



Published in final edited form as:

*Appl Prev Psychol.* 2008 ; 12(4): 159–168. doi:10.1016/j.appsy.2008.05.002.

## Actions speak louder than words: An elaborated theoretical model of the social functions of self-injury and other harmful behaviors

Matthew K. Nock  
Harvard University

### Abstract

The question of why some people do things that are intentionally harmful to themselves continues to puzzle scientists, clinicians, and the public. Prior studies have demonstrated that one fairly extreme, direct form of self-harm, non-suicidal self-injury (NSSI), is maintained by both automatic (i.e., intrapersonal) as well as social (i.e., interpersonal) reinforcement. However, the majority of theoretical and empirical papers on this topic focus almost exclusively on the automatic functions. The purpose of this paper is to provide a more comprehensive analysis of the social functions of NSSI. Evidence is presented supporting the notion that NSSI is maintained by social reinforcement in at least a substantial minority of instances. Moreover, an elaborated theoretical model of the social functions of NSSI is outlined that proposes that this behavior represents a high intensity social signal used when less intense communication strategies fail (e.g., speaking, yelling, crying). The model further proposes that NSSI can serve not only as a signal of distress that is reinforced primarily by the caregiving behavior it elicits from others, but that it also can serve as a signal of strength and fitness that is reinforced by warding off potential threats (e.g., peer victimization), and in some cases can strengthen affiliation with others. Support for this theoretical model is drawn from diverse literatures including psychology, evolutionary biology, and cultural anthropology. The paper concludes with specific recommendations for empirical tests of the proposed model of the social functions of NSSI, as well as other harmful behaviors such as alcohol and drug use.

### Keywords

Self-injury; self-harm; self-mutilation; suicide; evolution; animal signals; idioms of distress

---

*I have always thought the actions of men the best interpreters of their thoughts.*

~John Locke

*As I grow older I pay less attention to what men say. I just watch what they do.*

~Andrew Carnegie

*Talk doesn't cook rice.* ~Chinese Proverb

Humans have a faculty of language that is more sophisticated than that of all other animals (Hauser, Chomsky, & Fitch, 2002; Pinker, 2000). However, when language fails to elicit a desired response people often resort (or “return” from a phylogenetic perspective) to the use of physical behavior as a more powerful or forceful means of communication or influence. For

---

Correspondence to: Matthew K. Nock, Ph.D., Department of Psychology, Harvard University, William James Hall, 1280, 33 Kirkland Street, Cambridge, MA 02138, Tel: (617) 496-4484, Fax: (617) 496-9462, [nock@wjh.harvard.edu](mailto:nock@wjh.harvard.edu).

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

instance, on a societal scale, when diplomacy between nations fails to produce a desired outcome, the result is often an escalation to the use of physical force by one or all sides in an effort to obtain the desired effect. This pattern of escalation from verbal to physical means also is seen at an individual level in instances where failures to respond to verbal communications in the desired way lead to an escalation to physical intervention in the form of say, time out, physical restraints, or in extreme cases striking, beating, or killing the other individual. Of course, this process also can occur in a positive direction, such as when words fail to adequately express one's affection for another and so there is an escalation to behaviors such as hugging or kissing.

The escalation to the use of physical behavior toward others in order to communicate with or influence others is ubiquitous and so perhaps easily understood by most people. However, in some instances people use physical behavior to harm themselves, which is often much more difficult to understand. In this paper, I further elaborate on our theoretical model on the social functions of self-injurious behaviors (Nock & Prinstein, 2004) by describing how and why people may escalate to the use of self-injurious behaviors as a means of influencing the behavior of others when less intense forms of communication fail. This rarely occurs at a societal level in an attempt to resolve cross-national conflicts or establish social order (except perhaps in instances of hunger strikes or self-sacrifice) (e.g., Brockman, 1999; Durkheim, 1897; Goldney & Schioldann, 2004), but more often happens on an individual level in an attempt to provide a signal of distress intended to elicit caregiving behavior in others, to provide a signal of strength intended to ward off potential aggressors, and in some cases to increase affiliation with others in a valued social group. In marshaling support for this argument I draw on prior theoretical and empirical work from diverse fields including clinical, social, and cognitive psychology; evolutionary biology; and cultural anthropology. I provide specific examples to help illustrate the key components of the proposed theoretical model, and I conclude with recommendations for future research in this important area.

