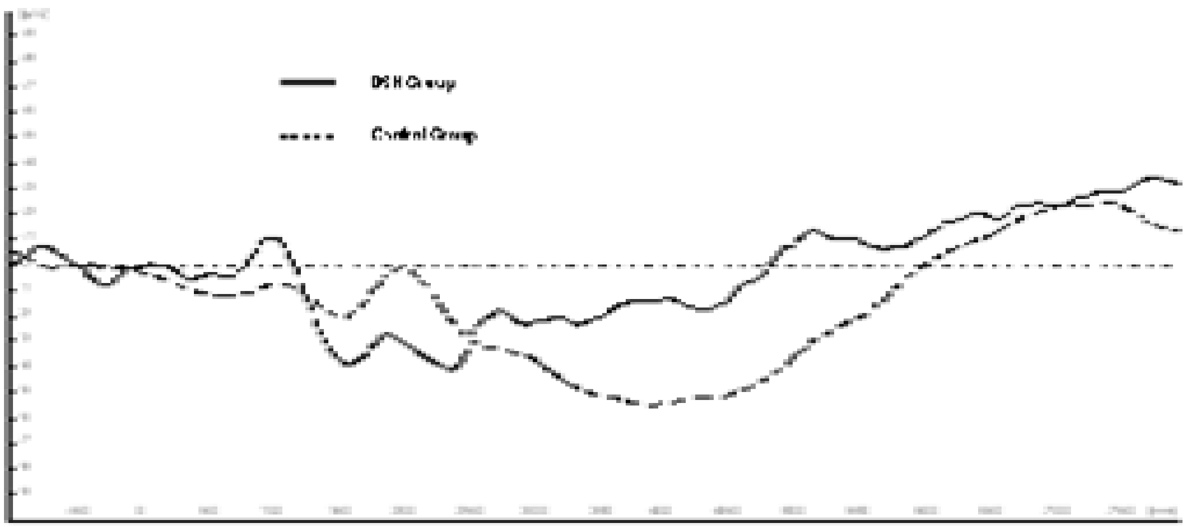
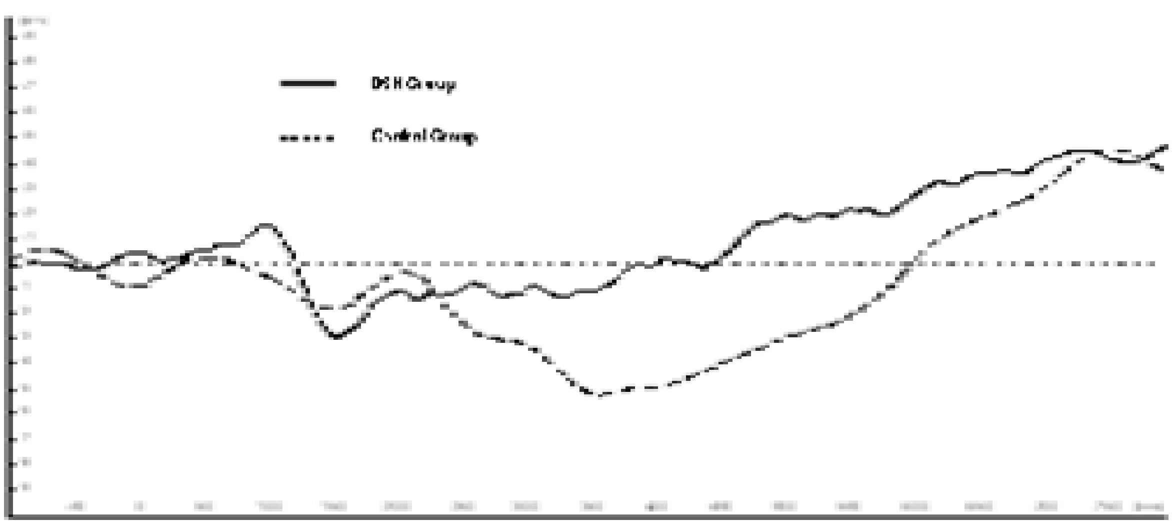
Control Group


