December 2012

Experiences Associated with Non-Suicidal Self Injury: An Internet Survey

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EXPERIENCES ASSOCIATED WITH NON-SUICIDAL SELF INJURY: AN INTERNET SURVEY

by

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A Thesis Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Master of Science

in Psychology

at

The University of Wisconsin-Milwaukee

December 2012

ABSTRACT
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The University of Wisconsin-Milwaukee, 2012
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Non-Suicidal Self Injury (NSSI) is characterized as self-harm without suicidal intent. NSSI typically encompasses behaviors such as "cutting" or "burning" one's self. Recent research has found NSSI to be increasingly prevalent in young adults, particularly those of college age, and that NSSI is associated with significant negative health consequences. Current conceptualization of NSSI includes four distinct functions described as The Four Factor Model of NSSI (Nock and Prinstein, 2004). The present study surveys UWM students to assess for NSSI and to follow-up with additional questions relating to the Four Factor Model. More specifically, the study aims to investigate the two automatic (intrapersonal) functions of NSSI described as Automatic Negative Reinforcement and Automatic Positive Reinforcement, with particular emphasis on the latter function.

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LIST OF ABBREVIATIONS

ANR – Automatic Negative Reinforcement

APR – Automatic Positive Reinforcement

ESG – Evaluative Space Grid

FFM – Four Factor Model

NSSI – Non-Suicidal Self Injury

I hurt myself today
To see if I still feel
I focus on the pain
The only thing that's real
- Hurt by Nine Inch Nails

Introduction

Non-suicidal self-injury (NSSI) is the "destruction of one's own body tissue in the absence of suicidal intent" and this self-injury is both "direct" and "deliberate" (Nock and Favazza 2009). NSSI is "direct" in that the self-injury is an immediate result of one's actions, such as cutting one's own skin with a razor. Drug and alcohol use, as well as risk taking behaviors – such as sexual promiscuity or reckless driving – do not qualify as NSSI because they do not immediately cause damage to the body and the harm that does occur is typically a secondary result of the behavior (e.g., reckless driving does not cause injury *per se*, but rather increases the likelihood of being injured in a car accident). NSSI is specified as "deliberate" to differentiate NSSI from self-injury that may occur by accident (e.g., accidentally cutting oneself while preparing a meal).

Prevalence and Topography

Within the research literature, NSSI encompasses a wide range of behaviors including skin cutting, burning, self-hitting or punching, head banging, severe skin scratching, and interfering with wound healing (Briere & Gil, 1998; Favazza, 1998; Favazza & Conterio 1989; Klonsky, 2007; Muehlenkamp, 2005). Although most people report using multiple methods of self injury, "cutting" is considered the most common form of self-injury and includes cutting or scratching skin until it bleeds, carving skin,

and inserting objects (e.g., safety pins) under the skin (Nock, 2010). Cutting is frequently performed using the assistance of an instrument, such as a sharp object, razor, or pin (Lang and Patel, 2011; Klonsky, 2007), and a majority of individuals report to have a preferred instrument (Woldorf, 2005). The sites of the body most typically used for self-injury include the forearms, upper legs, and torso (Walsh, 2006; Nock, 2010). The frequency with which an individual engages in NSSI appears to vary considerably. However, a community sample found that most self-injurers reported engaging in NSSI either a few times per week or a few times per month (Ross and Heath, 2002).

Although commonly conceptualized as a symptom of severe psychopathology, the majority of NSSI occurs without drawing clinical attention (Hawton et al., 2004). Accordingly, accurate demographic information and prevalence rates for NSSI are largely unknown. Clinical reports indicate that NSSI impacts individuals from a wide range of ethnic, racial, and economic backgrounds (Walsh, 2006), and that women are at greater risk than men (Ogundipe, 1999; Suyemoto, 1998; Hawton, Rodham, Evans, & Weatherall, 2002). However recent evidence suggests that NSSI may be more common in men than previously thought (Rodham & Hawton, 2009). Adolescents and young adults appear to be at highest risk; within community samples 14-21% of adolescents (Ross and Heath 2002; Zoroglu, Tuzun et al. 2003) and 12-17% of college students reported engaging in NSSI (Favazza et al., 1989; Whitlock et al., 2006). Prevalence rates of 14-15% are common when students are asked whether they have engaged in self-injury at least one time (Laye-Gindhu & Schonert-Reichl, 2005; Muehlenkamp & Gutierrez, 2004; Ross & Heath, 2002). Furthermore, evidence suggests that the rates within the adolescent and college populations are increasing (Muehlenkamp, 2005; Hawton et al., 2004).

Health Impact and Significance

NSSI represents a significant public health problem. Many self-injurers, including those from community and school samples, report moderate to severe tissue damage resulting from NSSI (Nock et al., 2007; Whitlock et al., 2008). Self-injurers are also at increased risk of infection and permanent scarring, and these scars may have long-term consequences for self-esteem and body image (Walsh, 2006). Although distinct, NSSI and suicide attempts are related behaviors that often co-occur (Brown, Comtois, & Linehan, 2002; Dulit, Fyer, Leon, Brodsky, & Frances, 1994); however evidence suggests that individuals with NSSI are able to distinguish between NSSI and injury with suicidal intent (Nock, Prinstein, & Sterba, 2009). Between 50% - 85% of individuals with a history of NSSI attempt suicide during their lifetime (Favazza & Conterio, 1988; Nock et al., 2006; Fyer et al., 1988) and those with NSSI are 18 times more likely to die by suicide (Van Sell et al., 2005).

Suicide is an alarming public health problem that ranks as the third leading cause of death among adolescents and young adults, accounting for 12.2% of all deaths annually among 15- to 24- year-olds (Centers for Disease Control and Prevention, 2010). In 2007, the deaths of 6.9 out of every 100, 000 adolescents (ages 15-19) and 12.7 out of every 100,000 young adults (ages 20-24) was attributed to suicide (CDC, 2010). Overall, the U.S. experiences approximately 34,000 annual deaths by suicide. This is equivalent to 94 suicides per day or one suicide every 15 minutes (CDC, 2010). Among adolescents, NSSI has been determined to predict longitudinal trajectories of suicidality (Prinstein, 2008) and individuals with NSSI have a 30-fold increase in risk for completing suicide compared to those without self-injury (Cooper et al., 2007). Although research has only

just begun to examine the link between NSSI and suicide, this represents an important step to understanding risk factors for suicide, as well as possibly providing potential for early screening and intervention.

Functional Approach

Historically clinicians and researchers conceptualized NSSI to primarily serve a manipulative or attention-seeking function (Yates, 2004). This viewpoint is associated with healthcare professionals' negative attitudes toward self-injury and likely influences the willingness of individuals with NSSI to seek treatment (White Kress, 2003). For this reason, the Four Factor Model (FFM) of NSSI proposed by Nock and Prinstein (2004, 2005) represents a pivotal transformation in the conceptualization and treatment of self-injury. The FFM is novel in that it applied a functional analytic approach to understanding NSSI where the specific function of the behavior is investigated rather than presumed to be simply manipulative or attention-seeking and furthermore, the four reported functions found in the investigations were then broadly classified according to an operant behavioral scheme. The functional approach provides analysis of variables maintaining clinically significant behavior and research in this area has provided significant advances to the understanding and treatment of these behaviors (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Functional analysis involves evaluating the antecedent events (e.g., environmental, social, and intrapersonal) preceding a behavior in addition to evaluating the various consequences that serve to maintain the behavior. A more in depth review of behavioral perspectives, methodology, and definitions employed within this functional approach is provided to assist in understanding of the development of FFM.

Overview of Behavioral Perspectives

From a functional perspective, such as B. F. Skinner's Radical Behaviorism (Skinner, 1974), reinforcement is a process that results in the increase in the occurrence of a behavior due to its consequences. Positive reinforcement is the *addition* of a stimulus immediately following a behavior resulting in an increased likelihood for the behavior's reoccurrence. By contrast, negative reinforcement involves the *removal* of a stimulus following a behavior resulting in an increased likelihood for the behavior's reoccurrence. Some theorists (e.g., Staats, 1975) further posit that positive reinforcement generally implies that stimuli are experienced as pleasant or rewarding, whereas negative reinforcement generally implies stimuli are unpleasant or aversive. Although the type of emotional response elicited by a stimulus may often correctly reflect the type of reinforcement involved, this is not universally true. Some seemingly negative or aversive stimuli have been found to be very effective positive reinforcers (Bernard & Gilbert, 1941; Morse & Kelleher, 1977). In fact, the subjective experience of the stimulus is irrelevant to the functional definition of reinforcement, which is the increase in the rate of behavior subsequent to the addition (positive reinforcement) or removal (negative reinforcement) of a stimulus.

Whereas reinforcement increases the frequency of a behavior, punishment – according to a functional definition – decreases the occurrence of a behavior. Punishment, like reinforcement, can be positive or negative in that a stimulus is either added or removed. Positive punishment is the addition of a stimulus following a behavior that decreases its reoccurrence, and negative punishment is the removal of a stimulus following a behavior that decreases its reoccurrence. Although punishment is often

associated with negative stimuli or experiences, the functional definition of punishment is strictly limited to whether the frequency of a behavior decreases subsequent to a stimulus that is either added or removed. This is particularly important to keep in mind as the term "punishment" is often used in the NSSI literature but does not reflect this functional definition of punishment. For a summary of definitions, refer to *Table 1*.

Table 1

Behavioral Definitions

	Definition
Punishment	The addition or removal of a stimulus which *decreases* the occurrence of a behavior.
Reinforcement	The addition or removal of a stimulus which *increases* the occurrence of a behavior.
Positive Reinforcement	The *addition* of a stimulus immediately following a behavior resulting in an increased likelihood for the behavior's reoccurrence
Negative Reinforcement	The *removal* of a stimulus following a behavior resulting in an increased likelihood for the behavior's reoccurrence

It is important to note that this functional approach is purely descriptive and operational in nature and thus makes no assumptions about underlying mechanisms. Moreover, although Skinner's functional analysis does not deny the existence of emotions and cognitions – which he refers to as private events – he does not systematically account for them in relation to behavior, as private events cannot be observed by an outsider (Skinner, 1974). An alternative behavioral tradition to that of radical behaviorism is that of neo-behaviorism descending from Skinner's predecessors and contemporaries such as Clark Hull, Edwin C. Tolman, O. H. Mowrer, Abram Amsel, and Arthur Staats. Although there is at least as much theoretical diversity among various neo-behaviorists as there is between neo-behaviorists as a group and Skinner, what makes

them all behaviorists is their commitment to the idea that observable behavior is the proper focus of psychology. What differentiates the neo-behaviorists from Skinner is their willingness to utilize various affective, cognitive, and motivational concepts within their theorizing as intervening variables or hypothetical constructs (MacCorquodale & Meehl, 1948), to the extent the concepts can be anchored by observable stimuli on the input side and observable behavior on the output side. One mechanism posited by some neo-behaviorists, the fractional anticipatory goal response or r_g-s_g mechanisms, hypothesized an unbroken chain of s-r connections based on hypothesized responses that give rise to hypothesized stimuli that serve a meditational function between the external stimuli directly manipulated by the researcher and the overt responses that were measured. From this perspective, cognitions and emotions are stimulus producing responses that can precipitate overt behavior.

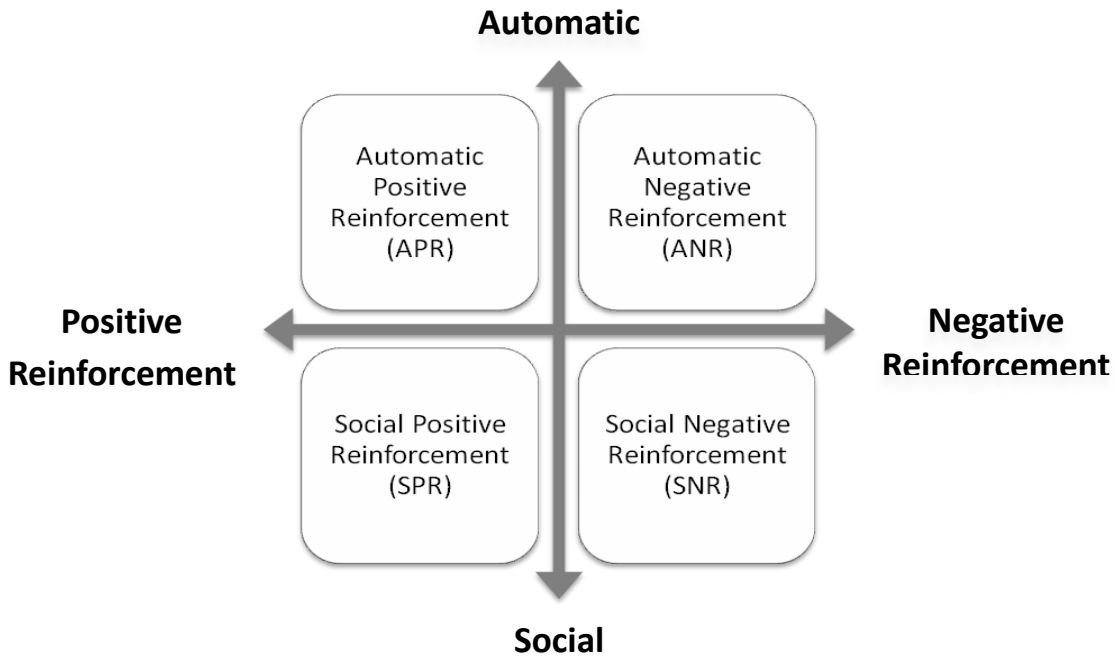
The Four Factor Model

The FFM builds upon previous research (Connors, 1996; Gallop, 2002; Gratz, 2003; Brown, Comtois, & Linehan, 2002) highlighting the emotion regulation function of NSSI. While the FFM acknowledges that NSSI can serve social and attention-seeking functions, it also emphasizes the internal or intrapersonal antecedents and consequences attributed to NSSI, thus providing both clinicians and researchers with a broader understanding of the behavior. Subsequent research (Nock, Prinstein, & Sterba, 2009; Klonsky, 2007) has demonstrated that these emotion regulation functions or intrapersonal experiences related to NSSI are actually the predominant function reported by individuals who self-injure.

Nock and Prinstein's FFM categorizes the functions of NSSI across two dimensions: type of variable and type of reinforcement. The two variable types are stimuli that are *automatic* (i.e., intrapersonal) vs. *social* (i.e., interpersonal). Automatic variables are private experiences within the person, such as thoughts and feelings, and social variables are experiences and interactions with others. The two types of reinforcement within the FFM are *positive* vs. *negative* reinforcement. As described before, positive reinforcement involves the addition of a stimulus whereas negative reinforcement involves the removal of a stimulus. The FFM involves the combination of type of variable and type of reinforcement to define four distinct functions for NSSI. These factors are outlined in *Figure 1*.