## Terminology

### What is “self-injurious behavior?”

The term “self-injurious behavior” refers broadly to any behavior in which a person directly and deliberately inflicts injury upon the self (i.e., this includes both suicidal and non-suicidal self-injury) (Nock, Wedig, Janis, & Deliberto, 2008). The more specific term “*non-suicidal self-injury*” (NSSI) refers to direct and deliberate destruction of body tissue in the absence of any intent to die, such as in the case of skin cutting (Nock & Favazza, in press). In contrast, a “*suicide attempt*” refers to self-injurious behavior in which there is any intent to die (i.e., at a non-zero level), such as in the case of shooting oneself or taking an overdose of medication. Finally, the term “*suicide gesture*” refers to an act in which a person does something to lead others to believe one has made or is going to make a suicide attempt when the person really had no intention of doing so. Such behaviors are surprisingly common, occurring at a prevalence only slightly below that of suicide attempts (Nock & Kessler, 2006). This can be a form of NSSI if any skin tissue is damaged as a result (such as skin cutting in front of someone else and stating that there is intent to die), or the suicide gesture may lack actual self-injurious behavior altogether (such as leaving out an empty pill bottle to appear as if one has consumed all of the pills as a suicide attempt when one actually has not done so).

It is notable that some clinicians and authors dislike the term “suicide gesture” because they contend that it implies that the individual intends to “manipulate” others (see Silverman, Berman, Sanddal, O'Carroll P, & Joiner, 2007). However, objectively speaking the term “gesture” refers simply to the use of movement to express thoughts or emotions, which accurately conveys the nature of this behavior. Dislike of this term may be a historical artifact of the original use of the term “suicide gesture” in early publications describing instances in

which soldiers would self-inflict gunshot wounds during wartime in order to be relieved of duty (Fisch, 1954; Tucker & Gorman, 1967). Some such reports described those making a suicide gesture in unfavorable terms. For instance, a study by Tucker and Gorman's began:

“The person who makes a suicide gesture in the military can usually be typified as ‘the man nobody likes.’ Even psychiatrists lose some of their usual equanimity when describing this group of patients. A review of the literature reveals such descriptive terms as ‘transparent insincerity,’ ‘manipulative,’ and ‘emotional blackmail.’” (p. 854).

My use of the term suicide gesture in this paper is not intended to carry such a connotation. It is notable, though, that the nature of these statements provides a sense of the feelings often evoked in others by those perceived to engage in NSSI for social reasons.

### **What is a “function?”**

The term “function” is used in different ways in the psychological literature and so a note of clarity is in order. This is not merely an academic issue, but one that can lead to confusion across and among researchers and clinicians, and when explaining scientific findings to clients and the public. There is a long and rich literature on learning theory and behavior therapy that proposes a functional approach to understanding, predicting, and treating behavior. From this perspective, the study of the function of a behavior involves an analysis of the events that cause or determine a given behavior by examining the antecedents and consequences of a behavior. It is from this tradition that *functional analyses* or *behavioral analyses*, which are used in several different forms of behavioral assessment and treatment, were derived. Separate from this tradition, some recent research on psychopathology and NSSI has used the term “function” in the colloquial sense to refer simply to the potential reason for or purpose of a behavior, without regard for specific antecedent or consequent events. For instance, the suggestion that NSSI serves the function of “controlling sexuality” or “boundary definition” lacks specificity and provides little information about the factors that might be controlling the behavior. In this paper I use the term “function” consistent with earlier work on learning theory to refer to the antecedent and consequent events proposed to cause or maintain a given behavior.

### **Not all instances of self-injury serve a social function...but some do**

Before going any further it is important to clarify what I am not proposing. I am *not* suggesting that all non-lethal self-injurious behavior is performed for the purpose of influencing others. This is a misconception held by some clinicians and members of the public. Indeed, it is not at all uncommon to hear family members or clinicians responding to an episode of skin cutting in an adolescent by stating definitively that the adolescent was clearly just seeking attention. Several lines of research suggest that in many cases NSSI does not serve a social function. For instance, most episodes of NSSI are performed in private (Nock & Prinstein, 2008) and many self-injurers never seek treatment (Deliberto & Nock, in press), arguing against the use of NSSI as a means of seeking caretaking from others. Moreover, careful experimental studies of the functions of NSSI demonstrate that although NSSI serves a social function in many instances, it often is maintained by automatic (i.e., intrapersonal) contingencies (e.g., Iwata et al., 1994). In addition, there is mounting physiological evidence that the automatic functions served by NSSI are characterized by a resulting decrease in physiological arousal (Haines, Williams, Brain, & Wilson, 1995), and perhaps via the release of endogenous opioids (Sher & Stanley, in press). Finally, NSSI often is observed among non-human animals raised in isolation (Dellinger-Ness & Handler, 2006; Kraemer, Schmidt, & Ebert, 1997) and thus unlikely influenced by social determinants.