DSH Group
Control Group


DSH Group
Control Group

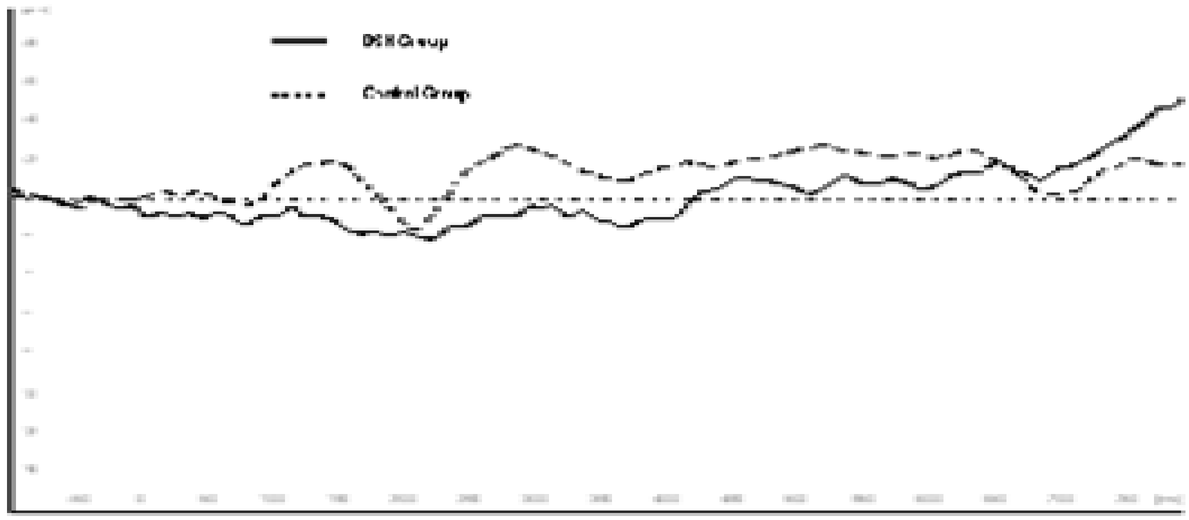

DSH Group
Control Group

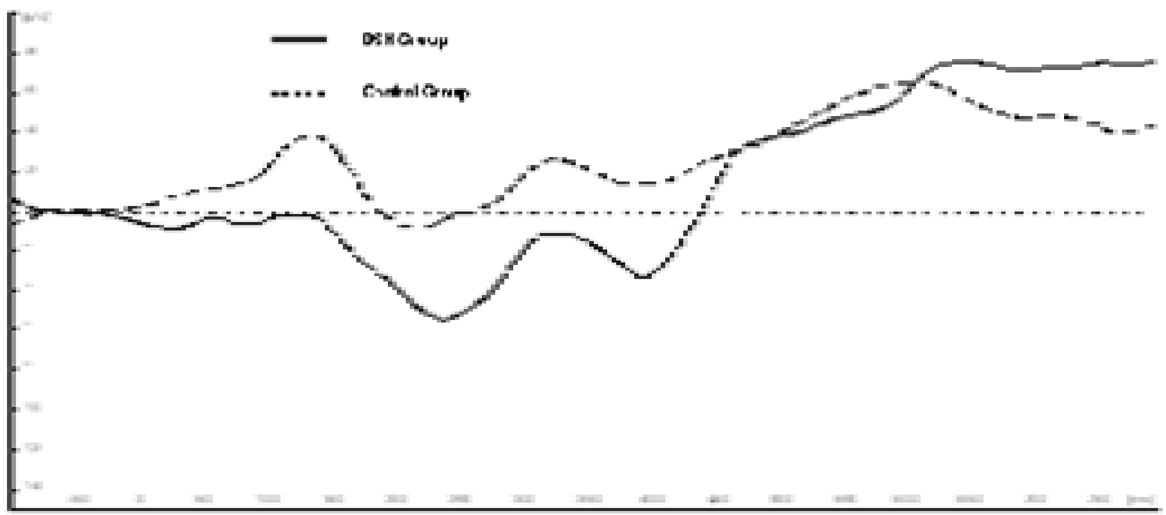

DSH Group
Control Group

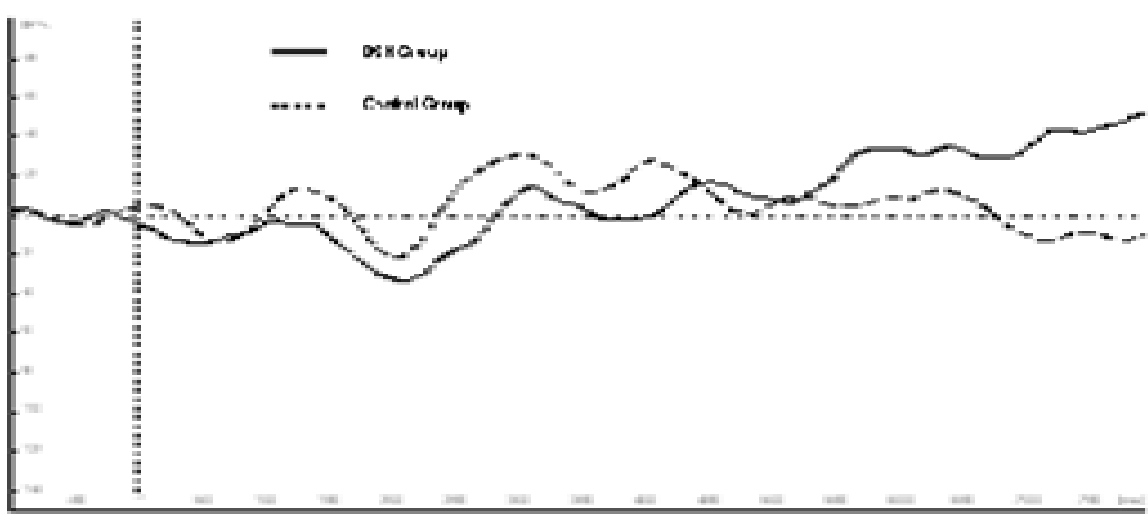

DSH Group
Control Group

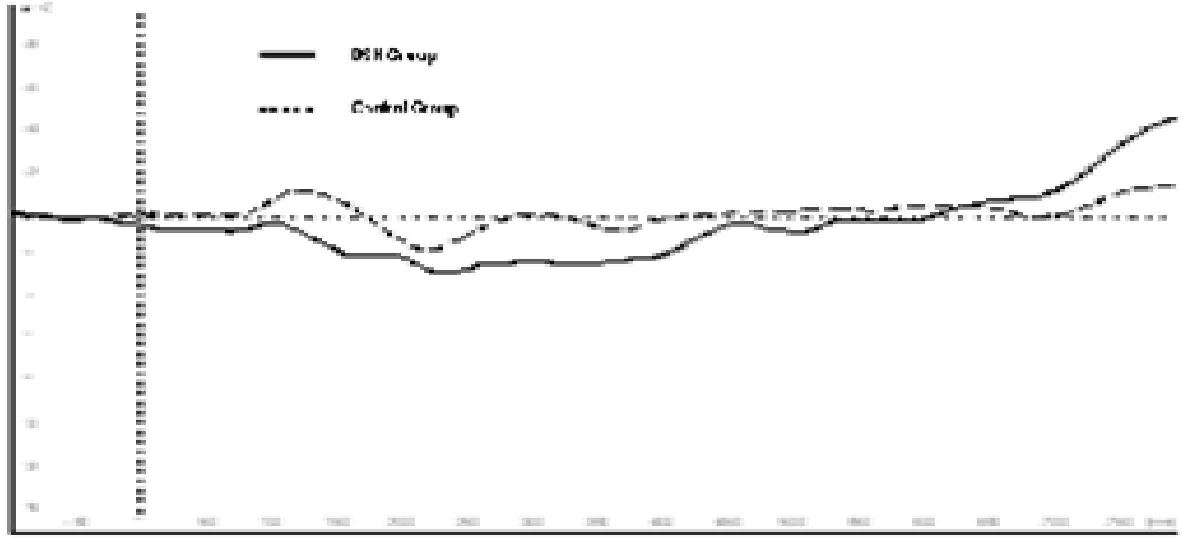
Oddball data