Figure 1

The Four Factor Model



Automatic Negative Reinforcement (ANR) describes NSSI that functions to remove, lessen, or escape from aversive affective or cognitive states (e.g., "to stop bad

feelings"). *Automatic Positive Reinforcement* (APR) is NSSI that functions to achieve desirable sensations, feelings, or cognitive states (e.g., "to feel something, even if it is pain" or "to feel relief"). *Social Negative Reinforcement* (SNR) describes NSSI that functions to remove or avoid interpersonal demands or pressure (e.g., to avoid school, work, or other activities). *Social Positive Reinforcement* (SPR) is NSSI that functions to gain attention or resources from others (e.g., "to let others know how unhappy I am"; Nock & Cha, 2009). These four factors are summarized in *Table 2.*

Table 2

Descriptions of the Four Factors.

	Description
APR	Performed to achieve desirable sensations, feelings or physiological state (e.g., "to feel something, even it was pain")
ANR	Performed to remove, lessen, or escape from aversive affective or cognitive states (e.g., "to stop bad feelings")
SPR	Performed to remove or avoid interpersonal demands or pressure (e.g., to avoid school, work, or other activities)
SNR	Performed to gain attention or resources from others (e.g., to let others know how unhappy I am)

The FFM of self-injury has garnered considerable evidence and support since its introduction to the literature. The FFM has been supported by confirmatory factor analyses and reliability analyses of the Functional Assessment of Self-Mutilation (Lloyd, Kelley, & Hope, 1997) – a common instrument used to assess the function of self-injury – which mapped on to the four theorized factors (Nock & Prinstein 2004, 2005). Other models for the function of NSSI, including two and three factor models, were explored but did not yield a better fit than the FFM. In addition, substantial research evidence has provided further support for the model's individual factors (Lloyd-Richardson, Perrine, Dierker, & Kelly, 2007; Franklin et al., 2010; Nock, Prinstein, & Sterba, 2009).

The ANR function of NSSI – to decrease or remove aversive feelings or cognitions – is supported by considerable research evidence (Armey, Crowther, & Miller, 2011; Hilt, Cha, & Nolen-Howksema, 2008; Klonsky & Olino, 2008; Chapman, Gratz, & Brown, 2006). This is consistently the most frequently endorsed reason for NSSI (Nock & Prinstein, 2004; Klonsky 2007; Najmi, Wegner, & Nock, 2007; Nock & Cha, 2009). In fact, a literature review by Klonsky (2007) determined that nearly all of the studies examined report that acute negative affect precedes NSSI which is then followed by a subsequent sense of relief or decrease in negative affect, supporting the ANR function of the FFM. Furthermore, physiological and behavioral studies have provided additional empirical support for the ANR function of NSSI (Nock & Mendes, 2008; Haines, Williams, Brian, & Wilson, 1995).

The APR function of the FFM comprises NSSI that serves to generate desirable states or pleasant sensations. Clinical symptoms related to posttraumatic stress disorder (PTSD), especially those from the avoidance/numbing cluster (Weierich & Nock, 2008), and major depressive disorder, such as anhedonia and psychic numbness are strongly related to the self-report for the APR function (Nock & Prinstein, 2005; Weierich & Nock, 2008). For individuals who experience these clinical symptoms, such as "numbness" or "emptiness," NSSI is hypothesized to function by generating feelings or sensations which are thought to be rewarding in this context. While the APR function has been described in clinical literature, is has not received the same empirical support as the ANR function of NSSI. For example, Nock and Cha (2009) stated:

> physiological or behavioral support for the APR function of NSSI has not yet been reported, perhaps because this function receives less attention in

> the literature and because of the lower rate of endorsement of this function by those who self-injure. (p.69)

The social functions within the FFM of NSSI, SPR and SNR, serve to communicate with others and provide honest signals of distress (Nock & Cha, 2009; Nock, 2008). Self-injury is hypothesized to increase support within individuals' social networks (Walker, Joiner, & Rudd, 2001). A prospective study determined that a subgroup of adolescents who self-injured reported subsequent improvements in the quality of their relationship with their parents (Hilt, Borelli, Nock, & Prinstein, 2004). Furthermore, individuals who self-injure display deficits in social problem-solving skills (Nock & Mendes, 2008) and the presence of social concerns is most strongly correlated with endorsement of the social functions of NSSI (Nock & Prinstein, 2005). However, the social functions related to NSSI are difficult to assess as social desirability may affect reporting and individuals may have limited insight into the factors influencing self-injurious behavior.

The limits to assessing the function of self-injury extend not just to the social functions but to all functions of self-injury. As Janis and Nock (2009) aptly state that:

> [M]ental processes involved in thinking about, planning, and enacting NSSI may be outside of conscious awareness. People are much more capable of accurately reporting that they have engaged in a specific behavior; however, it is less likely that they can accurately explain cognitive process underlying this behavior. (p. 261)

Because individuals may lack insight and have difficulty describing the precipitating factors and consequences of NSSI behavior, the accuracy of the FFM is called into

question. While the ANR function has garnered considerable support, the model's other factors, particularly the APR, has yet to be bolstered by the comparable research evidence.

Evaluating the APR Function of NSSI

The APR function within the literature is confounded by imprecise definitions and unclear criteria. Technically APR represents any NSSI that functions through positive reinforcement of automatic (intrapersonal) experiences. As previously defined, positive reinforcement is the addition of a stimulus immediately following a behavior resulting in an increased likelihood for the behavior's reoccurrence. Within the self-injury literature, the APR factor has been interpreted in several different ways, not all of which are consistent with the behavioral definition of reinforcement. Furthermore, Nock has since (Nock et al., 2007) utilized a slightly altered definition of APR than that which was outlined in his original FFM article (Nock & Prinetein, 2004). For these reasons, it is important to highlight the original conceptualization of APR as well as the many subsequent interpretations.

In Nock and Prinstein's (2004) original factor analysis of the FASM questionnaire, five of the twenty-two items loaded onto automatic factors (APR and ANR). The three items that loaded onto the APR factor were 1) "to feel something, even if it was pain," 2) "to feel relaxed," and 3) "to punish oneself." The two items that loaded onto the ANR factor were 1) "to stop bad feelings" and 2) "to relieve feeling numb or empty." These items and their corresponding factor loadings from the initial analysis are provided in *Table 3.*

Table 3

Nock and Prinstein's (2004) Confirmatory Factor Analysis of Reasons for Engaging in NSSI

Reported Reasons	APR	ANR
To stop bad feelings	.73	
To relieve feeling numb or empty	.61	
To punish yourself		.89
To feel relaxed		.67
To feel something, even if it was pain		.50

Within the self-injury literature, there are four different functions of NSSI that have been interpreted to represent APR. These four functions do not exactly reflect those described in the original factor analysis; however they do represent functions similar to the three FASM items which loaded onto APR and one FASM item which loaded onto ANR ("to relieve feeling numb or empty"). The four functions for NSSI described as APR within the literature can be summarized as:

1. Increasing positive affective states (e.g., to feel relaxed)
2. Generating desirable physiologic sensations or experiences (e.g., to feel something, even if it was pain)
3. Ending dissociative states (e.g., to relieve feeling numb or empty)
4. Self-retribution (to punish oneself)

Whereas these four functions may prove to overlap or represent the same phenomenon, they will be treated as distinct for further evaluation within this proposal.

Increasing positive affective states. Several studies have reported that positive affect increases following self-injury (Claes et al., 2010; Muehlenkamp et al., 2009; Franklin et al., 2010; Claes, 2007). However, closer examination of these studies presents questions regarding the valence of affective change following NSSI. A study by Muehlenkamp et al. (2009) determined that although positive affect increased following an act of NSSI in individuals with bulimia nervosa, negative affect also decreased. They

determined that NSSI can be used to create more positive emotional states but did not go so far as to draw conclusions about the way in which NSSI is reinforced (positive vs. negative). Another study by Claes and colleagues (2010) similarly determined that negatively valenced high-arousal affect states decreased and positively valenced low arousal affect states increased from before to after NSSI in self-report study. The positive-low-arousal state that increased in this study was the experience of feeling "relieved." Although Claes et al. classified "relieved" or "relief" as a positive-low-arousal state, the experience of relief does not necessarily reflect positive reinforcement; rather it could be used to describe the sensation experienced after removal or reduction an aversive stimulus, thus suggesting negative reinforcement.

Klonsky (2010) found evidence supporting conclusions similar to Claes et al. (2010) in that NSSI results in changes to both affective valence and arousal; more specifically, that high-arousal negative affect states (e.g., overwhelmed) decreased and that low arousal positive affect-states (e.g., calm, relaxed, relieved) increased. However, Klonsky interpreted these results using Tellegen's two-dimensional model of affect (Watson & Tellegen, 1985; Watson, Wiese, Vaidya, & Tellegan, 1999), which considers affect states such as calm, relaxed, and relieved to reflect low negative affect rather than high positive affect. Accordingly, Klonsky and colleagues (2010) concluded that, "From this perspective, results suggest that self-injury is predominantly associated with reductions in negative affect as opposed to increases in positive affect, and thus likely to be a negatively rather than positively reinforced behavior" (pg. 266).

There is minimal self-report research that supports the APR subtype and physiologic research is equally limited. One of the only examples of physiologic

evidence that has been interpreted as supporting the APR subtype of NSSI is a study by Franklin and colleagues (2010). In this study, individuals with NSSI and individuals with no history of NSSI completed a cold pressor task (CPT) designed to induce pain and serve as a proxy for NSSI behavior (which is not performed in an experimental setting for ethical reasons) while also obtaining physiological measures of startle reactivity and prepulse inhibition (PPI) before and after exposure to the CPT. Startle reactivity was measured by eyeblink electromyography and intended to assess affective valence (positive or negative; Lang, Bradley, & Cuthbert, 1990) and PPI was intended as a measure of information processing. In addition, Franklin et al. obtained subjective units of distress (SUDs) as a self-report measure of negative affect intensity. The importance of separately measuring affective intensity and affective valence is aptly stated by Franklin and colleagues:

> [P]erhaps one of the biggest limitations of the NSSI function literature is that previous studies have employed only measures of self-reported affect and/or measures of physiological arousal; none of these studies have utilized an independent measure of affective valence…This is important because affect is composed of both arousal (the intensity of the affect) and valence (positive or negative tone…). Accordingly, a decrease in physiological arousal does not necessarily indicate a less negatively valenced affective state…In other words, does NSSI just reduce the intensity of what one is feeling, or does it help one feel better? Resolving this issue would help to clarify the affective function of NSSI. (p. 851)

In addition to hypothesizing that individuals with a history of NSSI would show a different pattern of affective valence following the CPT than those without such an history, Franklin et al. hypothesized the effect would be associated with a differential pattern of PPI. Specifically, Franklin et al. hypothesized the NSSI group would show initial deficits in PPI that would improve after exposure to the CPT, whereas the control participants would show a decrease in PPI on exposure to the CPT.

Consistent with predictions, the PPI results clearly showed a differential pattern across experimental groups, with the NSSI group showing increased PPI following exposure to the CPT, suggesting that NSSI or its offset may enhance information processing in those with a history of such behavior. However, contrary to predictions, the startle results showed a strong main effect in which startle magnitude declined across the experiment, suggesting a strong habituation effect that was not differential across groups. In the absence of support from the startle reactivity data for their hypotheses with regard to affective valence, the authors reinterpret their PPI data in light of prior findings that PPI varies as a function of arousal (Grillon & Davis, 1997) to conclude the NSSI group showed a decrease in arousal (indicated by increased PPI which is then equated with ANR) following exposure to the CPT, whereas control participants showed an increase in arousal (indicated by decreased PPI and equated with APR). These findings are then further interpreted in light of Solomon's (1980) opponent process theory to propose a pathway by which the function of NSSI may start as APR and shift to ANR with experience:

> …it may be that NSSI (or its offset) is initially positively reinforcing and later becomes negatively reinforcing. This hypothesis is supported when the affective

> valence results of the present study are combined with the affective arousal results of previous laboratory NSSI studies. In sum, these studies have shown that NSSI groups display decreased arousal and a shift away from negative valence, indicating a reduction in negative affect (see Lang et al., 1990). This supports an ANR function for individuals with NSSI experience. In contrast, control groups have shown increased arousal and a shift away from negative valence, suggesting increased positive affect (see Lang et al., 1990). This supports an APR function for individuals with no NSSI experience (p. 861).

There are several problems with Franklin et al.'s conclusions. To reiterate, startle response reactivity was their *a priori* physiologic measure used to assess for changes in affect and prepulse inhibition was their *a priori* measure to assess cognitive regulation. Contrary to their initial hypothesis that pain would regulate affect in only the NSSI group, the authors found that startle response decreased following the CPT for the NSSI group *and* the control group, suggesting that pain regulates affective valence for both groups. Consistent with predictions regarding effects on cognitive regulation, he NSSI group experienced a significant increase in prepulse inhibition following the CPT, whereas the control group experienced a significant decrease in prepulse inhibition indicating that the NSSI group experienced improved cognitive regulation subsequent to pain. However, authors interpret these findings, which were not intended to measure affect and did not measure arousal, in light of arousal findings from other research to make several leaps regarding the current results in support of APR for the group with no history of NSSI. Furthermore, these conclusions are contradictory to reports of subjective

distress in which both NSSI and control participants showed an increase in negative affect subsequent to the CPT.

The conclusions from this one study providing physiologic support for the APR subtype of NSSI are problematic for several additional reasons. As Franklin and his fellow authors themselves note, the validity of their conclusions depends on the validity of a laboratory CPT as a proxy for naturally occurring cutting. It is possible that pain induction is not the mechanism by which cutting produces affective or cognitive change; some evidence indicates that the experience of seeing blood to be an important aspect of NSSI behavior (Kumar et al., 2004; Glenn & Klonsky, 2010; Favazza & Conterio, 1989). Although not highlighted by the authors, their data does suggest that the NSSI group experienced improved cognitive processing subsequent to pain (CPT). However, the reason for this improvement in cognitive processing is not yet understood and may function by positive (i.e. improving focus or executive function) or negative reinforcement (i.e. removing distractions or detriments to cognitive processing). The evidence from this physiologic research and self-report studies (e.g. Claes et al., 2010 and Klonsky, 2010) does not yet clearly support the APR subtype in NSSI.

In summary, several studies purport that positive affect increases following NSSI in conjunction with the decrease in negative affect states. Yet it is unclear whether the function of NSSI is to directly increase positive states (APR) or that the apparent increase in positive affect is a result of the reduction in negative affect (ANR). This has yet to be carefully assessed within the self-injurious population.