Another important point to bear in mind is that just because an episode of NSSI influences the behavior of others (e.g., elicits caregiving), this does not mean that such a consequence

influenced the person's decision to engage in NSSI. From an operant conditioning perspective, a functional relation is demonstrated only by showing that the probability of a behavior increases following administration of a given consequence, not just by showing that the consequence has been presented. Consider an example: if a child swears and is subsequently slapped by his mother, one cannot accurately infer that the child swore *because* he wanted to be slapped by his mother. In such a case the consequence is unlikely to have increased the probability of the behavior. As the popular children's story has told us, the rooster's crow does not bring up the sun (e.g., Peet, 1990).

While some people have perhaps over-estimated the role of the social functions of NSSI, many researchers in this area have largely downplayed the social functions of this behavior. Recent reviews of NSSI have focused largely (Klonsky, 2007; Muehlenkamp, 2005; Walsh, 2006) or completely (Chapman, Gratz, & Brown, 2006) on the affect regulating properties of NSSI, providing limited consideration of social functions. This focus is understandable given that: (a) the majority of adolescents and adults who engage in NSSI report doing so for the purpose of affect regulation, (b) the mechanisms through which NSSI may regulate one's affect are not well understood and so such work is sorely needed, and (c) there is perhaps a desire to not reinforce the popular conception that people who engage in NSSI only do so for the purposes of attention seeking or manipulation.

However, regarding the first point above, it is important to bear in mind that virtually every study that has included an examination of the social functions of NSSI has found that a substantial minority of self-injurers report using NSSI to influence others (e.g., Brown, Comtois, & Linehan, 2002; Nock & Prinstein, 2004, 2005; Rodham, Hawton, & Evans, 2004). Moreover, although most such work has found that self-injurers endorse automatic functions more strongly than social functions, the fact that this research is based almost entirely on self-report data suggests that results are likely to be biased in this direction as it is perhaps more acceptable or socially desirable to say that one uses NSSI for affect regulation than to influence the behavior of others. Slightly more objective, prospective data also have supported the presence of social functions of NSSI. For instance, Hilt and colleagues recently showed that adolescents engaging in NSSI reported increases in the quality of their relationships with their fathers over time relative to non-injurers, who showed no such increase (Hilt, Nock, Lloyd-Richardson, & Prinstein, in press).

Regarding work on the mechanisms through which NSSI arises, one must consider the possibility that some of the research that seems to support the automatic functions of NSSI could also plausibly support a social function (Hagen, Watson, & Hammerstein, 2008). For instance, recent research has demonstrated that self-injurers experience greater physiological reactivity in response to stress and show a poorer ability to tolerate distress (e.g., Nock & Mendes, 2008; Nock, Wedig, Holmberg, & Hooley, in press). This seems to support the automatic functions of NSSI; however, it is possible that the high arousal and poor distress tolerance revealed in such studies represents antecedent conditions that lead some people to use NSSI to marshal social support from those around them in order to help with their own affect regulation.

Finally, although research demonstrating that NSSI may serve a social function is not likely to be very popular among most people engaging in the behavior, it is important that clinical science seek to reveal the true nature of relations in the world regardless of popular opinion. Moreover, if NSSI is influenced by its effect on others, research that elucidates the processes involved may help to better predict and prevent such behaviors in the future.

## Behavior as communication

As mentioned above, theoretical models of NSSI suggest that this behavior is often used to communicate with, or influence the behavior of, others (e.g., Nock & Prinstein, 2004). This raises the important question: Why would it be necessary to use behavior as a means of communication rather than language? Simply stated, behavior carries greater social and scientific currency than does words. In everyday life people are more concerned with what others *do* than with what they *say* (e.g., “You say you are for the environment, but do you recycle?” ... “You said you would have that book chapter completed last week, but where is it?” ... “You said you were going to quit smoking, but that's your fourth cigarette today!”). Similarly, in scientific endeavors, social and behavioral scientists often ask people why they do what they do and what they think about different topics; however, *behavior* is held up as the more important and more accurate measure of what a person *really* thinks and feels (e.g., Baumeister, Vohs, & Funder, 2007). In short, actions speak louder than words.