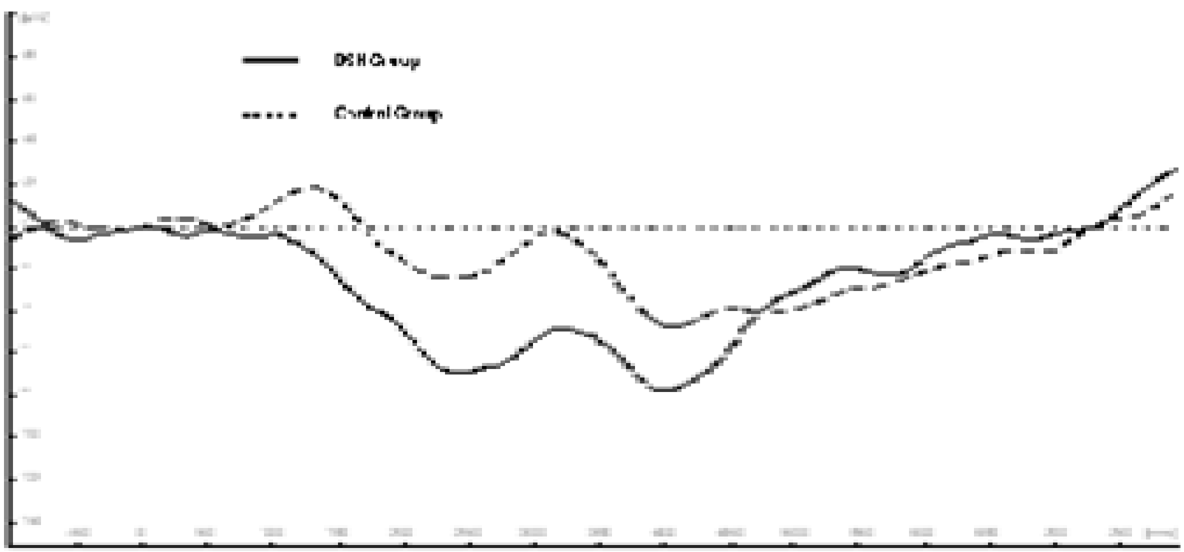
The first three graphs depict grand averaged waveforms at Fz, the second three at Cz and the final three at Pz sites. In each set, the top graph depicts activity to primary DSH cues, the central to secondary DSH cues and the lower graph to neutral cues.