Generating desirable physiologic sensations or experiences. The second function of NSSI generally classified under APR is self-injury that creates a desired physiologic

state. "To feel something, even if it is pain" is the prototypical example for APR outlined in the original Nock and Prinstein (2004, 2005) articles and is the example most commonly provided when describing APR. Although the function to feel something may appear similar to the first function described as APR – to increase a positive state – they differ in two important ways. First, NSSI performed "to feel something" involves the *addition* of new sensations or experiences rather than changing the intensity of a current affective state. Second, NSSI performed "to feel something, even if it is pain" indicates that such experiences need not be reported as pleasant or positive. Notably, descriptions within the literature of the desired physical sensations in NSSI are typically vague. This is commonly expressed as a desire to feel "pain" or to feel "something" (Nock & Prinstein, 2004). Kleindast and colleagues (2008) describe a more general desire to regain awareness of physical sensations. However, such descriptions are rarely elaborated upon. Further analysis of these specific feelings prior to cutting and changes after cutting may provide additional insight into the APR subtype and NSSI in general.

Other examples of sensations or experiences that would qualify as a desire for certain physiologic sensations or experiences are described in the literature, although these have been understudied. One such example is NSSI functioning as "sensation-seeking" in that it generates excitement or exhilaration in a manner similar to sky-diving or bungee jumping. This has received less attention in the literature likely because it is not readily apparent in clinical populations (Klonsky, 2007). The experience of excitement or exhilaration, similar to that seen in other "sensation-seeking" behaviors, has yet to be thoroughly explored within the field of self-injury.

Another physical experience described in the literature is the desire for the sight of blood. The experience of seeing blood has been reported to be an important factor for many individuals with NSSI behaviors (Kumar et al., 2004; Glenn & Klonsky, 2010 Favazza & Conterio,1989). Glenn and Klonsky (2010) found that half of their sample (*N*=64) of college-aged self-injurers reported that it was important to see blood during NSSI. The group of individuals that reported seeing blood to be important was further distinguished from the other NSSI individuals in that they were characterized by higher frequency of skin-cutting and greater endorsement of intrapersonal functions for NSSI. Glenn and Klonsky state that "the desire to see blood during NSSI is relatively common, and that seeing blood may be an 'active ingredient' that helps NSSI achieve the desired effect" (p. 467).

It is unclear how seeing blood after self-injury is reinforcing. Glenn and Klonsky (2010) speculate that the sight of blood may induce physiological effects via sympathetic and parasympathetic responses. Another explanation hypothesized within the literature is that NSSI within these contexts stimulates the release of endorphins, thus creating rewarding stimulation or experiences consistent with the APR function. Several researchers have suggested the possibility that brain opiate activity may promote NSSI behavior (Sandman et al, 1997; Winchel and Stanley, 1991). Whitlock (2010) hypothesized that individuals who self-injure may have chronically lower than normal levels of endogenous opioids and self-injury represents an attempt to restore opioids to normal levels. This theory, like the physiological explanation related to the sight of blood, is highly speculative and requires independent empirical support.

These physiologic mechanisms may be outside the individuals' awareness so that they are unable to report the specific function or reason for self-injury; therefore positive reinforcement may be involved but the reinforcers are speculative at this time and require further research. In summary, the research field requires greater examination of the exact sensations and experiences reported prior to self-injury and how these sensations and experiences change after afterwards. This particularly includes more specific examination regarding the desire to "feel something" or "feel pain" as well as examining the experience of seeing blood.

Ending dissociative states. Although Nock and Prinstein (2005) reported the desire "to feel something" was the second most endorsed function in the model (after "to stop bad feelings), they determined that endorsement of this function is the strongest in the presence of symptoms of posttraumatic stress disorder and depression. Since then, the literature has often considered the reason "to feel something, even if it is pain" in the context of antecedent feelings of numbness or emptiness. To feel pain or any sensation is desired "to relieve feeling numb or empty," which is considered to be a symptom of dissociation or anhedonia associated with depression. The desire to end these states is the third function often described as APR.

Originally, "to relieve feeling numb or empty" was conceptualized as functioning through negative reinforcement as it loaded under ANR in the initial factor analysis (Nock & Prinstein, 2004). Subsequent literature has grouped self-injury performed "to relieve feeling numb or empty" as closely pertaining to the item "to feel something, even if it was pain" and therefore classified under the APR function of self-injury (Nock & Prinstein, 2005; Nock et al., 2007). The Self-Injurious Thoughts and Behaviors Interview

(SITBI) – currently the most comprehensive interview for the assessment of NSSI and related behaviors – includes 4 questions (items 153-156) that specifically address the four factors of the FFM. Item 154 of the SITBI assesses on a 0-4 scale the degree with which an individual endorses the APR function of NSSI. Notably, this item explicitly connects NSSI for the purpose of feeling something with an antecedent dissociative state: "How much did you engage in NSSI in order to feel something, because you were feeling numb or empty?" Furthermore, in a study that compared the SITBI with the FASM, the Nock et al. (2007) reported that

> [W]e classified Item 2 of the FASM ("To relieve feeling numb or empty") on the Automatic Positive Reinforcement (APR) subscale rather than the Automatic Negative Reinforcement subscale given its theoretical similarity to that behavioral function. There was also empirical support for this adjustment, as it increased the internal consistency reliability of the APR function from .35 to .61. (p.315)

This presents confusion as to the exact function of NSSI that serves "to relieve feeling numb or empty" which originally loaded with the ANR factor, suggesting negative reinforcement.

The two items from the FASM "to relieve feeling numb or empty" and "to feel something" often co-occur and may therefore reflect the same underlying function. However, whether that underlying function is positive or negative reinforcement is unclear. One possible interpretation is that these feelings of emptiness and numbness are symptoms of depression (e.g., anhedonia) or reactions to trauma (e.g., derealization and numbing) and that NSSI serves to lessen these symptoms, thus supporting an ANR

function for this type of self-injury. Alternatively, some individuals who engage in NSSI report a lack of emotional feeling preceding self-injury and have a higher threshold for physical feeling or pain (e.g., Russ et al., 1992). The lack of feeling and physical analgesia have been shown to relate to greater dissociation, traumatic experiences, and depressive symptoms (Claes, Vandereycken, & Vertommen, 2006; Nock & Prinstein, 2005), leading some (e.g., Hilt, Cha, & Nolen-Hoeksema, 2008) to conclude that individuals who are distressed by a lack of feeling may engage in NSSI for automatic positive reinforcement (i.e., "to feel something, even if it is pain").

Similarly, Nixon, Cloutier, and Aggarwal (2002) reported that a subgroup of their NSSI sample reported self-injuring to "stop feeling numb or out of touch with reality." The experience of being "numb" or "out of touch with reality" is consistent with symptoms of dissociation – detachment from one's emotional or physical state. Strong evidence links NSSI with dissociation and the dissociative symptoms related to trauma (Briere & Gil, 1998; Zlotnick, Mattia, & Zimmerman., 1999; Yates, Carlson, & Egeland, 2008). Researchers have theorized that for some individuals NSSI functions to end feelings of dissociation, derealization, or "numbness" by redirecting attention to the physical experience of the injury (Klonsky, 2009; Muehlenkamp et al., 2009; Nock and Prinstein, 2004; Briere & Gil, 1998). The sight of blood, as was described earlier, has been reported as important for restoring a sense of authenticity to the individual and may serve as a reminder that they are still alive (Favazza, 1996), thereby facilitating the ending of the dissociative state (Van der Kolk, Perry, & Herman, 1991). However, it is yet to be thoroughly assessed as to whether this functions through positive reinforcement

by providing the addition of new stimuli or by negative reinforcement by relieving aversive symptoms of dissociation or anhedonia.

Self-retribution. The final item that loaded under the APR factor in the Nock and Prinstein (2004) factor analysis was "to punish yourself." This function is referred to as "self-punishment" within the NSSI literature, but doing so presents confusion for functional analysis. The behavioral definition of punishment is the addition or removal of a stimulus which *decreases* the occurrence of a behavior. Punishment, by its definition, cannot explain the continuation and repetition of NSSI of behavior. Self-punishment reported by individuals with NSSI reflects a colloquial understanding of the term "punishment" – the imposition of injury or suffering as retribution for an offense or misdeed. Because of the confusion, the term "self-retribution" will be used in place of "self-punishment".

Self-retribution NSSI is conceptualized as self-injury performed to derogate or express anger at oneself (Klonsky, 2007). This is typically in response to feelings of guilt or feeling oneself to be weak or undisciplined (Vanderlinden & Vandereycken, 1997). Nock (2010) describes this function as providing a vehicle to reprimand oneself for "some perceived wrong- doing or responding to general self-hatred or self-deprecation" (p. 353) and reports it to be one of the most common self-described reasons for engaging in NSSI. However, the mechanism by which this behavior is reinforced is unclear. A study utilizing ecological momentary assessment (EMA) that assessed self-reported experiences prior to NSSI found that "self-hatred" and "anger at self" are reported as the thoughts/feelings precipitating nearly half the episodes of NSSI (Nock et al. 2009). This is consistent with findings by Glassman and colleagues (2007) that found individuals

with NSSI behaviors report significantly higher levels of self-criticism than do noninjurers. Linehan (1993) hypothesized that individuals who self-injure have learned to "punish" themselves from maladaptive or abusive environments. This is further speculated upon by Glassman et al. (2007):

> [P]eople who experience maltreatment during childhood in the form of repeated insults, excessive criticism, or some form of physical abuse may come to adopt a similarly critical view of themselves over time through modeling the behavior of those who criticized and abused them. This could lead to the development of a self-critical cognitive style, and may ultimately manifest in the engagement in NSSI as an extreme form of self-punishment [sic] or self-abuse whenever they disapprove of their own behavior. (p.2484)

Although this provides a hypothesis for how self-injury may first come about, it does not functionally explain how this behavior is reinforced or maintained.

Some researchers have reported that individuals feel "purified" after NSSI (Glenn & Klonsky, 2010, Himber, 1994). It may be that self-injury is performed in response to feelings of anger or criticism towards oneself and this behavior may be reinforced by reducing these feelings. However, this has yet to be explored within the self-injury literature. Other research has demonstrated that aversive emotions (anger, depression, loneliness and frustration) were reduced following NSSI, while emotions deemed as positive (relief) and self-consciousness (guilt, shame, disgust) increased following self-harm (Laye-Gindhu & Schonert-Reichl, 2005). There is evidence that self-anger feelings (guilt, shame, disgust) increase after NSSI, which would support APR,

however the research does not clearly specify if these emotions function to increase self-anger present before NSSI, whether the person intends to increase these feelings (guilt, shame, disgust), and whether this increase in the primary intention or function of NSSI. On face value, the experience of self-evaluative emotions (e.g., shame) following an act of NSSI appear to represent a potential punisher, making NSSI performed for self-retributive reasons difficult to understand. It is possible that the increase in these self-evaluative emotions is a delayed reaction to NSSI and not its primary function. For example, negative affect preceding an incident of NSSI is subsequently decreased, representing negative reinforcement. However, sometime later the individual experiences shame or guilt about having hurt themselves. Because these consequences are delayed relative to the reduction of negative affect, they may have less impact over the recurrence of NSSI behavior. For example, Osuch and Payne (2008) summarize this principle:

> For the behavioral reinforcement schema to be valid, one must assume that the rewarding quality of the reinforcer is great enough to overcome the aversive quality of the NSSI, or, contrarily, that the negative quality of the NSSI is less extreme than that of the negative reinforcer that is stopped by the behavior. (p.96)

Although self-criticism and self-hatred are reported prior to NSSI, the experience of these has yet to be comprehensively assessed for individuals after self-injury. This represents a critical step in NSSI research.

The function of self-retribution NSSI has been conceptualized as APR. This is mainly because the item "to punish yourself" loaded on the APR factor in the original factor analysis (Nock & Prinstein, 2004). It has also been conceptualized as the

generation or infliction of "feelings of self-punishment" (Lloyd-Richardson, Nock, & Prinstein, 2009). This is based on the idea that the cognitive concept of self-retribution represents an addition of a new stimulus. However, the function of "self-retribution" has not been clearly explored with consideration to the antecedent and consequent experiences of the individual. Until a more comprehensive evaluation is conducted for the self-retribution function of self-injury, it is unclear exactly how self-injury of this sort is maintained and which type of reinforcement (positive vs. negative) is involved.

Current Limitations of the APR

There is significant evidence that NSSI produces reduction of negative affect; however, evidence suggesting an increase in positive affect subsequent to NSSI is less clear. Although some studies do report NSSI may result in a reduction of negative affect and increase in positive affect, this does not necessarily reflect evidence of positive reinforcement. The increase in positive affect may be an after-effect of reducing negative affect so that positive affect is epiphenomenal, rather than casual, in influencing the likelihood of subsequent NSSI. Another possibility is that the apparent increase in positive affect may actually reflect a decrease in negative affect – relief, for example, may strictly reflect removal of a negative state rather than induction of a positive state.

In summary, there is considerable evidence suggesting that negative reinforcement is involved in the maintenance of NSSI. In all instances in which there is an increase of positive affect following NSSI it seems the positive affect is accompanied by the reduction of negative affect. Accordingly, the principle of parsimony would lead us to prefer an explanation in terms of negative reinforcement alone, rather than a two-process (negative and positive reinforcement) theory. Walsh, one of the leading clinical

experts in the NSSI field, supports this notion that reduction of negative affect is primary: "I have yet to encounter a self-injurer who identified a positive emotion as triggering self-harm" (Walsh, 2006 p. 252)

Language used with many of the NSSI self-report instruments has likely influenced interpretation of ANR and APR, resulting in confusion between their distinction. For instance, endorsing engagement in NSSI "to calm down" may or may not be different than endorsing that NSSI "increases feelings of calm". This example presents one of the challenges in determining whether to classify the process through negative or positive reinforcement. Furthermore, it is yet unclear as by what process NSSI functions when it is performed in response to feelings of numbness, emptiness, or derealization. It is possible that NSSI "relieves" or lessens these experience, which supports an ANR function in this case. However, it is also possible that NSSI creates new physical sensations within this context that are rewarding or desirable that also serves to distract from or end the experience (e.g., numbness, dissociation) which would support an APR function of NSSI in addition to the ANR. It is also unclear what reinforcement is involved with NSSI that is performed for self-retribution. While originally classified as APR, there has been little research into the affective, cognitive, and physiological changes NSSI causes for this type of self-injury. These functions require further investigation and at this point it is unclear whether they represent examples of APR or may be better classified as ANR.