There are of course good reasons that behavior is considered more important than words. First, behavior is more valuable to both the individual and to society, as succinctly and cogently noted in the Chinese Proverb presented at the beginning of this paper. Second, behavior is readily observed and so in a concrete sense is perhaps a more reliable and valid measure of reality. For instance, I could tell you that I am in peak physical condition as evidenced by the fact that I can lift 500 pounds over my head. However, saying that does not make it so. A more reliable, valid, and “honest” measurement of my physical condition would be provided if you actually observed me trying to lift 500 pounds over my head. The concept of behavior as “honest” communication is one that has captured the attention of evolutionary biologists for decades. Some of the central principles of animal communication patterns that have been revealed by this work can prove quite useful in understanding psychopathology in general (see Gilbert, 2006; Hagen, 2003; Hauser, 1996; Maynard Smith & Harper, 2003; Nesse, 2000; Price, Gardner, & Erickson, 2004; Searcy & Nowicki, 2005; Watson & Andrews, 2002), and in explaining why some people would use NSSI as a means of social communication (see Hagen et al., 2008). In the following section, I review some basic concepts in animal signaling and extend earlier work in this area by describing how research on animal signaling can help us to better understand the use of NSSI by humans.

## Animal signaling

Non-human animals do not have the capacity for language that humans do and so they rely largely on the use of other physical or behavioral signals for social communication (Hauser et al., 2002). A *signal* refers broadly to an act that influences the behavior of another animal. Signals can be tactile, visual, auditory, olfactory, or gustatory (see Hauser, 1996; Maynard Smith & Harper, 2003). Given the focus of our discussion is on NSSI, let us concentrate primarily on examples in which the signaler displays behavior that is visually observable by others in the service of social communication.

Scientists studying animal signals aim to understand why most animal signals are reliable or “honest” in their use of signals, meaning that they accurately communicate the intended information and rarely lie. Of course, sometimes signals are not honest, as in the case of mimicry or bluffing (e.g., Cote & Cheney, 2005), which often is done between, rather than within, species. Two of the most well-supported explanations for the use of honest signaling derive from (1) the concept of indices of quality, and (2) the handicap principle. *Indices of quality* are performance-based signals whose honesty is guaranteed because the quality being signaled is causally related to characteristics of the signaler (Enquist, 1985; Maynard Smith & Harper, 2003). One example of such an index of quality is the scratches that tigers make on trees to mark their territory, which are made as high on the tree as possible, thus providing an

honest signal or index of the size of the tiger (Maynard Smith & Harper, 1995; Thapar, 1986). Only big tigers can make high marks. They cannot be faked by small tigers.

In contrast, *handicaps* are choice-based signals whose honesty is inferred by the fact that they are so costly to produce relative to the signaler's current condition that it would not pay off to produce them unless they were honest (Zahavi, 1975; Zahavi & Zahavi, 1997). A classic example of a handicap is "stotting" (i.e., jumping highly with rigid legs) among gazelles when being pursued by a predator (e.g., a cheetah). Such a behavior is believed to be a signal to the predator that s/he should abandon the hunt because the gazelle is of superior fitness—so much so that the gazelle can afford to expend the extra energy and loss of speed required for such jumps. Such behavior is believed to be a reliable signal because it is too costly to display otherwise, and this behavior actually decreases the probability that predators will continue to pursue the gazelle (Caro, 1986). Other examples abound in nature in which animals ranging from insects, to frogs, to deer use these two types of signals to communicate with group members, potential mates, and possible competitors (Hauser, 1996; Maynard Smith & Harper, 2003).

Among humans, there are myriad examples of the use of indices of quality to communicate information to others. For instance, owning a mansion requires a relatively high level of wealth or financial fitness that simply cannot be faked (i.e., poor people do not live in mansions). Less common, but more relevant to the current discussion, is the use of handicapping by humans. The handicapping principle may help explain why humans engage in NSSI (see also Hagen et al., 2008). That is, they may do so as a display of a costly, and thus honest, communication signal. If not for the costly nature of NSSI, both in terms of the physical harm as well as feelings of shame and guilt often reported in response to NSSI, the message accompanying such behavior is less likely to be taken seriously or viewed as honest (i.e., the person who cuts is likely to be viewed as more distressed than the person who cries).