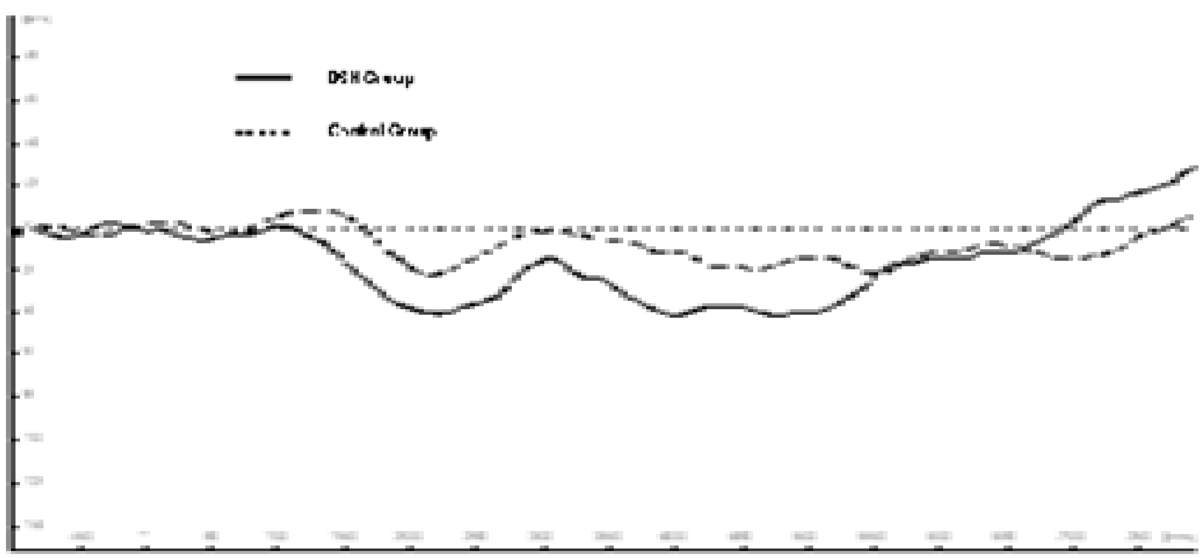

DSH Group
Control Group

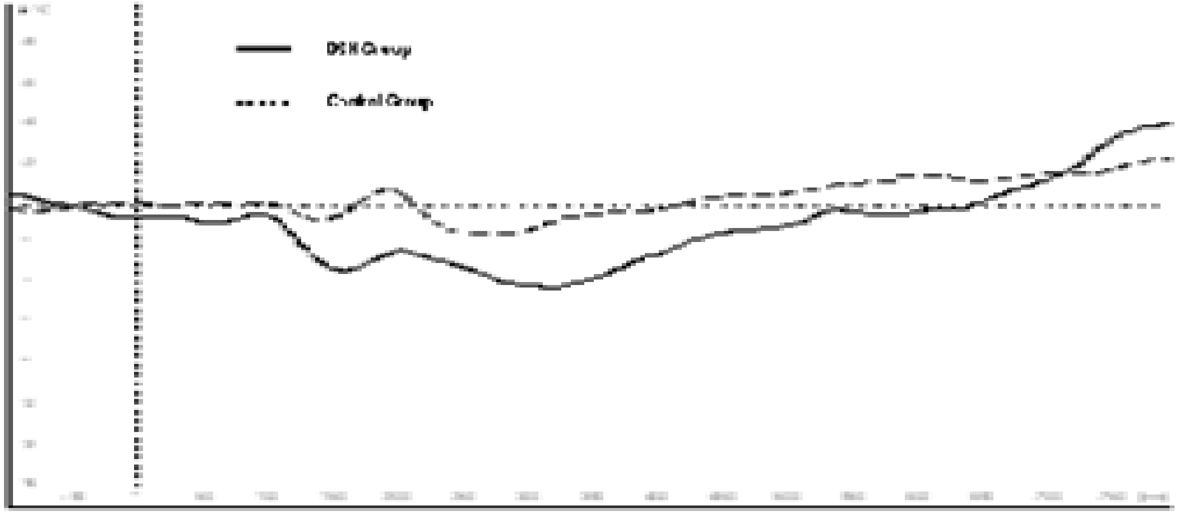

DSH Group
Control Group

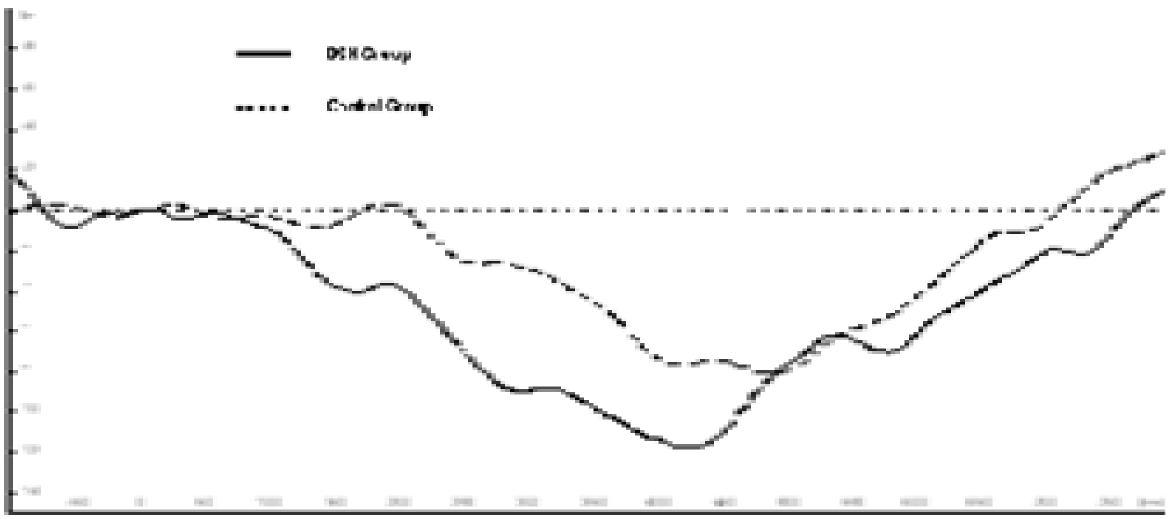

DSH Group
Control Group

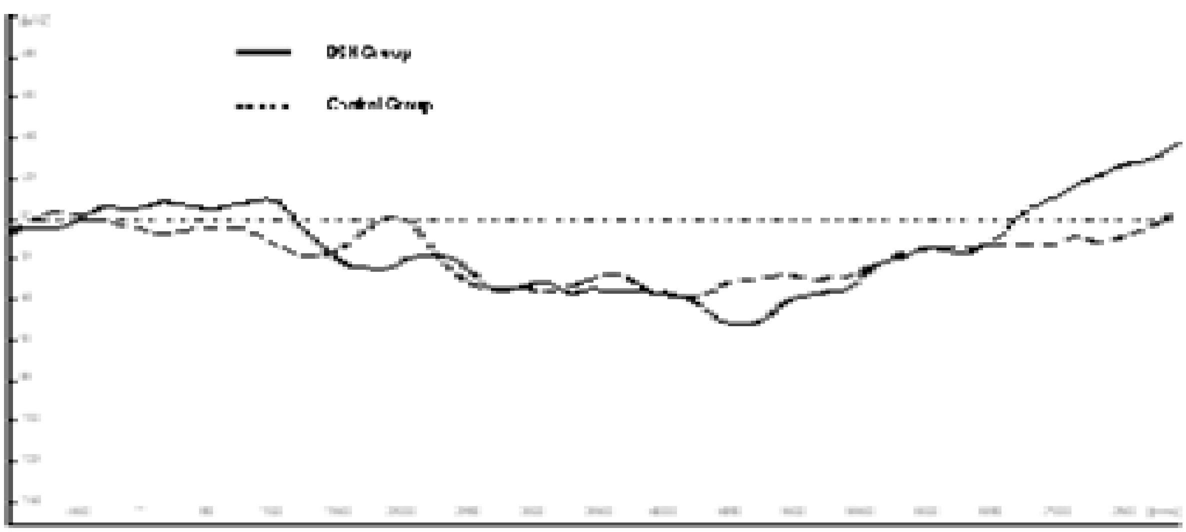

DSH Group
Control Group


DSH Group
Control Group


DSH Group
Control Group


DSH Group
Control Group


DSH Group
Control Group


DSH Group
Control Group

Appendix D. *Screening questionnaire*

Age:____ Sex: Male____(0) Male ______(1)

1. Over the past 6 months, how many times have you had 5 or more drinks of alcohol on one occasion? ____

2. Over the past 6 months, what is your cigarette smoking status (check the answer)?

   Nonsmoker (less than 10 cigarettes) ______
   Occasional smoker (more than 10 cigarettes, but not on a daily basis) ______
   Regular smoker (at least one each day) ______

3. In your lifetime, how many times have you intentionally (i.e., on purpose) severely scratched yourself, to the extent that scarring or bleeding occurred (if never write "0") ____________.

   When was the <u>most recent time</u> that you did this (place a √ onto the line to the right of the best answer)?

   never _____ this week ____ past 6 months ____ past year ___ over 1 year ago ____

4. In your lifetime, how many times have you intentionally (i.e., on purpose) burned yourself or cut your wrist, arms, or other area(s) of your body (if never write "0") ____________.

   When was the <u>most recent time</u> that you did this (place a √ onto the line to the right of the best answer)?

   never _____ this week ____ past 6 months ____ past year ___ over 1 year ago ____