Accordingly, the purpose of the current study is to investigate patterns of change in positive and negative affect from before to after instances of NSSI that, according to participants' report, occur for different functional reasons (i.e., ANR and APR) as

identified through a modified version of the FASM. According to Nock's analysis, we predict that although NSSI functioning as ANR will be more prevalent than APR, there should be a substantial number of cases of APR. More importantly, ANR and APR should be associated with different patterns of change in positive and negative affect.

This was done utilizing an internet survey of students enrolled in psychology classes at the University of Wisconsin-Milwaukee (UWM) to gather information on individuals who report NSSI and their experiences related to self-injury. Traditional functional analysis involves real-time examination of the antecedent and consequential experiences related to a behavior. However, there are obvious ethical limitations in the case of NSSI in that researchers cannot observe self-injurious behavior without intervention or request individuals voluntarily self-injure. Therefore, self-report methods including internet survey represent one of the few ethical means by which to assess self-injury. Results from the survey were examined using two separate approaches each intended to to assess the automatic functions of NSSI. These approaches to assess the primary aim are described as first and second primary aims.

Primary Aims

First Aim. The first aim was to characterize the patterns of change in positive and negative affect from before to after engaging in NSSI and to contrast the pattern for instances designated as ANR with those designated to APR. Five questions corresponding with automatic reinforcement, and utilized in conceptualization of the Four Factor Model, were assessed in the survey with follow-up questions asking individuals to rate affective experiences (positive and negative) as they are recalled to have been present immediately prior and subsequent to NSSI. The patterns of affective

change were examined for each of the items associated with automatic reinforcement. Patterns of change in the item most definitively representative of ANR were examined in detail, against which to compare and contrast the other items associated to greater or lesser extent with APR to determine if there are distinctive patterns of change in positive and negative affect that differentiate ANR and APR. Thus, group patterns of positive and negative affect are compared for incidents associated with automatic positive and negative reinforcement.

Second Aim. The second primary aim is to examine the affective ratings, described in the first primary aim, on an individual level. Individual's reported changes in positive and negative affect subsequent to NSSI will assessed and categorized based on match with the definitions of the automatic reinforcement subtypes (e.g. APR or ANR). This aims to assess the presence and frequency of the APR subtype at the individual level.

Hypotheses:

1) The pattern of affective experience reported for FASM questions typically associated with APR were hypothesized to be significantly different from the FASM question associated with ANR. It was also predicted that the magnitude of negative affect reduction will be greater than that of potential changes in positive affect for ANR and that the reverse will be observed for cases of APR.

2) The majority of affective experiences coded at the individual level were hypothesized to be consistent with ANR (reduction of negative affect, no change in positive affect) – as this is the most frequently reported function of NSSI. However, based on Nock's analysis, it is expetected that a significant minority of individual cases

will be designated as APR (positive affect increase, no change in negative affect). Other characterizations of affective change, such as those associated with increases in negative affect, decreases in positive affect, or no affective change, will be rare or non-existent.

Method

Participants

Participants were recruited from undergraduate psychology classes at the University of Wisconsin-Milwaukee (UWM) and offered 1-hour of extra credit for study participation. A total of 296 participants consented to participate in the survey; however 5 participants discontinued the study before completing the demographic information or answering questions determining a history (yes/no) of NSSI. Therefore, 291 participants in total were used for sample analyses. Because this study examines the role of reinforcement in maintaining NSSI, the NSSI group focused on participants with a history of repeated self-injury. Accordingly, participants were categorized as self-injurers (NSSI group) if they met the following criteria: 1) are at least 18 years of age; and 2) endorse a history of self-injury (either cutting or burning) occurring more than once. Participants were sorted into the non-NSSI group if they: 1) are at least 18 years of age; and 2) do not endorse a history of NSSI (cutting or burning) or endorse engaging in NSSI only once. 66 individuals met criteria for the NSSI sample and 225 met criteria for the non-NSSI sample.

Procedures

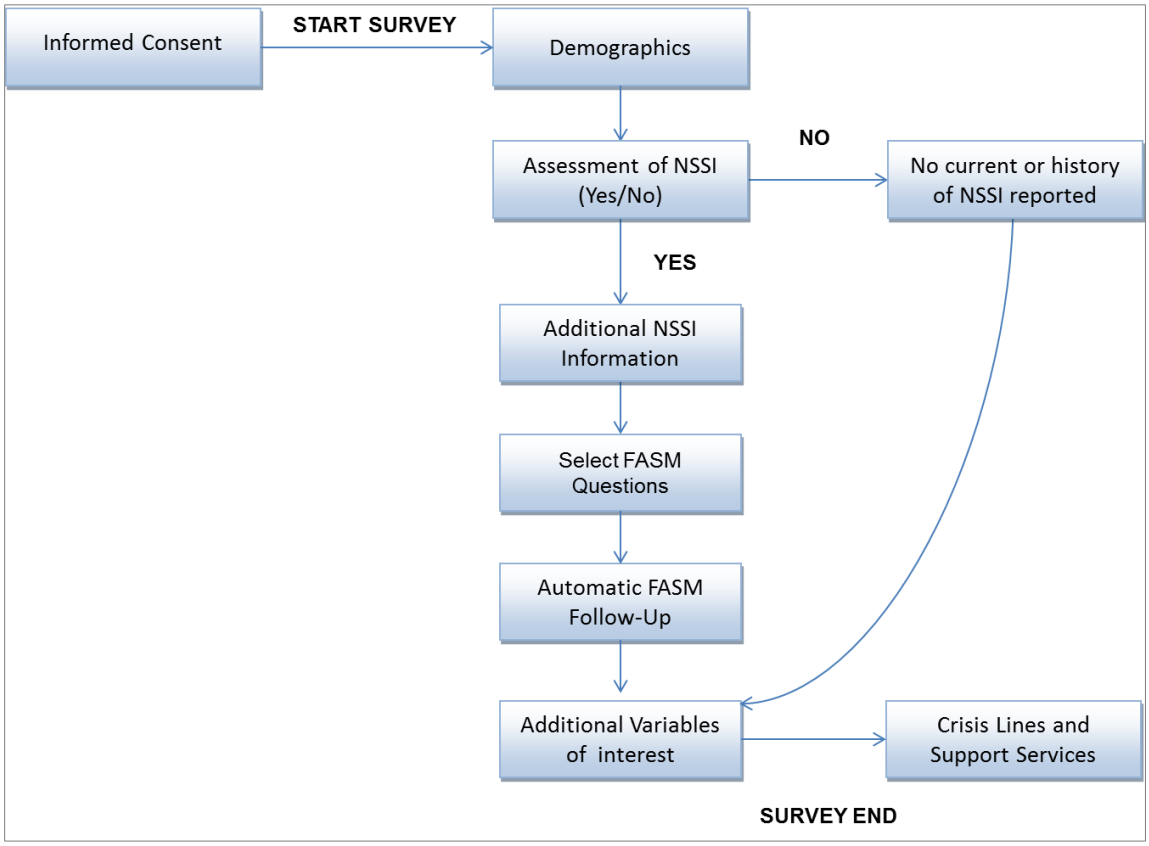
To participate in the study, students logged into UWM's Experiment Management Website (SONA; http://uwmilwaukee.sona-systems.com/) which also provided additional information about the study. Using the SONA system, students were able to "sign-up" for the study, automatically granting them 1-hour of extra credit regardless of further participation. In addition to granting them extra credit, signing up for the study generated an e-mail to the student that provided a link to the survey. This survey link was not

connected to the SONA system, so that responses remained anonymous, and participants could choose to take the survey at any point after receiving the link.

The study link directed participants to a survey posted using the Qualtrics Survey Instrument (http://www.qualtrics.com/), a nationally- respected survey instrument software company that has partnered with UWM. The first page of the survey presented a detailed explanation of the study and provided an online consent form approved by UWM's Institutional Review Board. Study participants were asked to agree that they were at least 18 years of age and provide consent for participation by retyping the phrase, "I have read the informed consent and agree to participate in this survey." After successfully typing this phrase, participants were provided access to the study questions and responses were recorded using a unique study id code generated randomly by the Qualtrics program. Survey responses were not linked to student names or e-mail so that responses would remain anonymous.

After consent, individuals entered the main survey which contained 7 sections including: 1) Demographics, 2) Assessment of NSSI, 3) Additional NSSI Information, 4) Select FASM questions, 5) Follow-Up to the Automatic FASM questions, 6) Additional variables of exploratory interest (e.g. emotion regulation, etc) and finally 7) Study Debriefing. Individuals who did not endorse NSSI skipped over further questions pertaining to self-injury and re-directed to the additional variables of interest as outlined in *Diagram 1.* Additionally, crisis information (*National Suicide Prevention Lifeline*) was provided at the bottom of every page throughout the survey in the case distress was experienced during the study.

Diagram 1. Survey Design



Materials

Demographics (Appendix A). Participants were asked to provide the following basic demographic information: age, year in school, gender, sexual orientation, ethnicity (Hispanic or not), and race.

Assessment of NSSI (Appendix B). The presence of cutting and burning NSSI for classifying participants into NSSI and Non-NSSI groups was assessed with an adaptation of the

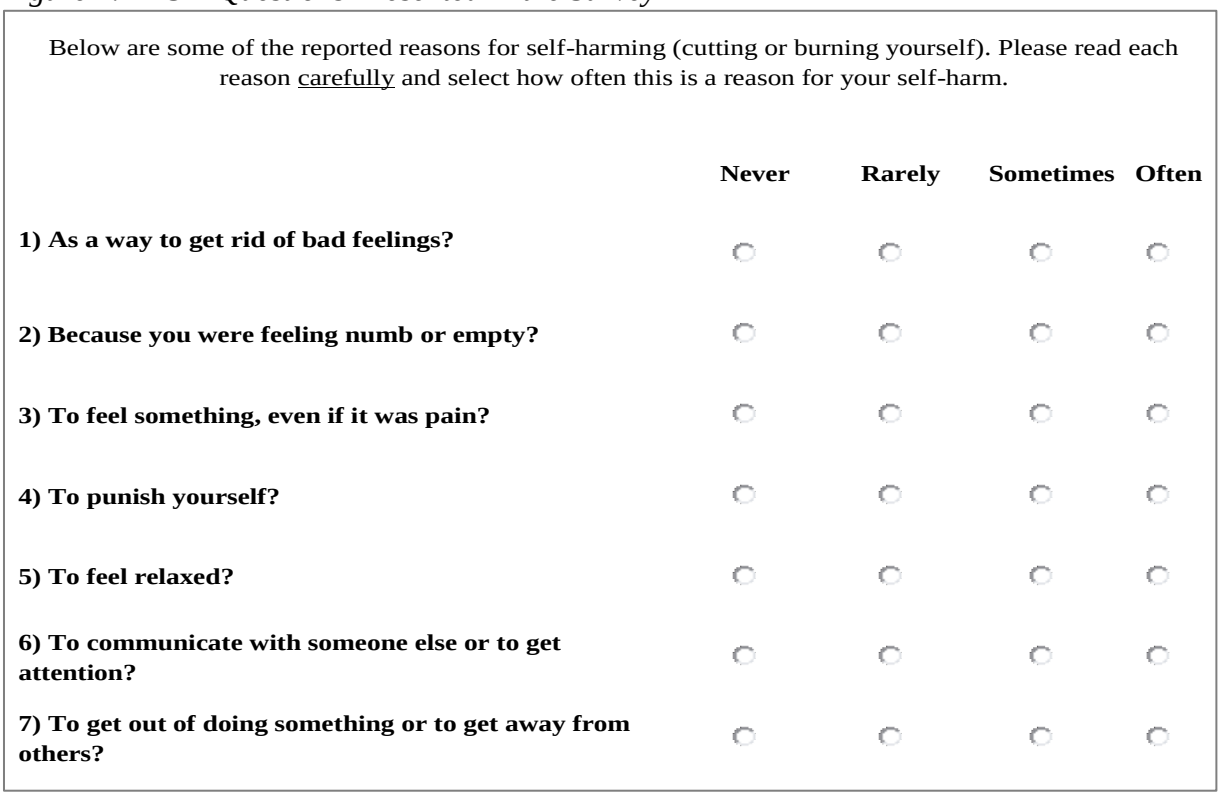
Deliberate Self-Harm Inventory (DSHI; Gratz, 2001). The survey was limited to these two types of self-injury because they are the most common (Nock, 2010) and less likely to capture other self-harm behaviors (e.g., hairpulling or head banging) that may be better characterized by a specific disorder (e.g., trichotillomania or motor stereotypy).

Additional Information about NSSI (Appendix C). We have devised several additional follow-up questions assessing the history, frequency, severity, and topography of NSSI adapted from the Self-Injurious Thoughts and Behavior Interview (SITBI; Nock et al, 2007).

Functional Assessment of Self-Mutilation Questions (Appendix D). The Functional Assessment of Self-Mutilation (FASM; Lloyd, Kelley, & Hope, 1997) was used to assess the functional reasons or motivations related to self-injury. Seven questions (out of 22) from the FASM were selected for mapping on to one of the four factors of the FFM described by Nock and Prinstein (2004, 2005). Five of the seven questions map onto automatic functions and were renumbered for the purpose of this study and referred to as FASM1 – FASM5. The remaining two FASM questions, referred to here as FASM6 and FASM7, correspond with the two social factors described by the FFM and are essentially the same questions used to assess these factors in the Self-Injurious Thoughts and Behavior Interview (STIBI). These social questions were not explored with follow-up in the current survey as the automatic functions were the variables of interest.

In the survey, participants who endorsed NSSI were presented the list of reported reasons for self-harming (7 FASM items) and asked to carefully rate how often each item represents a reason for his/her self-harm. The 7 FASM questions and the frequency options as they were presented to participants are provided in Figure 2.

Figure 2. FASM Questions Presented in the Survey



Below are some of the reported reasons for self-harming (cutting or burning yourself). Please read each reason carefully and select how often this is a reason for your self-harm.