As a brief aside, from this perspective a suicide gesture is essentially a dishonest signal, or one in which the intensity of the signal does not match the intensity of the characteristic being signaled and thus could be considered a "bluff" in some sense (Searcy & Nowicki, 2005). To be sure, a person who makes a suicide gesture is undoubtedly experiencing some level of distress. However, because the person has conveyed information that does not accurately reflect the true state of affairs (remembering that by definition a suicide gesture is intended to give the false impression that one intends to die as a result of their behavior), this behavior often is met with negative reactions from others (cf. Tibbetts & Dale, 2004). In addition, suicide gestures also may elicit a negative response because they represent a lack of cooperation with the larger group. Throughout nature, groups with members that cooperate are more successful than groups with defectors (Nowak, 2006), and so those who engage in "dishonest" behaviors that limit the potential contribution to the group (e.g., as in the case of soldiers shooting themselves in the foot during wartime) or use group resources (e.g., as in those admitted to hospitals following a suicide gesture), may not be viewed as a valued group member (e.g., Huband & Tantam, 2000; Tucker & Gorman, 1967).

There are some interesting parallels between animal signaling and engagement in NSSI, but also some important differences. In terms of similarities, it is fairly well-documented that engagement in NSSI is significantly associated with early environmental stressors, such as the experience of abuse during childhood and adolescence (e.g., Glassman, Weierich, Hooley, Deliberto, & Nock, 2007; Weierich & Nock, 2008; Yates, 2004). Recent experimental evidence suggests that some animal communications may represent honest signals of earlier developmental stress (e.g., Buchanan, Spencer, Goldsmith, & Catchpole, 2003; Spencer, Buchanan, Goldsmith, & Catchpole, 2003), presenting an interesting similarity to engagement in NSSI.

Regarding differences, although many animal signals are used throughout the lifetime (even if only seasonal in the instance of mating calls), NSSI appears to typically occur during a relatively brief developmental period. There are some instances in which NSSI may persist for decades, but the typical course is likely much shorter, lasting only a few episodes or months/years (although long-term data on the course of NSSI are lacking). Moving beyond the animal signaling, humans have other unique methods of communicating in which actions often speak louder than words. This is well articulated in the literature on “idioms of distress.”

### Idioms of distress

Although humans are unique in their capacity for language and their ability to verbally communicate an infinite array of subtle, nuanced messages (e.g., Hauser et al., 2002; Pinker, 2000; Pinker, 2007), they often use actions in place of words. For instance, people regularly use facial expressions, body posture, and hand gestures to communicate with others. In most cases such behaviors are used to supplement language; however, in some instances a person's physical or somatic behaviors may be used as the primary means of communication. The term *idioms of distress* is one used primarily in the anthropologic literature to refer to physical or somatic modes of expressing distress that often occur when verbal modes of expression are inadequate or unable to convey the information (Kleinman, 1982; Nichter, 1981).

The anthropologic literature contains numerous reports of culture-specific idioms of distress. For instance, South Kanarese (India) Havik Brahim women reportedly are given limited opportunities to verbally express any experienced distress. Such women live at home with limited social contact and function largely to serve their husband and family. As a result, rather than verbally expressing unhappiness or distress when it may be present, these women often report vague somatic complaints to their doctor such as body ache, weakness, heat, or dizziness—symptoms that are more acceptable to report and thus more likely to be responded to than symptoms of unhappiness or psychological distress (Nichter, 1981). Over the years, research has revealed similar instances across numerous cultures, and both sexes, in which psychological and social distress are described primarily in physical terms, such as in “nervios” in Latin cultures (Guarnaccia & Farias, 1988; Hinton, Chong, Pollack, Barlow, & McNally, 2007), “nevra” in Greece (Clark, 1989), and “fañ” in Taiwan (Tzeng & Lipson, 2007). Interestingly, prior work suggests that people somaticize (i.e., report physical symptoms) at a rate proportional to their level of social or psychological distress (Parsons & Wakeley, 1991). Thus, as distress increases so might the reporting or actual manifestation of physical signs and symptoms. Such a pattern could lead to NSSI as an extreme physical manifestation of social or psychological distress—a point discussed in more detail in the following section.

In Western psychiatry and psychology, several disorders outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (APA, 1994) could be conceptualized from an ‘idioms of distress’ perspective. The most obvious example is the case of the somatoform disorders. Somatoform disorders are those in which physical symptoms are reported—suggesting the presence of a non-psychiatric medical condition—but are not explained by any such medical condition, substance use, or by any other psychiatric condition. Examples include complaints of physical pain, gastrointestinal symptoms, or pseudoneurological symptoms. Somatoform disorders and the idioms of distress described above may represent instances in which physical symptoms are reported as an alternative means of communicating experienced psychological or social distress.