5. In your lifetime, how many times have you intentionally (i.e., on purpose) banged your head against something, to the extent that you caused a bruise to appear or punched yourself, to the extent that you caused a bruise to appear (if never write "0") ____________.

   When was the <u>most recent time</u> that you did this (place a √ onto the line to the right of the best answer)?

   never _____ this week ____ past 6 months ____ past year ____

   over 1 year ago ____

6. List 6 words that describe what you do to manage your emotions when you are upset?

| | |
|---|---|
| ____________________ | ____________________ |
| ____________________ | ____________________ |
| ____________________ | ____________________ |

Appendix E *Neutral interpersonal interview*

## Neutral Interpersonal Interview and Script Generation

Instructions to Interviewers:

Attached is the neutral interpersonal interview for the generation of IP neutral scripts. The interview should be recorded. Below are some instructions for conducting the interview:

- We would like the participants to describe a recent neutral incident in their own words as much as possible.
- We would like the event to be neutral and recent (not negative or positive) and not something that evokes any strong feelings. .
- The first part of the interview gives the participant the opportunity to tell the story in her own voice. As she is telling the story, listen to make sure she addresses all of the questions listed on the interview. Check them off as they are covered. When the client is done with her initial description, go through and ask the questions that she did not cover. Throughout the entire interview process, ask as many follow up questions as possible. We only need enough material to produce a 60 second script. However, we would like it to be as detailed as possible.
- The entire interview should take approximately 15 to 30 minutes (may adjust after pilot testing).

Subject ID#: ___________________ Date of Interview:____________

Interviewer: ____________________

The following interview should be tape-recorded:

"On a daily basis a number of neutral events occur. I would now like you to describe a recent everyday situation or event that does not evoke any strong positive or negative feelings. Please think of a recent very typical incident that occurred involving an individual who you have an ongoing relationship with, for example, a spouse, partner, family member, friend, co-worker or new acquaintance, for example, meeting a friend for coffee, bumping into a colleague in the street). Please take a few moments to think about this recent experience and let me know when you have an episode in mind." Give subject up to 5 minutes.

When they have an event in mind, continue: Please close your eyes and take a few moments to picture the situation in your head. Try to visualize and recall as many details as possible about how you felt, the other person (s) involved, and the environment in which the event occurred. Try to get as vivid of a picture as you can. (Allow the participant a few minutes to visualize the event).

What was the approximate date of this event: _____________________?