	Never	Rarely	Sometimes	Often
1) As a way to get rid of bad feelings?	○	○	○	○
2) Because you were feeling numb or empty?	○	○	○	○
3) To feel something, even if it was pain?	○	○	○	○
4) To punish yourself?	○	○	○	○
5) To feel relaxed?	○	○	○	○
6) To communicate with someone else or to get attention?	○	○	○	○
7) To get out of doing something or to get away from others?	○	○	○	○

However, the FASM questions of interest relating to the automatic functions of NSSI are provided below:

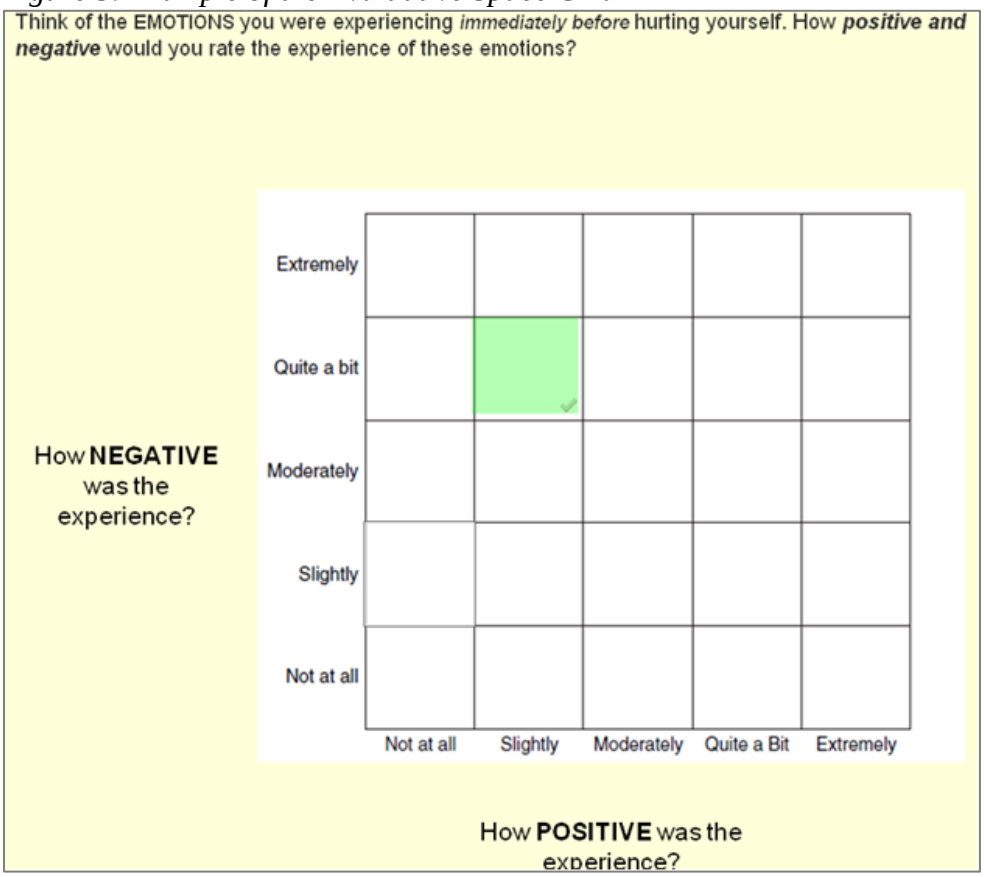
FASM1 - As a way to get rid of bad feelings?
FASM2 - Because you were feeling numb or empty?
FASM3 - To feel something, even if it was pain?
FASM4 - To punish yourself?
FASM5 - To feel relaxed?

Automatic Function Follow-Up (Appendix E). For each of the five FASM questions associated with automatic functioning (Nock & Prinstein, 2004; 2005) that a participant endorsed, follow-up questions related to affective experience before and after NSSI were administered. Positive and negative affect were assessed simultaneously using the "Evaluative Space Grid", or ESG, a method for describing mixed emotional experiences in a single-item measure (Larsen et al. 2008). Use of the ESG is based on

evidence suggesting that, although they may partially correspond, dimensions of positivity and negativity are functionally separable – an increase in one dimension does not necessarily result in an equal reduction of the other dimension, which may or may not be reduced at all. The ESG allows for the independent activation of positive and negative affect as well as the possibility of their co-activation. (Norris et al. 2010). Several studies have demonstrated the generalizability and predictive validity of the ESG and additional research has found ESG ratings to predict facial electromyographic activity for tasks utilizing affective stimuli (Larsen et al. 2009).

The ESG grid in the current study was designed with negative affect along the x-axis (1-5) and positive affect along the y-axis (1-5). Participants could thus select the point on the grid that reflected their simultaneous experience of positive and negative affect before NSSI and again after NSSI. This procedure yielded a pair of scores for positive and negative affect that corresponded to the x and y coordinates of the ESG, respectively, at each time point (i.e., before and after engaging in NSSI). A short video explaining how to rate positive and negative affect using the ESG was provided to participant prior to follow-up questions. For an example, see Figure 3. The positive and negative affect scores for the example illustrated in Figure 3 would be 2 and 4, respectively, on a 1-5 scale.

Figure 3. Example of the Evaluative Space Grid



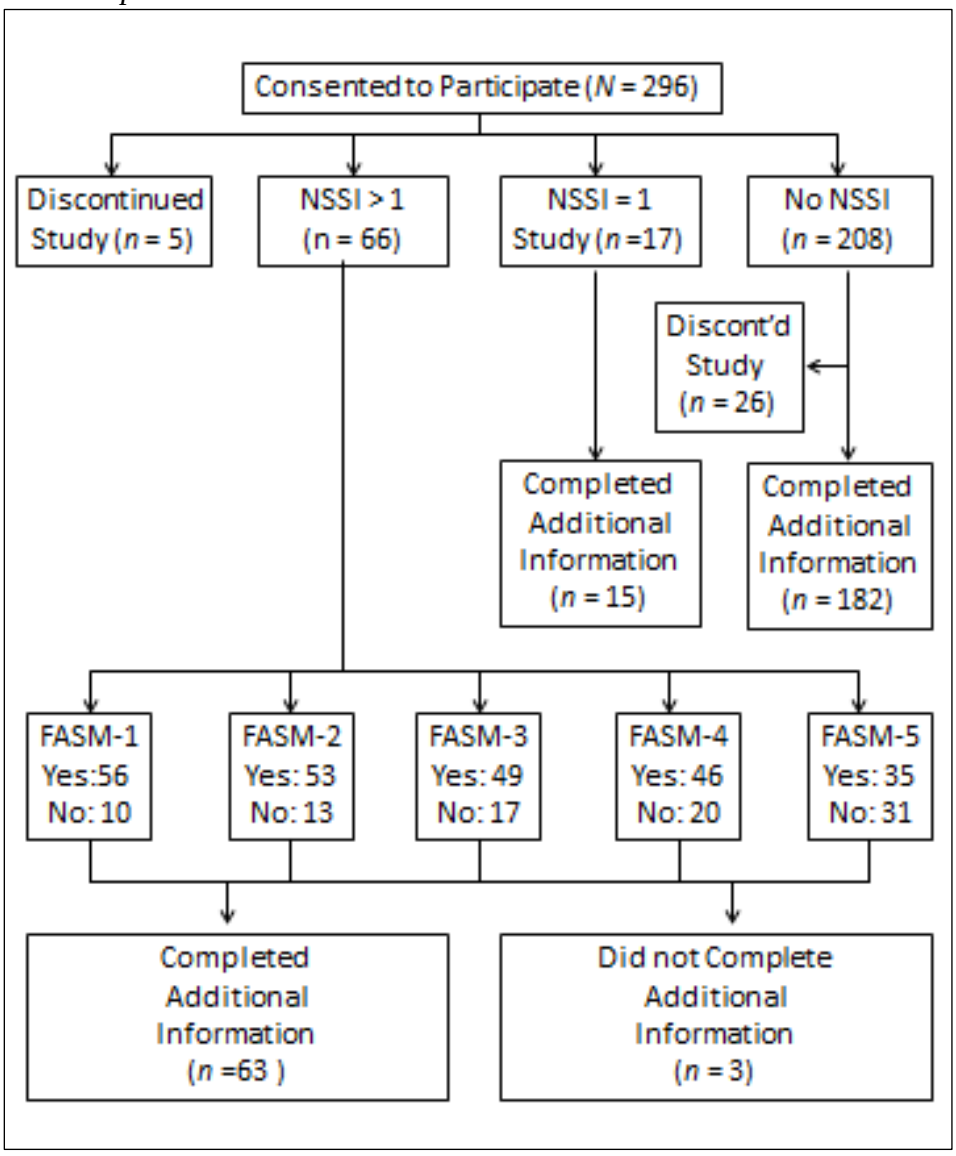
End of Survey and Debriefing (Appendix F). The end of the survey provided a short explanation to debrief participants and thank them for their time. Additional crisis and support services pertaining to NSSI were provided on this page as well for individuals in need.

Study Participation and Attrition

Participant flow through the study is illustrated in Figure 4. A total of 296 participants consented to participate in the survey, but only 291 participants were used for analyses, as these represent participants who completed demographic and NSSI history information. Of these participants, 208 reported never having engaged in NSSI and 17 reported engaging in NSSI only once. These participants were assigned to the Non-NSSI sample (n=225). Sixty-six participants endorsed a history of NSSI occurring more than

once and were thus assigned to the NSSI sample (*n*=66). These 66 participants responded to the 5 FASM questions of interest and breakdown of their responses can be seen in Figure 4. Overall, there were 63 participants in NSSI group (*n*=66) and 197 participants in the Non-NSSI group (*n*=225).

Figure 4. Participant Flow



Data Security and Analysis

Data collection and storage was hosted by Qualtrics. The procedures for the capture and storage of data have been reviewed by the UWM Information Security Office

to ensure data security. They have determined that the security and privacy provided by Qualtrics is fully compliant with the UWM Security Policy and that this is the only survey software that is pre-approved meeting University IRB privacy requirements. After the conclusion of the study, data was directly exported from Qualtrics into an SPSS database for data analyses.

Results

Respondent Characteristics

Of the 291 participants who completed the demographic and NSSI history questions, 83 participants reported having tried NSSI (cutting or burning) at some point in their lifetime. Of these 83 individuals, 17 reported only self-injuring on one occasion, and 66 reported having self-injured on two or more occasions. The remaining 208 participants reported never to have engaged in NSSI. Because this study examines the role of reinforcement in maintaining NSSI, the NSSI sample (n=66) involved only individuals reporting multiple instance of NSSI and the Non-NSSI (n=225) sample included those reporting no history of self-injury or trying it only once.

Demographics for the NSSI and Non-NSSI samples, as well as overall study demographics, are provided in Table 4. The mean age for the NSSI-group was 20.7 years-old (SD=2.2) compared to mean age of 21.7 years-old (SD=4.4) for the Non-NSSI group. Variance in age for the NSSI-group was statistically less than for the Non-NSSI, as indicated by Levene's Test for Equality of Variance (F=6.94, p=.009). When accounting for this difference in variance, the age difference between groups was statistically significant ($t(132) = 1.986$, $p = .049$), indicating that self-injurers in the NSSI group (n=40) were younger than non-NSSI participants (n=142). Reporting age was optional and several participants left this information blank.

In regard to sex of the participants, overall 80.8% were female and 19.3% male. A chi-square test indicated that the sex distribution of the NSSI-sample was significantly different than that of the Non-NSSI sample ($\chi 2 = 5.66$, p =.017); the NSSI-sample had a higher percentage of females (90.9%) compared to the Non-NSSI sample (77.8%).

About half the participants in the study reported being in their Freshman (23.7%) or Sophomore (27.1%) year of college. The other half of participants comprised Juniors (21.0%), Seniors (15.8%), and 5th year or continuing students (12.0%). There was no statistically significant difference between the NSSI-sample and Non-NSSI sample in the distribution of reported year in school ($\chi 2 = 4.67$, $p = .323$).

The majority of participants in the sample identified as heterosexual (91.4%). The remaining participants endorsed attraction to the same sex (2.8%) or attraction to both sexes (5.8%). The sexual orientations of individuals in the NNSI sample were significantly different than those characterizing the Non-NSSI sample ($\chi^2 = 13.43$, $p = .001$). Individuals in the NSSI sample had a smaller percentage of individuals reporting exclusive attraction to the opposite sex, with only 80.3% of the sample reporting heterosexual orientation compared to 94.7% of the non-NSSI sample. Self-injurers in the current study were more likely to endorse homosexual (6.1%) or bisexual attraction (13.6%), in comparison to their Non-NSSI peers (1.8% and 3.6%, respectively). In terms of racial demographics, the NSSI sample was 1.5% Asian, 6.1% Black/African American, 84.8% White/Caucasian, and 7.6% Biracial or of multiple race. Regarding ethnicity, 4.5% of self-injurers identified as Hispanic/Latino(a). These percentages were similar to those of the overall sample as the NSSI-sample and Non-NSSI sample were not statistically different in terms their racial ($\chi^2 = 8.90$, $p = .064$) or ethnic (Hispanic/Non-Hispanic) breakdown ($\chi^2 = 0.01$, $p = .909$).

In summary, the overall study sample was predominately non-Hispanic White/Caucasian heterosexual young women. The NSSI sample was, on average, younger, more likely to be female, and more diverse in their sexual orientation.

Table 4. Sample Characteristics and Comparisons

	NSSI Sample (n = 66)	Non-NSSI Sample (n = 225)	Overall (N = 291)	Comparison of NSSI with Non-Study Sample
Age in years*				$t(132) = 1.986$, $p = .049$
Mean (SD)	20.7 (2.2)	21.7 (4.4)	21.5 (4.0)	
Min	18	18	18	
Max	28	46	46	
Sex				$\chi^2 = 5.66$, $p = .017$
Female	60 (90.9%)	175 (77.8%)	235 (80.8%)	
Male	6 (9.1%)	50 (22.2%)	56 (19.3%)	
Year in School				$\chi^2 = 4.67$, $p = .323$
Freshman	17 (25.8%)	52 (23.1%)	69 (23.7%)	
Sophomore	14 (21.2%)	65 (29.0%)	79 (27.1%)	
Junior	16 (24.2%)	45 (20.0%)	61 (21.0%)	
Senior	14 (21.2%)	32 (14.2%)	46 (15.8%)	
$\geq 5^{th}$ Year	5 (7.6%)	30 (13.3%)	35 (12.0%)	
No response	0 (0%)	1 (0.4%)	1 (0.3%)	
Sexual Orientation				$\chi^2 = 13.43$, $p = .001$
Opposite sex	53 (80.3%)	213 (94.7%)	266 (91.4%)	
Same sex	4 (6.1%)	4 (1.8%)	8 (2.8%)	
Both sexes	9 (13.6%)	8 (3.6%)	17 (5.8%)	
Race				$\chi^2 = 8.90$, $p = .064$
Asian	1 (1.5%)	18 (8.0%)	19 (6.5%)	
Black/African American	4 (6.1%)	16 (7.1%)	20 (6.9%)	
White/ Caucasian	56 (84.8%)	172 (76.4%)	228 (78.3%)	
Multiple race	5 (7.6%)	8 (3.6%)	13 (4.5%)	
Other	0 (0%)	11 (4.9%)	11 (3.8%)	
Hispanic				$\chi^2 = 0.01$, $p = .909$
No	63 (95.5%)	214 (95.1%)	277 (95.2%)	
Yes	3 (4.5%)	11 (4.9%)	14 (4.8%)	

**Note: Individuals were allowed to skip the age question and several participants left this blank.*

Characteristics Related to NSSI

In the NSSI sample (*n*=66), 61 individuals reported a history of cutting (*n*=61), and that the first incident of cutting occurred at a mean age of 14.38 (*SD*=2.14). The majority of individuals reported cutting fewer than 20 times in their lifetime (66%). However, approximately a third of the sample reported relatively high incidence of cutting– 8.2% endorsed cutting "20-50 times" and 24.6% endorsed cutting "more than 50" times in their lifetime. Most individuals with a history of cutting (65.6%) reported not to have cut in over 2 years. About a quarter reported cutting within the last 12 months, with 4 individuals (6.6%) reporting to have cut within the past month and 1 individual (1.6%) reporting to have cut as recently as within the week of participating in the survey. However, only two of these individuals (3.3%) reported cutting "5 times or more" within the last 12 months.