There are multiple mechanisms that might explain how idioms of distress and somatoform disorders develop and are maintained. It is possible that the presence and reporting of physical symptoms themselves provides the person with desired attention or resources. It also is possible that the reporting of such problems allows one to make initial contact with a healer or health professional, and that such contact makes it easier to raise concerns about social or

psychological distress. In contrast, such symptoms may be reported in an effort to distract from experienced psychological or social distress. In the next section I describe several different processes through which one may come to use pathological behavior as a means of communicating with others, using NSSI as an example of perhaps the most extreme physical signals or idiom of distress that humans may display.

## Behavior provides a more intense social signal than language

Among humans, spoken language is most often the easiest and least costly method of communication. That is, the communication of an idea typically takes significantly less time and effort using language (e.g., “I am thirsty”) than using writing or physical gestures. In most instances, language is sufficient to communicate one's message and hopefully to obtain the desired response. However, failures in communication or in obtaining a desired response can occur for several different reasons: a problem with the signaler (e.g., deficits in the ability to generate a clear message), a problem with the signal (e.g., accompaniment by too much noise), or a problem with the receiver (e.g., poor signal detection, or simply choosing to ignore the signal).

In a given interaction, the signaler may be unaware of why a message was not responded to in a desired manner. For instance, if I asked you for glass of water (“Would you please bring me a glass of water?”) and you did not bring me said glass of water, I may wonder if the problem was with me (Did I actually ask you the question?), the message (Did I speak loudly enough?), or with you (Are you ignoring me?). If the signaler perceives a failure in communication due to a weak signal or lack of receptivity, which are perhaps the most common problems, the signaler may then switch to a stronger or more intense signal (Bring me a glass of water, NOW!!!). If unsuccessful, the signaler may escalate to the use of a more intense mode or channel of communication, in this case switching from verbal to physical means (e.g., standing in front of you and pointing to the glass of water). If unsuccessful still, the signaler could continue to increase the intensity of the signal within the new mode, and so on, until the desired response is obtained. This strategy of *escalation* is one in which there is an increase in the chances of “winning” (i.e., greater likelihood of the desired outcome), but also an increase in the “costs” to the signaler (i.e., higher intensity behaviors require greater resources and risk to the signaler) (Price et al., 2004).

Embedded in this pattern of escalation in humans is the idea that when higher order processes such as language fail, people often resort to more primitive processes, such as the use of physical force as described in the introduction of this paper. Such a process may help explain how some pathological behaviors develop, including NSSI in many cases. An example of the process through which this may occur is presented in Figure 1. An individual may first attempt to communicate with others using language, and if unsuccessful may then increase the intensity of the communication to yelling. If still unsuccessful in a given interaction, or repeatedly across interactions, the person may then increase the intensity and mode of communication to, for example, crying behavior. If still unsuccessful in eliciting the desired response, the person may escalate further to mild and ultimately more severe forms of direct, destruction of body tissue. The increases in intensity and mode come with increased cost in the form of higher response effort (i.e., they require more resources to perform) and greater threat of negative consequences (i.e., greater physical and psychological harm).

Findings from several recent studies provide initial support for this model in the occurrence of NSSI. For example, although adolescents who engage in NSSI do not differ from those who do not on general intelligence, problem-solving, or design fluency, they have significantly poorer verbal fluency than non-injurers (i.e., a poorer ability for word generation) (Photos & Nock, 2006) and they report being less mindful of their emotions (Lundh, Karim, & Quilisch,



2007) and having greater difficulty expressing emotions (Gratz, 2006). Moreover, adolescent self-injurers show deficits in their ability for social problem solving relative to non-injurers, with self-injurers particularly more likely to select maladaptive and potentially harmful social responses (Nock & Mendes, 2008).

In addition to these problems that may interfere with effectively generating appropriate and effective verbal communication, failures in communication also may occur due to poor signal detection in the family environment. This idea is consistent with the critical and invalidating environments proposed to be associated with some forms of psychopathology (e.g., Hooley, 2007; Linehan, 1993) and also with recent findings on the family environment of those engaging in NSSI (Wedig & Nock, 2007). Finally, those engaging in NSSI are more likely than those who do not to have psychiatric disorders characterized by behaviors such as yelling (e.g., oppositional defiant disorder, conduct disorder) as well as heightened emotion reactivity and crying (e.g., major depression, borderline personality disorder) (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006; Nock et al., in press).