"In as much detail as possible, please describe what happened (in global terms)?" Give them a chance to share the schematic of the story. After listening carefully for a few minutes, tell the subject that you would like to ask them a series of questions to get some greater detail about the event.

The interviewer should then proceed with asking as many of the following questions as necessary (some details would have already been provided by some subjects).

- ☐ Where did this incident occur? Please describe your surroundings:
- ☐ Where were you?
- ☐ Who were you with (supply the name [first name only])?
- ☐ Was there anyone else involved in the incident (supply the name [first name only])?
- ☐ How did you feel?
- ☐ How did your body feel?
- ☐ What did you do at the time?
- ☐ How did the person respond?
- ☐ What was the expression on their face?
- ☐ What did they say, using their own words?
- ☐ What was he or she wearing?
- ☐ What did you say and in what tone of voice (have them give an example)
- ☐ What were you thinking?
- ☐ What happened after the incident?
- ☐ What did you do afterwards (how did you act?)
- ☐ What was the outcome of all of this?

Thank you for sharing that incident. That's very helpful.

Appendix F. *Sample priming scripts*

*During the next few minutes you will hear a description of a situation. Close your eyes, and sit comfortably in your chair. As you listen, try to imagine yourself actually being in the situation. After the description, there will be a brief period of silence. Continue to imagine yourself as being part of the situation until you are told to stop. Then you will be instructed to stop imagining and just relax…*

**DISTRESS**

Your advisor has just completed your three-year college plan. You are at home looking over the plan, when you realize that she has made a mistake. You realize that she has misunderstood what you wanted, and where you would like to be headed. You are really concerned that she is sending you on the wrong track and that your whole schedule may be wrong. You feel intensely upset and let down by your advisor. As you look over the plan, the telephone rings. When you answer, it is your Mother. You begin to explain to her what has happened. As you explain the situation your mother gets really upset, and angry, and expresses that she feels that you are getting screwed over by your advisor. You feel more and more distressed, feeling that she is making you feel worse about the situation when you are already upset. Your mother tries to advise you on how to handle the situation, but you feel that you need to handle it yourself. You feel that while she is so far away there is little she can do to help. You are frustrated and upset and you wish that she would leave the issue alone. You feel yourself getting more and more upset and angry, and you do not want to yell at your mother. You ask her to leave you alone, and you tell her that you can handle the situation your self. You leave the conversation feeling upset, angry and frustrated, as well as concerned about your plan.

**NEUTRAL**

It is early in the morning and you have just woken up. You are still feeling drowsy and not yet awake. You walk across the hall to the bathroom to brush your teeth. There is a girl in the bathroom already, drying her hair. She has just woken up too, and has just had a shower.  She seems to be in a good mood, and you say hello. She asks how you are doing and you say hello. You are still feeling tired and not really awake yet so you say hello and that you will see her later. You go in the bathroom and brush your teeth feeling neutral and relaxed.

Appendix G. *Further background information on Kate*.

*Current presentation*

Kate described a range of physical complaints including asthma, a lung condition which has left her hospitalised twice with pneumonia and poor hand-eye co-ordination. She expressed that she had been through some very difficult times recently, with the loss of her best friend to leukaemia and her own ill health due to polycystic ovaries and pneumonia.

Kate was unemployed having left her work due to bullying and currently received benefits. She wished to return to work. Eight weeks before the assessment Kate's friend made up a story about being raped and Kate expressed extreme anger towards her friend for ruining the boy's life.

*Family and social history.*

Kate was born 7 weeks premature after her mother fell down the stairs and went into spontaneous labour. She spent 5 days in a special care baby unit with respiratory distress syndrome. Kate described her childhood as unhappy. At the age of 5 months she experienced a rib and skull fracture after being thrown across the room for crying. She experienced physical and emotional abuse through her neighbours when she was left in their care. She lived with a range of step-fathers who were physically and emotionally abusive towards her and her mother, including holding a knife to her throat. At the age of 15, Kate witnessed a fight between her mother's partner and a neighbour that resulted in the neighbour being stabbed through a major artery and being left bleeding in the garden. Kate felt unprotected by her mother, who was diagnosed with cancer when Kate was 8 years old. Kate had a strained relationship with her family on her mother's side. She had a history of behavioural problems, with suspected ADHD in childhood. At the age of 6 or 7 she was fined and cautioned for criminal damage. Kate attended a special school for her learning difficulties, although there was no reference to an IQ score on her file. It is of note that no sign of a learning difficulty was observed. Kate was referred to Child Psychiatric Services at the age of 10 years. When at school Kate ran away after threatening a classmate with a knife. Kate started drinking alcohol at the age of 13 years and smoking Cannabis at the age of 18 years and had made a previous attempt at suicide.