Individuals with a history of burning (*n*=14) first started the behavior at a mean age of 15.56 (*SD*= 1.01). Half of individuals (50%) reported only burning "2-5 times" in their lifetime. Of the remaining individuals, 5 (35.7%) reported burning "5-20 times" and 2 (14.3%) reported burning "20-50 times" in their lifetime. However, only 2 individuals (14.2%) reported burning within the most recent year of taking the survey and neither endorsed burning "5 times or more" during this timeframe.

The overall characteristics of NSSI – using the more frequent or severe type (cutting vs. burning) reported – are reported in Table 5. The mean age for first instance of any NSSI was at 14 and half years old. The majority of the sample reported lifetime instance of NSSI to be less than 20 instances. Most reported no NSSI to have occurred in over a year. In regards to where on the body individuals harmed themselves, the most

common sites were arms (n=57), legs (n=29), and thighs (n=21) with individuals reporting multiple sites.

Table 5. Characteristics of NSSI

	NSSI (n=66)
Age first attempt	
Mean (SD)	14.5 (2.1)
Min	10
Max	21
How many times ever in lifetime?	
2-5 times	29 (44.0%)
5-20 times	1 (24.2%)
20-50 times	6 (9.1%)
More than 50	15 (22.7%)
How recently?	
Within the past week	1 (1.5%)
Within the past month	4 (6.1%)
Within the past 6 months	4 (6.1%)
Within the past 12 months	6 (9.1%)
Within the past 1-2 years	7 (10.6%)
Not in over 2 years	44 (66.7%)
How many times in the last 12 months?	
Less than 5 times	64 (97%)
5 times or more	2 (3%)
Hospitalization or medical attention required?	
Yes	5 (7.6%)
No	61 (92.4%)
Currently taking Psychiatric Medication	
Yes	11 (16.7%)
No	55 (83.3%)
Where on the body?*	
Arms	57 (86.3%)
Chest	4 (6.1%)
Feet	1 (1.5%)
Hands	6 (9.1%)
Legs	29 (44.0%)
Stomach	11 (16.7%)
Thighs	21 (31.8%)

**Note: Individuals were able to report multiple body sites.*

Although this NSSI sample was recruited from a college population, the severity of the self-injury experienced by these individuals should not be discounted – 5 of the 66 individuals in the NSSI sample (7.6%) reported that their self-harm behavior had resulted in injury severe enough to require medical attention or hospitalization. Within the NSSI sample (n=66), 11 individuals (16.7%) reported taking medication for a psychiatric condition.

Initial FASM Response

Consistent with the reported literature, items related to the automatic function of self-injury (FASM1-FASM5) were endorsed more than the items representing social functions (FASM6 & FASM7). Regarding reasons for NSSI reported in the study sample (n=66), 56 endorsed FASM1 (84.8%), 53 endorsed FASM2 (80.3%), 49 endorsed FASM3 (74.2%), 46 endorsed FASM4 (69.7%), 35 endorsed FASM5 (53.0%), 31 endorsed FASM6 (47%), and 7 endorsed FASM7 (10.6%). Individuals also provided information as to how often the endorsed item was a reason for NSSI. This information is presented in Table 6.

Table 6. Responses to FASM

Question	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	*Mean (SD)*
1) As a way to get rid of bad feelings?	10	8	29	19	2.86 (1.03)
2) Because you were feeling numb or empty?	13	18	17	18	2.60 (1.11)
3) To feel something, even if it was pain?	17	13	16	20	2.59 (1.19)
4) To punish yourself?	20	14	22	10	2.33(1.07)
5) To feel relaxed?	31	14	12	9	1.98 (1.10)
6) To communicate with someone else or to get attention?	35	12	15	4	1.82 (0.99)
7) To get out of doing something or to get away from others?	59	6	1	0	1.12 (0.37)

Primary Analyses of FASM

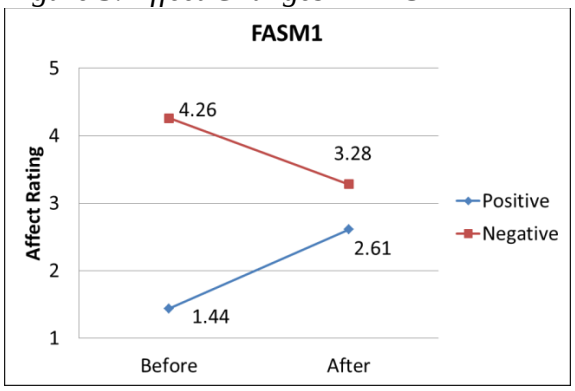
The primary aim of the current study was to examine the automatic (intrapersonal) functions of NSSI included in the Four Factor Model, in particular the APR subtype. The purpose of the following analyses was to characterize the pattern of change in positive and negative affect reported immediately prior and subsequent to NSSI using the evaluative space graph.

Current NSSI literature suggests that NSSI motivated by ANR should be associated with decreased negative affect subsequent to engaging in NSSI accompanied by little or no change in positive affect. NSSI motivated by APR should hypothetically be associated the reverse pattern – increased positive affect subsequent to NSSI accompanied by little to no change in negative affect. It was therefore hypothesized that these respective changes in affect would be reported by participants endorsing FASM items related to ANR and APR.

To test the hypothesis ANR would be associated with a decline in negative affect from prior to post-NSSI, data from FASM1 item (NSSI "as a way to get rid of bad feelings") – which is considered the prototypical question identifying ANR – were submitted to a 2 X 2 ("Time": before vs. after NSSI) X ("Affect": positive vs. negative) repeated measures factorial analysis of variance (ANOVA). Results of the ANOVA revealed a non-significant main effect for "Time", $F(1,53) = 1.02$ $p = .317$, and a significant main effect for "Affect", $F(1,53) = 114.3$, $p < 0.001$. Of importance, the two-way "Time" X "Affect" interaction was also significant, $F(1,53) = 62.3$ $p < 0.001$. To better understand the interaction, the simple main effects of time were explored through separate paired *t*-tests for positive and negative affect.

The means depicting the "Time" X "Affect" interaction for FASM1 are displayed in Figure 5. Inspection of the figure suggests, and statistical analyses confirm, that there was a significant decrease in negative affect from prior (M = 4.26, SD = 1.03) to after (M = 3.28, SD = 1.16) engaging in NSSI, $t(53) = 4.98$, $p < .001$. In contrast, there was a significant increase in positive affect from prior (M = 1.44, SD = 0.77) to after (M = 2.61, SD = 1.17) NSSI, $t(53) = -5.62$, $p < .001$. Inspection of the figure further suggests that the decrease in positive affect (a mean decrease of 0.98 points, SD = 1.44) is of similar magnitude to the increase in positive affect (a mean increase of 1.17 points, SD = 1.53) To evaluate whether there were any differences in the magnitude of change from prior to post NSSI across positive and negative affect, an interaction contrast was conducted comparing change scores for positive affect (post-NSSI score – pre-NSSI score) with change scores for negative affect after first multiplying the change scores by -1 (i.e., -1*[post-NSSI score – pre-NSSI score]) using a paired t-test . The transformation of negative affect scores was performed to express increases in both positive and negative affect as a positive number, and decreases in both positive and negative affect as a negative number. Results of this analysis indicated no difference in the magnitude of change for positive affect in comparison with negative affect, $t(53) = 1.302$, p=.198).

Figure 5. Affect Changes in FASM1



In summary, consistent with our expectations the assessment of negative affect experienced before and after engaging in NSSI for reasons of automatic negative reinforcement, as indicated by endorsing the FASM1 item, found a significant decrease in reported negative affect. However, contrary to our predictions, FASM1 was also associated with a significant increase in positive affect subsequent to NSSI – we had hypothesized little or no change in positive affect in cases of ANR. Furthermore, it was expected that for ANR changes in negative affect would be significantly greater than changes in positive affect; however this was not the case as net change was not statistically significant different between positive and negative affect.

Comparison of FASM1 to other FASM Items

The previous analyses focused on the experience of positive and negative affect subsequent to NSSI for individuals endorsing FASM1, regarded as the definitive item for assessing the presence of ANR (Nock et al. 2007). The next set of analyses compares the remaining FASM items (FASM2-FASM5) with the results observed in FASM1 in regards to before/after changes in positive and negative affect. The purpose is to compare these items, which have all been described as reflecting APR to varying degrees, with that of the item prototypical of ANR to assess differential patterns of affect change. This comparison was conducted using four separate 2 X 2 X 2 ("FASM" X "Time" X "Affect") repeated measure factorial ANOVAs. For the "FASM" factor of each ANOVA, FASM1 was compared with one of the four remaining FASM items (i.e., FASM1 vs. FASM2, FASM1 vs. FASM3, FASM1 vs. FASM4, and FASM1 vs. FASM5). The "Time" factor assessed ratings before and after NSSI. Finally, the "Affect" factor compared positive and negative affect. For NSSI motivated by APR, as indicated by

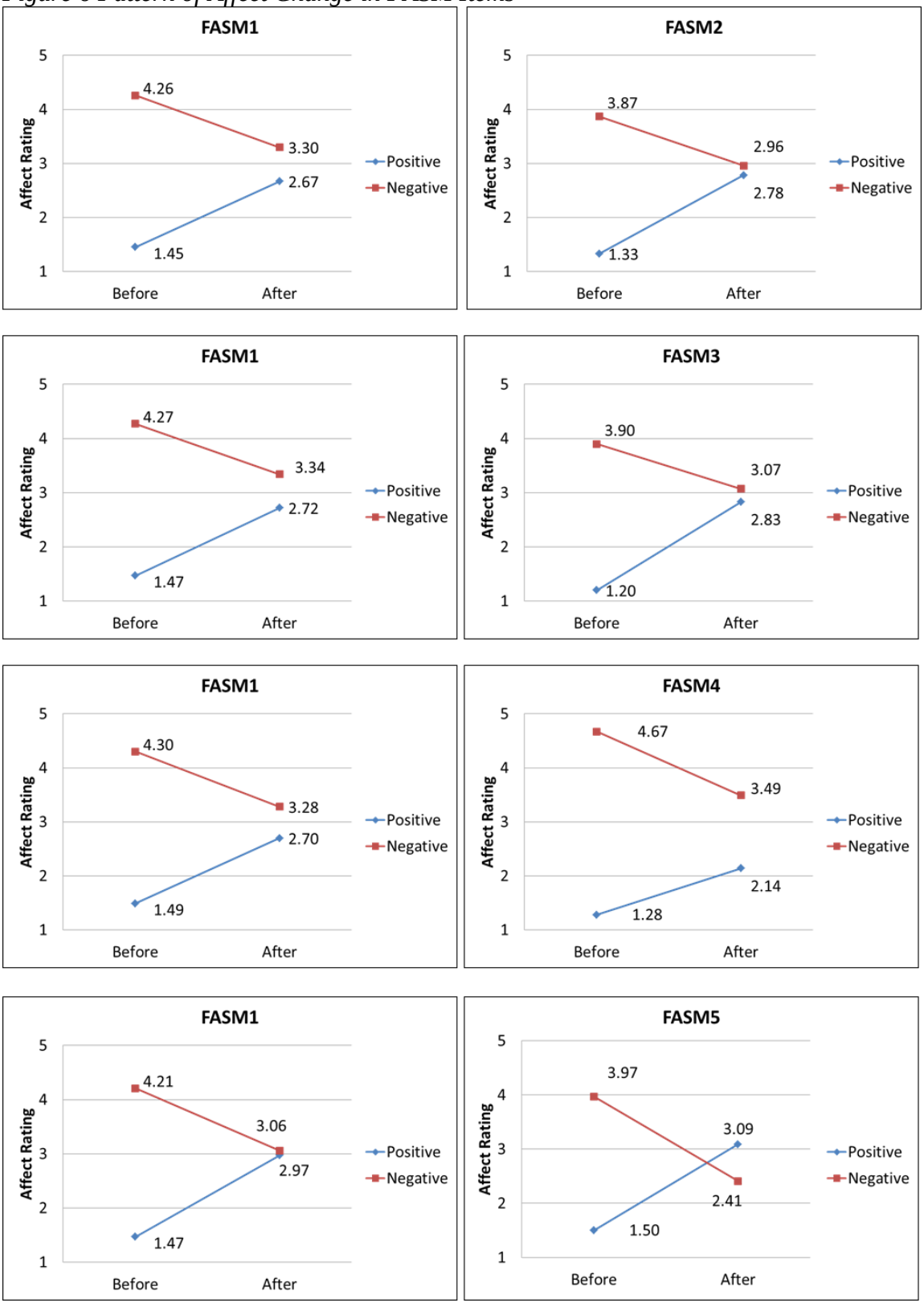
endorsing any of FASMs 2 -5, it was hypothesized based on Nock's analysis that the pattern of change in positive and affect from prior to post-NSSI would be different from that observed for ANR, which would be indicated by the presence of a significant three-way interaction.

The results of these ANOVAs are presented in Table 6. In the series of four 2 X 2 X 2 ANOVAs, each analysis yielded a statistically significant "Time" X "Affect" interaction but none resulted in a significant 3-way interaction. This suggests that although there were significant differential changes in positive and negative affect across time, the pattern of changes were not significantly different for FASM1 than for any of the other FASM items. The means for the 3-way interaction are displayed in Figure 6. As can be seen in the figure, the pattern of change for positive and negative affect pre-to-post NSSI in graphs of FASM2 – FASM5 (the right-hand graph in each panel) do not differ upon visual inspection from the pattern illustrated in the graphs of FASM1(the left-hand graph in each panel) . These results suggest that, contrary to expectations, the FASM items associated with APR do not significantly differ from the ANR item in regards to changes in positive and negative affect. A small number of other main effects and interactions achieved significance that will be described next.