## Elaboration on the social functions of NSSI

In our prior work on the functions of self-injury, we have outlined the four function model (FFM) of NSSI (Nock & Prinstein, 2004, 2005). According to this model, NSSI serves four primary functions that differ along two dichotomous dimensions depending on whether contingencies for NSSI are automatic (i.e., intrapersonal) versus social (i.e., interpersonal), and also whether reinforcement is positive (i.e., followed by the presentation of a favorable stimulus) versus negative (i.e., followed by the removal of an aversive stimulus). As outlined in the top left corner of Figure 2, this creates the four functions of automatic negative reinforcement (i.e., removal or distraction from aversive thoughts or feelings), automatic positive reinforcement (i.e., feeling generation), social positive reinforcement (i.e., obtaining a favorable social response), and social negative reinforcement (i.e., removal or distraction from external events). The structural validity, internal consistency reliability, and construct validity of the FFM have been supported in our earlier work (Nock & Prinstein, 2004, 2005) and the model has received independent support from other research groups (e.g., Hilt, Cha, & Nolen-Hoeksema, 2008; Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007).

A theoretical synthesis of the FFM with the work presented above on animal signaling, idioms of distress, and the escalation of communication signals leads to a further elaboration of the social functions of NSSI. The original two social functions are retained here, but the incorporation of these other concepts provides a more complex model that presents a more nuanced picture of the processes influencing NSSI. This theoretical model is presented in Figure 2 and described below.

There are two fundamental signals that NSSI may communicate: signals of distress and signals of strength and fitness. In both cases, the use of NSSI as a signal may develop over time after a lack of success using less intense and less costly behaviors (as shown in Figure 1 and as indicated by the brief examples in each of the boxes in the Elaborated Social Functions graphic in Figure 2). Also, in both cases the signal may be maintained over time by either positive or negative reinforcement. Each of these four pathways is described in slightly more detail below.

### Signals of distress

If credible, the display of NSSI is perhaps most likely to elicit caregiving behavior from others (e.g., attention and concern from family and friends). The signal of distress hypothesis is most closely tied to the idioms of distress literature reviewed above. Of course, it is not necessary to engage in NSSI to obtain caregiving, and one may get to this point only when earlier signals have been unsuccessful due to poor signal quality (e.g., Gratz, 2006; Nock & Mendes, 2008)

or an environment that may be unreceptive to the low intensity signal (e.g., Hooley, 2007; Wedig & Nock, 2007). The escalation to NSSI may occur after one habituates to the level of caregiving provided in response to a weaker signal, when the level of caregiving decreases over time, or in the context of an “extinction burst” when caregiving is no longer provided in response to earlier signals. Either way, the consequence of caregiving is likely to be experienced as rewarding and thus lead to an increase in the probability of engaging in NSSI in the future. In the example presented in Figure 2, a person may initially engage in excessive reassurance-seeking behavior (a characteristic of those with depression) (Joiner & Metalsky, 2001; Joiner & Schmidt, 1998) or crying as a means of eliciting caregiving, and only when these strategies are unsuccessful is there need to “up the ante” to NSSI as the more costly means of achieving this end.

Crying represents an interesting parallel to NSSI in many ways. Crying is perhaps most often conceptualized as a behavioral signal of distress that serves a social function in the form of eliciting caregiving behavior from others (Blumberg & Sokoloff, 2001; Hendriks, Rottenberg, & Vingerhoets, 2007; Zeifman, 2001). Crying can be thought of as a handicap as well given that it is difficult to fake, costly to produce in that it blurs vision, and it leaves a physical trace once engaged (Hauser, 1996). Like NSSI, crying behavior also serves an automatic function in the form of arousal reduction (Blumberg & Sokoloff, 2001; Gross, Frederickson, & Levenson, 1994; Hendriks et al., 2007; Rottenberg, Wilhelm, Gross, & Gotlib, 2003). In support of the escalation of communication hypothesis, prior work on infant crying has shown that higher intensity crying elicits more rapid caregiving than lower intensity crying (e.g., Wood & Gustafson, 2001). This supports the idea that if lower levels of intensity are not rewarded, increasing the intensity of the signal may increase the probability of the desired response.