Kate described her relationship with her current partner as generally happy but sometimes violent. Kate had three half-sisters and lived with her mother. At the time, she described her relationship with her mother as supportive but strained. She often stayed with her older cousin, Jane, who also engaged in DSH. She described her relationship with Jane as very close. Jane was experiencing emotionally difficulties and her son (with whom Kate had a very close relationship) had recently been placed in foster care. Kate had no relationship with her biological father until recently and at the time of assessment this was strained, although improving.

Appendix H. *Cue exposure priming script*

**Imagery script**

**Setting the scene**
Right, now put yourself back in the hallway of your cousin's flat. Really imagine yourself there. You have been helping to look after the cat while your cousin is away. It is evening time now, and you are there with your friends. You are standing with your friend Tash now. Look around you. You can see the living room door open in front of you, and John your partner is in the room. Gav is in the kitchen. The atmosphere is tense, your head is pounding there have been arguments and fights all day. *Concentrate on that feeling right now (Pause).* Your partner John has been beaten up and Kylie, and Ben have just left, you are feeling angry and tense. You can feel your chest tightening and you begin to crack your knuckles. Your fists are clenched and you just keep picturing the baby in the road, and hearing the screaming. *Concentrate on that feeling right now (Pause).* Tash is stressed, and you feel pissed off. You know there is only one way to make this feeling go away. Now open your eyes and switch that scene off.

**Approach**
You move towards the kitchen your anger boiling, the pain deep inside you is raging, and you feel sick thinking about how vulnerable the baby is, and how unfair it is that she is caught in the middle of the arguments. Take a moment to really picture the room you are thinking back to when you were a child reliving the arguments, the fear and the panic and this makes you angry. *Concentrate on that feeling right now (Pause).* They should know better, Jade shouldn't be brought up how you were its not fair. She's only little and she can't escape, she shouldn't have to hear everything it's not right. You are so angry with Kylie and Ben for putting you through this and then making up as if nothing has happened. You can't cope with this anger and this pain, and so you reach for the nearest thing you can to end this. *Concentrate on that feeling right now (Pause).* Your eye catches sight of a dirty knife on the kitchen unit. You can see the black handle and the shining blade, and on instinct you grab it quickly and put it in your back pocket. Tash sees you, but doesn't do anything to stop you, and you run to the bathroom and lock the door. Now open your eyes and switch that scene off.

**Incident**
Right, you are now in the bathroom, really put yourself back in the moment. Your anger and pain have become unbearable and you are thinking that if you just end things now, you won't have to feel anymore pain, anymore anger. *Concentrate on that feeling right now (Pause).* You can feel your temperature rising and you are telling yourself to stop. You are pacing round the room. You know that you are about to cut yourself and you are angry with yourself that you are this weak. You pause for a moment thinking about the ways you could end your life, the pills downstairs, they would stop everything. You have the knife in front of you now, and you can see the blade gleaning. You are trying hold back and willing Tash to open the door. Tash shouts to ask if you are ok and you tell her that you are on the toilet and to go away. You are really angry now, as she knows what you are doing and doesn't try to stop you. You look around the bathroom, your urges getting

stronger and you are telling yourself to stop. You try to calm yourself down telling yourself that you don't need to do, this but you can't stop. *Concentrate on that feeling right now (Pause).* You grab the knife and hold it to your right arm. You are trying not to think you begin to slash at your arm, cutting downwards over and over again until you see the drops of red blood trickle down your arm. *Concentrate on that feeling right now (Pause).* Now open your eyes and switch that scene off.

---------------------------------*PRIMING STOPS HERE*--------------------------------

**Consequence**
As you watch the blood trickle down your arm you feel relief. Your anger slowly starts to reduce little by little and you can feel yourself calming down. You are shocked at what you have done and you feel disgusted and ashamed. *Concentrate on that feeling right now (Pause).* You move towards the sink, and you put your arm under the tap. You can feel the cool water rushing over your skin, and you feel relief as the blood washes away. *Concentrate on that feeling right now (Pause).* You grab a bit of tissue and hold it to your arm. You don't want to see it, you feel sick and disgusted with your self. You quickly grab a plaster, shove it on, and cover up your arm. You don't want to see what you have done. You walk out of the bathroom and shut the door behind you, feeling ashamed. Now open your eyes and switch that scene off.

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