Table 7. FASM ANOVA Results

FASM Comparison	FASM	Time	Affect	FASMXTime	FASMXAffect	TimeXAffect	FASM X Time X Affect
FASM-1 vs. FASM-2	$F(1,45) = 6.17$	$F(1,45) = 3.46$	$F(1,45) = 119.45$	$F(1,45) = 1.28$	$F(1,45) = 3.68$	$F(1,45) = 53.99$	$F(1,45) = 0.248$
	$p = 0.017$	$p = 0.069$	$p < .001$	$p = 0.264$	$p = 0.061$	$p < .001$	$p = 0.621$
FASM-1 vs. FASM-3	$F(1,43) = 6.43$	$F(1,43) = 7.51$	$F(1,43) = 98.15$	$F(1,43) = 2.34$	$F(1,43) = 1.75$	$F(1,43) = 49.28$	$F(1,43) = 0.690$
	$p = 0.015$	$p = 0.009$	$p < .001$	$p = 0.130$	$p = 0.193$	$p < .001$	$p = .411$
FASM-1 vs. FASM-4	$F(1,42) = 0.66$	$F(1,42) = .167$	$F(1,42) = 166.38$	$F(1,42) = 4.89$	$F(1,42) = 10.21$	$F(1,42) = 42.58$	$F(1,42) = 0.250$
	$p = 0.421$	$p = 0.685$	$p < .001$	$p = 0.033$	$p = 0.003$	$p < .001$	$p = 0.620$
FASM-1 vs. FASM-5	$F(1,31) = 2.94$	$F(1,31) = 1.35$	$F(1,31) = 64.01$	$F(1,31) = 1.00$	$F(1,31) = 4.31$	$F(1,31) = 55.59$	$F(1,31) = 0.954$
	$p = 0.097$	$p = 0.255$	$p < .001$	$p = 0.325$	$p = 0.046$	$p < .001$	$p = 0.336$

Figure 6 Pattern of Affect Change in FASM Items



FASM 1 vs. FASM 2. A significant main effect was observed for the "FASM" factor, $F(1,45) = 6.17$, $p = 0.017$, in which the average affect scores for FASM1 (M=2.92, SE=0.064) was greater than for FASM2 (M=2.73, SE=0.085).

FASM 1 vs. FASM 3. A significant main effect was observed for the "FASM" factor, $F(1,43) = 6.43$, $p = 0.015$, in which the average affect scores for FASM1 (M=2.96, SE=0.066) was greater than for FASM3 (M=2.76, SE=0.091).

FASM1 vs. FASM4. There was a significant "FASM" x "Time" interaction, $F(1,42) = 4.89$, $p= 0.033$ as well as a FASM x Affect interaction $F(1,42) = 10.21$, $p= 0.003$. Follow- up analyses for the "FASM" x "Time" interaction to investigate the simple main effect of FASM at each time point were conducted using two paired *t*-test. At time-point 1 (prior to NSSI), FASM1 ($M = 2.90$, $SD = .42$) did not differ significantly from FASM4 ($M = 2.98$, $SD = .36$), $t(42) = -1.16$, $p=.255$. Similarly, at time-point 2 (after NSSI) FASM1 ($M = 2.99$, $SD = .68$) was not significantly different than FASM4 ($M = 2.81$, $SD = .10$), $t(42) = 1.92$, $p=.062$, although may represent a trend for higher scores in FASM1 vs. FASM4 at this time-point. Follow-up analyses for the "FASM" x "Affect" interaction to investigate the simple main effect of "Affect" for each FASM item were conducted using two additional paired *t*-tests. Positive affect in FASM1 ($M = 2.09$, $SD = .63$) was found to be significantly higher than in FASM4 ($M = 1.71$, $SD = .83$), $t(42) = 3.33$, $p=.002$. However, the reverse was found for negative affect for which FASM4 ($M = 4.08$, $SD = .65$) was found to be significantly higher than FASM1 ($M = 3.80$, $SD = .87$) $t(42) = -1.16$, $p=.025$.

FASM1 vs. FASM5. There was a significant "FASM" x "Affect" interaction, $F(1,31) = 4.31$, $p= 0.046$ and follow-up analyses investigating the simple main effect of

"Affect" for each FASM were conducted using paired *t*-tests. Positive affect in FASM1 (M = 2.22, SD = .59) was not significantly different than in FASM5 (M = 2.30, SD = .12), $t(31) = -.688$, $p=.509$. There was however a significant difference in negative affect, $t(31) = 2.19$, $p=.037$, which was higher in FASM1 (M = 3.64, SD = .82) than in FASM5 (M = 3.19, SD = .15).

Second Aim

The secondary aim of the study was to sort individual responses into categorical variables associated with the FFM based on reported increase or decrease in positive and negative affect following NSSI. For each FASM, participants were sorted into four categories of reinforcement: ANR, APR, Both, and Other. "ANR" was assigned for cases with a decrease in negative affect and either no change in positive affect or a decrease in positive affect. "APR" was assigned for increases in positive affect with either no change in negative affect or an increase in negative affect. A decrease in negative affect and increase in positive affect was assigned to the category "Both". Any remaining combinations (e.g. no change in both positive and negative affect) were assigned to the "Other" category. This classification scheme is summarized in Table 8. It was hypothesized that a pattern of responding consistent with "ANR" would be observed for most instances of NSSI assessed by FAMS1 and that a pattern of responding consistent with "APR" would be observed for most instances of NSSI in FASMs 2 – 5. Moreover, instances of NSSI associated with affect changes not reflective of positive or negative reinforcement (i.e., instances in which the person reported no reduction in negative affect and no increase in positive affect) should be rare.

Table 8 Combination and Type of Affect Changes

Combination	Positive Affect	Negative Affect	Type
1	No Change	Decrease	ANR
2	Decrease	Decrease	ANR
3	Increase	No Change	APR
4	Increase	Increase	APR
5	Increase	Decrease	Both
6	No Change	No Change	Other
7	No Change	Increase	Other
8	Decrease	No Change	Other
9	Decrease	Increase	Other

The number of cases and respective percentages for the four categories are reported in Table 9. Separate chi-square analyses were performed to compare the frequency of reinforcement categories ("ANR", "APR", "Both", "Other") reported for each FASM assuming equal likelihood. For every FASM item, a significant chi-square value was reported, indicating the observed frequency distribution was statistically different than would be expected by chance. Inspection of the table indicates that, contrary to expectation, the "Both" category is always the most common across all FASM items, followed by either "APR" (FASMs 2-4) or "Other" (FASMs 1 and 5). "ANR" is consistently the most infrequent category for all FASMS.

Table 9. Comparison of Reinforcement Categories

Scale	ANR	APR	Both	Other	χ^2
FASM 1	4 (7.4%)	8 (14.8%)	31 (57.4%)	11 (20.4%)	χ^2 (3) =32.1, p < .001
FASM 2	5 (9.8%)	14 (27.5)	26 (51.0%)	6 (11.8%)	χ^2 (3) =22.2, p < .001
FASM 3	4(8.7%)	17 (37.0%)	20 (43.5%)	5 (10.9%)	χ^2 (3) =17.5, p < .001
FASM 4	12 (26.1%)	3 (6.5%)	20 (43.5%)	11 (23.9%)	χ^2 (3) =12.6, p < .01
FASM 5	2 (5.9%)	4 (11.8%)	22 (64.7%)	6 (17.6%)	χ^2 (3) =29.6, p < .001
Total	27 (11.7%)	46 (20.0%)	119 (51.5%)	39(16.9%)	N/A

Consistent with expectations more participants showed pattern consistent with "APR" than "ANR" for FASMs 2, 3, and 5. Contrary to our expectations, more participants showed affect pattern consistent with "APR" than "ANR" and FASM1. Also, contrary to expectations, more participants showed affect patterns consistent with "APR" than "ANR" for FASM4. Consistent with the prior ANOVA results, but contrary to expectations, the largest percentage of participants showed a pattern of combined reinforcement (APR+ANR; the "Both" category) for all five FASMS.

Individuals reporting instances of "ANR" or "APR" (n=37) for at least one FASM item were examined further to assess whether "ANR" or "APR" was a subtype reported consistently across FASM items. However, when the "Both" or "Other" categories are included, only 4 individuals reported "ANR" exclusively and only 1 individual reported "APR" exclusively for all endorsed FASM items. Within the sample the majority of individuals (n=61) report experiencing a combination of experiences, "APR", "ANR", "Both", or "Other", rather than describe reinforcement that is exclusively "ANR" (n=4) or "APR" (n=1).

Discussion

Although NSSI has only recently come to the attention of the research and clinical community, this behavior is associated with significant negative health consequences and its occurrence is reported to be fairly common even within community samples. It is therefore a serious and relatively frequent clinical behavior, highlighting the importance of understanding the functions and motivations related to NSSI potentially contributing to the behavior. The Four Factor Model (FFM) represents the prevailing conceptualization pertaining to the functions of NSSI. Before the FFM, NSSI was conceptualized as primarily serving social functions (e.g. cry for help or to garner attention). Introduction of the FFM represented a significant conceptual advancement with the inclusion of automatic (intrapersonal) functions. The FFM further categorizes these functions according to positive and negative reinforcement. There is significant evidence for automatic negative reinforcement (ANR) in the motivation of NSSI but there is not clear evidence supporting automatic positive reinforcement (APR). Increases in positive affect following NSSI have yet to be reported in the absence of reductions in negative affect, thereby allowing for the possibility the functional source of motivation is ANR.

Therefore, the present study aimed to evaluate the presence of the Four Factor Model's APR subtype in a college sample endorsing NSSI in an online survey. Examination of APR occurred in two ways. First, at the group level,question items that corresponded to APR and ANR within the FFM were compared for participants experiences of positive and negative affect before and after NSSI. It was hypothesized that ANR would be characterized by decreases in negative affect and little or no change in positive affect, whereas APR would be characterized by in increase in positive affect

and little or no change in negative affect. Second, at the level of the individual, experiences of affective change within the individual were examined and classified by reinforcement pattern (e.g. “APR”, “ANR”, “Other”, “Both”) so that individual cases of APR and ANR could be assessed for frequency.

In total, 296 consented to the study and, overall, responders were predominantly White (78.3%) and female (80.8%). Eighty-three individuals reported at least one occasion of NSSI which represents approximately 28% of participants – this is consistent with other college samples reporting 14-35% endorsement of NSSI (Gratz, 2001; Whitlock et al., 2008). Because the purpose of the current study was to examine affective experience related to reinforcement, which is more likely evident in cases of repeated behavior, analyses were limited to individuals reporting multiple occasions of NSSI (n=66). Compared to the Non-NSSI (n=225) sample, the NSSI sample was slightly younger, more likely to be female, and more diverse in their sexual orientation. This pattern is consistent with other college samples reporting higher rates among women and individuals endorsing a sexual orientation other than heterosexual (Whitlock et al., 2011).

Nearly half (44.0%) of individuals in the NSSI sample reported a low lifetime occurrence, endorsing “2-5 times”. Moreover, 77% reported no incidence of NSSI within the last year. The workgroup for DSM-V (Selby, Bender, Gordon, Nock, & Joiner, 2012) has proposed “NSSI Disorder,” for which diagnosis requires 5 or more instances of NSSI within the past year. Based on these criteria, only two individuals would be diagnosed with current NSSI Disorder so that responses from the current sample may not be reflective of current or clinically significant NSSI representing a limitation for the current study.

However, 21 (31.8%) of individuals reported to have engaged in NSSI more than 20 times. Fifteen individuals (22.7%) also reported engaging in NSSI within the past year. Furthermore, 5 (7.6%) individuals reported to have required medical attention or hospitalization because of NSSI. While the majority of individuals may not meet the proposed diagnostic criteria for NSSI Disorder, responses indicate that the sample includes individuals who have experienced serious or frequent NSSI at some point in their lifetime

The goal of the current study was to examine the APR subtype by assessing the affective experiences at the group level reported for question items representative of APR as outlined by the FFM. The researchers who proposed the FFM developed the model's automatic reinforcement constructs based on five of twenty-two items from the FASM questionnaire. The item consistently defined as ANR, in which the person endorses engaging in NSSI "To get rid of bad feeling?" is referred to in this study as FASM1 and this item is used for the assessment of ANR on the SITBI. The four other items referred to in this study as FASM2 – FASM5 have been reported, to varying extents, to reflect APR. Therefore, FASM1 was used as the standard for comparison of the other four FASM items to assess changes in positive and negative affect. If an item is representative of APR, the experience of positive and negative affect should significantly differ from that observed in ANR as characterized by FASM1.

The hypotheses associated with our first primary aim was that for each of the four FASM items associated with APR the pattern of positive and negative affect reported before and after NSSI would be significantly different from that associated with FASM1. Based upon the descriptions of ANR in the literature, we hypothesized that ANR NSSI

would be associated with a decrease in negative affect and relatively no change in positive affect. We therefore predicted that the magnitude of reduction in negative affect would be significantly greater than that of the increase in positive affect. Consistent with our hypothesis, there was a significant "Time" X "Affect" interaction such that individuals reported a significant reduction in negative affect pre-to-post NSSI. However, contrary to our expectations, FASM1 was also associated with a significant increase in positive affect subsequent to NSSI. Moreover, when magnitude of changes in positive and negative affect was compared, there was no statistically significant difference between them. Therefore, FASM1 – and by extension ANR – was characterized by significant reduction in negative affect and significant increases in positive affect, and these changes in affect were similar in magnitude.

Each FASM item associated with APR was then submitted for statistical comparison with FASM1 to determine potential differences in reported experience of positive and negative affect before and after NSSI. It was hypothesized that affect patterns would differ for ANR and APR, which would be indicated by an observed three-way interaction. In each of the four analyses, there was a significant "Time" X "Affect" interaction similar to the one observed for FASM1 alone, but contrary to expectation there were no significant three-way interactions. This pattern of findings indicates significant differential changes in positive and negative affect across time, but the pattern of changes observed for FASM1 was not different for any of the remaining FASM items. The present results suggest that the positive and negative affect before and after NSSI is not different for items used to identify ANR compared to those associated with APR.

A few additional significant main effects and interactions were observed that do not relate to the specific questions addressed in this study. The one possible exception was the "FASM" X "Affect" interaction observed for comparison between FASM1 and FASM4 (NSSI to punish onself). The overall experience of positive affect was significantly higher in FASM1 compared to FASM4 and the overall experience of negative affect was significantly lower in FASM1 compared to FASM4. This suggests NSSI that functions "to punish one's self" is possibly associated with greater overall distress (more negative affect plus less positive affect) than that associated with other functions of NSSI.

In the second primary aim, the current study examined the reported experience of positive and negative affect and their change following NSSI at the level of the individual. For all responses, across FASM items, individuals were categorized according to the affect changes associated with the automatic functions. Observed decreases in negative affect, with no increase in positive affect, were classified as "ANR" while observed increases in positive affect, with no decrease in negative affect, were classified as "APR". A decrease in negative affect with a combined increase in positive affect was classified as "Both" – as it represents experiences containing the primary affect change of both ANR and APR. Any remaining combination of affect change was characterized as "Other". The experiences pertaining to the "Both" category – increases in positive affect accompanied by decrease in negative affect – have been reported in NSSI literature (Claes et al., 2010; Muehlenkamp et al., 2009; Franklin et al., 2010; Claes, 2007) However the FFM involves distinct subtypes of automatic reinforcement and therefore these "mixed" cases should be infrequent. The other combinations of affect change (e.g.,

no change for positive and negative affect or increased negative affect paired with decreased positive affect) are not generally described in NSSI literature or encompassed by the FFM. Moreover, based on an extension of reinforcement theory to include a symmetrical consideration of punishment (e.g., an increase in negative with no countervailing increase positive affect or a decrease in positive affect with no countervailing decrease in negative affect, which would correspond to positive and negative punishment respectively), the number of such "Other" cases should be very limited.

We had hypothesized that individuals' experiences would mostly be categorized as consistent with one of the two automatic subtypes described by the FFM. Because ANR is the reason most frequently reported for NSSI (Nock & Prinstein, 2004; Klonsky 2007; Najmi, Wegner, & Nock, 2007; Nock & Cha, 2009), we predicted the "ANR" category to have the highest rates, followed by the rates of the "APR" category, with comparatively fewer rates for the "Both" and "Other" category. These predictions proved vastly inaccurate. Overall, "ANR" was the *least* frequent category described, and this was true for each individual FASM (including FASM1 – the question used to define ANR within the FFM).The "APR" category was reported as the second most frequent experience for affect, which was consistent with our predication. This category describes increases in positive affect with no reduction in negative affect, providing some of the strongest evidence for individual cases of APR. However, this finding is overshadowed by the fact that the majority of NSSI cases described (51.5%) were classified by the "Both" category – experiencing both increased positive affect and reduction in negative affect. Furthermore, 16.9% of cases were categorized as "Other," encompassing

experiences inconsistent with either FFM subtype and considered uncharacteristic of NSSI. Therefore, the current study found reported patterns of affect in NSSI were more varied than previously reported and the patterns associated with the FFM's two automatic subtypes did not correspond appropriately to the FASM items or serve to distinguish these items more generally.

Although the FASM items did not correspond with the "ANR" or "APR" categories, it was possible that these subtypes existed for individuals regardless of reported reason for NSSI. The 37 individuals endorsing at least one case of "ANR" or "APR" were examined further to assess whether this was reported consistently across FASM items. However only 5 individuals reported exclusive "ANR" (n=4) or "APR" (n=1). Therefore, the majority of individuals do not report a singular subtype for the different reasons endorsed for NSSI. Rather, they reported a combination of experiences – "APR", "ANR", "Both", or "Other" for different cases or instances of NSSI.

There are several limitations to the current study. As mentioned earlier, our sample was derived from an undergraduate population and the majority of participants reported a history of NSSI but not current NSSI of clinical significance. This presents uncertainty about whether our findings translate to a NSSI clinical sample. Moreover, many of the participants in the current study had not self-injured in a year or more's time questioning the accuracy of recall for the specific affective experiences before and after instances of NSSI. Retrospective ratings in general represent a limitation of the study, as studies using real time analyses provides more compelling evidence for functional analysis.

In summary, the current study's examination of automatic functions in NSSI found evidence for cases of APR – a small number of individuals described cases of NSSI for which positive affect increases without a concomitant decrease in negative affect. This represents perhaps the strongest empirical evidence to date for the existence of this type of NSSI. However, the current study resulted in surprisingly few cases of NSSI that corresponded as "pure" APR or ANR. The majority of cases reflected "both" APR and ANR processes and a substantial percentage of cases reflected a variety of unexpected affect patterns not relating to either FFM subtype. These results indicate that individual affective experiences are more varied than those currently encompassed by the FFM. However, NSSI appears to be primarily associated with *both* the reduction of negative affect and the increase of positive affect. This suggests that a nosology based on trying to differentiate classes of reinforcement may not represent the most useful way of assessing or distinguishing between cases of NSSI. In fact, some behavior analysts have argued for the elimination of the distinction between positive and negative reinforcement citing the lack of behavioral and physiological evidence indicating distinctly different processes (Baron & Galizio, 2005). Therefore, NSSI performed for reduction in negative affect may not be different than NSSI performed to experience feelings of relief or calmness. For clinical and research purposes, it may be more important to examine the contextual variables proceeding NSSI – such as feeling "unalive" or a desire for "self-punishment" in comparison to other high negative affect states – rather than focusing on the precise mechanism of reinforcement.

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Appendix A

Demographic Information

Demographic Information

What is your age?

What is your year in school?

- Freshman
- Sophomore
- Junior
- Senior
- Senior Plus (More than 4 years)

What is your gender?

- Male
- Female
- Transgender

What is your sexual orientation?

- Attracted to the ***opposite*** sex
- Attracted to the ***same*** sex
- Attracted to ***both*** sexes

Do you consider yourself to be Hispanic or Latino/a?

- Hispanic or Latino/a
- ***Not*** Hispanic or Latino/a

Which racial group best describes you? Please check all that apply.

- American Indian or Alaska Native
- Asian
- Black or African-American
- Native Hawaiian or Pacific Islander
- White or Caucasian
- Other (specify)
- More than one race (specify)

Are you currently taking medication for a psychiatric condition (i.e. antidepressant medication)?

- Yes
- No

Appendix B

Self Injury Assessment

The following questions asks about self-harm behaviors that are ***intentional*** (i.e., on purpose) and ***without suicidal intent*** (i.e., you were **not** trying to kill yourself).

Have you ever ***intentionally*** (i.e., on purpose) cut your wrists, arms, or other areas of your body (without intending to kill yourself)?

- Yes
- No

The following questions asks about self-harm behaviors that are ***intentional*** (i.e., on purpose) and ***without suicidal intent*** (i.e., you were **not** trying to kill yourself).

Have you ever ***intentionally*** (i.e., on purpose) burned yourself with a cigarette, lighter, or match?

- Yes
- No

Appendix C

NSSI Follow-Up Questions

1) How old were you when you first harmed yourself by (cutting/burning)?

2) In the last 12 months, how many times have you done this?

- Less than 5 times
- 5 times or more

3) How many times have you done this in your lifetime?

- Once
- 2-5 times
- 5-20 times
- 20-50 times
- More than 50

4) When was the most recent time you did this?

- Within the past week
- Within the past month
- Within the past 6 months
- Within the past 12 months
- Within the past 1-2 years
- Not in over 2 years

5) Has this behavior ever resulted in hospitalization or injury severe enough to require medical attention

- Yes
- No

6) Do you experience shame or guilt after self-harming?

- Yes
- No

    a. Is this shame or guilt immediate (within seconds of self-harming) or delayed (minutes or hours after self-harming)?

        - Immediate
        - Delayed
        - I don't know

7) Where on your body do your harm yourself by cutting or burning?

- ☐ Arms
- ☐ Legs
- ☐ Chest
- ☐ Stomach
- ☐ Thighs
- ☐ Face
- ☐ Genitals
- ☐ Other (specify) _____

8) Do you experience an "urge" to cut

- ○ Yes
- ○ No
- ○ Sometimes
- ○ Unsure

9) On average, how long after you first think about or feel like self-harming before you actually do self-harm?

- ○ 0 seconds (immediately)
- ○ 1-60 seconds
- ○ 1-2 minutes
- ○ 2-15 minutes
- ○ 15-60 minutes
- ○ less than one day
- ○ 1-2 days
- ○ More than 2 days
- ○ I don't know

Appendix D

FASM Questions

Below are some of the reported reasons for self-harming (cutting or burning yourself). Please read each reason carefully and select how often this is a reason for your self-harm.

	Never	Rarely	Sometimes	Often
1) As a way to get rid of bad feelings?	○	○	○	○
2) Because you were feeling numb or empty?	○	○	○	○
3) To feel something, even if it was pain?	○	○	○	○
4) To punish yourself?	○	○	○	○
5) To feel relaxed?	○	○	○	○
6) To communicate with someone else or to get attention?	○	○	○	○
7) To get out of doing something or to get away from others?	○	○	○	○

Appendix E

Evaluative Space Grid

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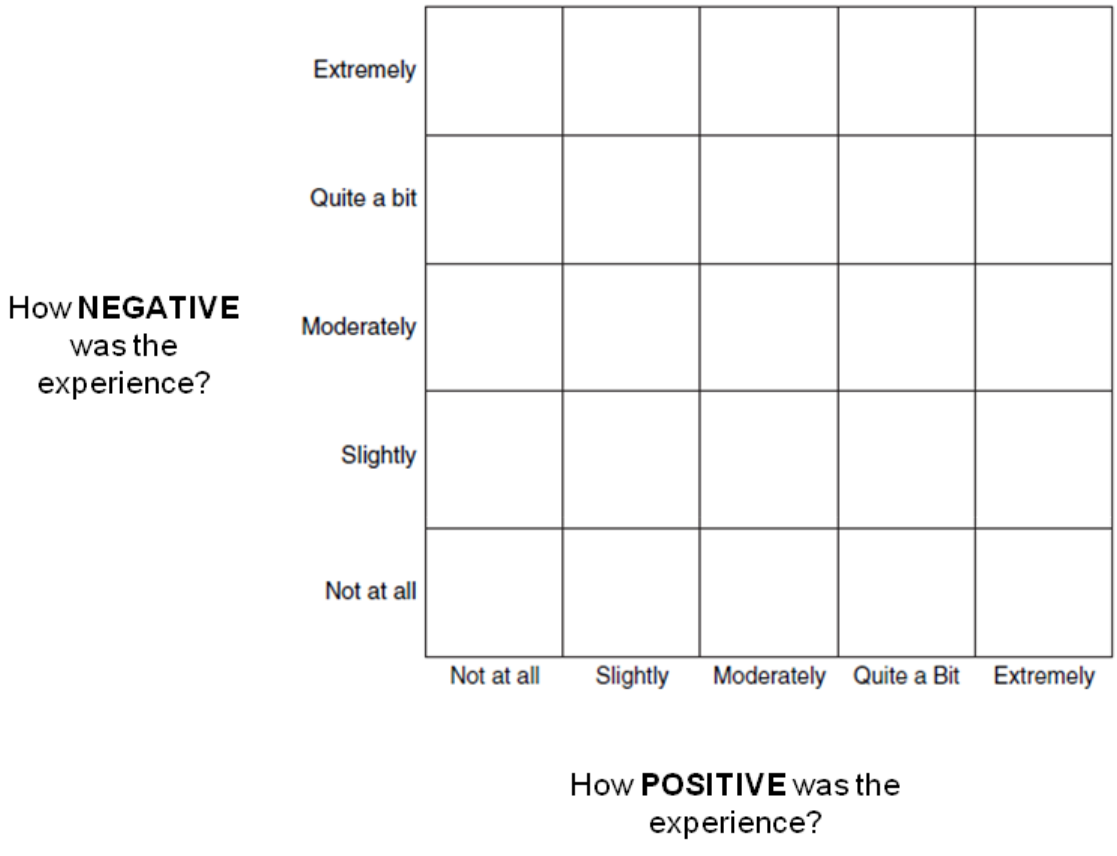
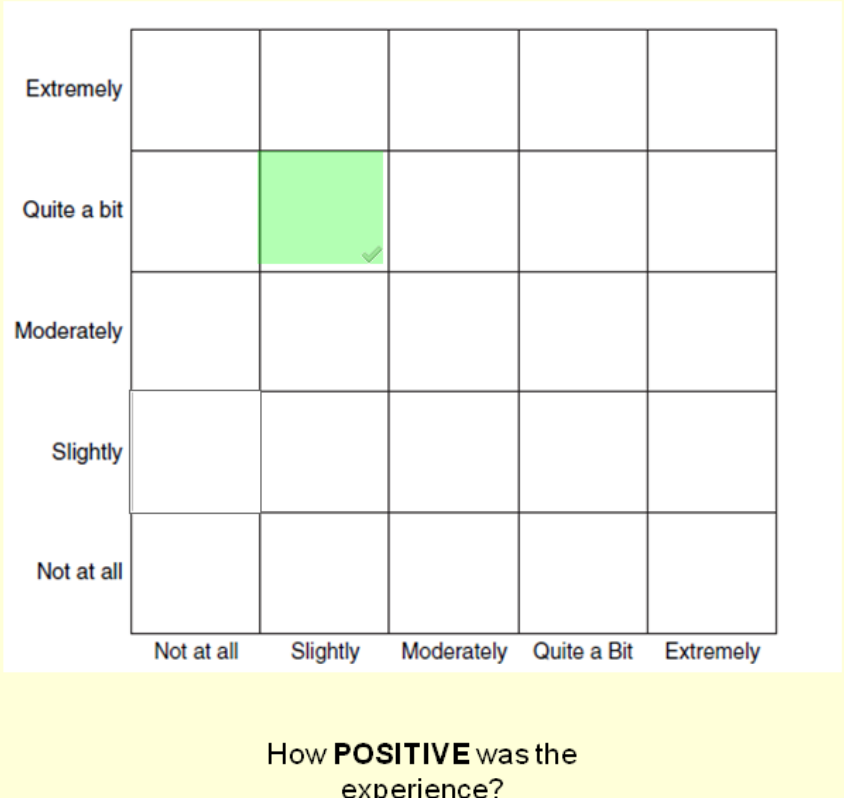
One way to describe the experience of thoughts, emotions and physical sensations is in terms of **how *positive* AND how *negative* the experience** The following grid asks you two questions:

1) Along the **horizontal axis**, it asks how **POSITIVE** you feel about the experience from **"not at all"** at the left to **"extremely"** at the right.

2) Along the **vertical axis**, it asks how **NEGATIVE** you feel from **"not at all"** on the bottom to **"extremely"** on top.



Think of the EMOTIONS you were experiencing *immediately before* hurting yourself. How ***positive and negative*** would you rate the experience of these emotions?



Appendix F

End of Survey Debriefing Form

Debriefing Sheet

What is self injury?

Self injury is defined by the deliberate harm to one's own body or bodily tissues without the intention of suicide. It is estimated that approximately 4% of the general population engages in self injury. Furthermore, recent studies suggests that as many as 17% of college students report having engaged in these behaviors at least once in their lives.

Your participation in the study will hopefully help us to understand the experiences of those with self-injury. Thank you for completing the survey.

Where can I get help?

S.A.F.E. (Self Abuse Finally Ends) Alternatives
1-800-DON'T CUT or (1-800-366-8288)
www.selfinjury.com

National Suicide Prevention Lifeline
1-800-273-TALK or (1-800-273-8255)
www.suicidepreventionlifeline.org