The display of NSSI as a signal of distress also may be maintained via a negative reinforcement process. For instance, an adolescent may attempt to escape from an unwanted request or command by acting out (i.e., displaying deviant behavior) until the request is removed. There is a rich literature on deviant behavior among children and adolescents supporting such a process (Granic & Patterson, 2006; Patterson, Reid, & Dishion, 1997). Here too, if initial forms of behavior are unsuccessful, intensity and mode may increase, resulting in engagement in NSSI. Such a pattern seems to be less prevalent than the social positive reinforcement process associated with NSSI as a signal of distress (see Nock & Prinstein, 2004), but is important to consider in seeking to explain this behavior.

### Signals of strength and fitness

Another potential message conveyed by NSSI is that a person has sufficient strength or fitness to withstand the injury resulting from the behavior. The use of NSSI in this way is most closely tied to the handicapping principle from the animal signaling literature (e.g., stotting among gazelles). In such instances, the intention is not to elicit caregiving, but in contrast to demonstrate one's high level of strength or fitness to others. Such a display may serve a negative reinforcement function by warding off potential competitors or predators. Such a use of NSSI is most likely among those who fear victimization by others. Lower intensity behaviors performed for this purpose may include dressing in a “Gothic” style (currently characterized by black, death-related clothing and jewelry often emblazoned with crosses, coffins, skulls, chains, and daggers) or in a “thug” or “hoody” style (currently characterized by large, loose-fitting clothing—a style popularized by prison wear and the clothing of gang members with the intent of concealing weapons), or decorating one's body with tattoos or body piercings. Following the escalation processes outlined above, such behaviors may ultimately reach the point of engaging in NSSI as a more costly display of strength or resilience. Doing so may

provide the signaler with a displayable “battle scar” or warning to potential predators that one has survived an aggressive encounter in the past.

In support of this theory in the case of NSSI, recent studies have reported a significant relation between peer victimization and engagement in NSSI (Hilt et al., 2008; Photos, Nock, & Prinstein, 2006). Moreover, a more specific relation has been demonstrated between identification with Goth subculture and engagement in both suicidal and non-suicidal self-injury (Young, Sweeting, & West, 2006), and tattooing and body piercing also have been linked to higher rates of suicidal and other risky behaviors (Carroll, Riffenburgh, Roberts, & Myhre, 2002). Of course, this theory suggests that victimization precedes these less intense behaviors, which in turn precede engagement in NSSI, and that victimization decreases following the NSSI behavior. Prior work in this area to date is cross-sectional and thus the testing of the temporal relations of these variables remains an important task for future research.

Another less common and less problematic instance of self-injury—and one that most researchers and clinicians would probably not even consider NSSI although it meets the accepted criteria for this behavior—is one in which a person intentionally engages in low-injury behaviors in the service of signaling strength and fitness to others. As an example, when recruiting for research studies on NSSI, we sometimes are contacted by college students who occasionally perform behaviors such as smashing empty beer cans on their head, shooting staples into their legs, punching holes in a wall, or branding themselves as part of a college fraternity initiation process. Unlike most other self-injurious behaviors, these somewhat more mainstream and socially accepted behaviors typically occur while consuming alcohol with a group of friends. As such, although these behaviors technically fit the definition of NSSI, they are different in kind, and perhaps are best conceptualized as “minimal-cost signals” (Maynard Smith & Harper, 2003) designed to display strength or fitness to potential mates or competitors.

## Social functions of other harmful behaviors

This paper used NSSI as an example of how behaving in a way that is harmful to oneself can be maintained by its influence on others. The focus remained on NSSI throughout for the sake of clarity and given the direct and dangerous nature of this behavior. However, the model outlined in this paper is applicable to other harmful behaviors as well. Alcohol and drug abuse/dependence represent behaviors that are harmful to the self (although less directly than NSSI) and may be maintained by automatic (e.g., Koob & Kreek, 2007) or social (e.g., Hussong, 2003) reinforcement. As with NSSI, the majority of research on each of these behaviors that has focused on the potential functions has addressed the automatic functions. Less work has examined the social functions. Each of these indirectly harmful behavior problems may hold a place on the continuum of signaling behaviors between crying and NSSI and may be used in increasing levels of intensity to signal distress in some cases (e.g., an adolescent getting high while at home and leaving drug paraphernalia where it is likely to be discovered), and to signal strength and fitness in others (e.g., drinking games and competitions among high school and college students), much in the same way as outlined above.

## Harmful behaviors in the service of affiliation

One final element of this social model of harmful behaviors that is important to consider is the use of such behaviors as a means of affiliating with others. In some instances, self-injurers report engaging in this behavior for the purpose of being like, or bonding with, others through different processes of homophily (see Prinstein, Guerry, Browne, & Rancourt, in press). Such processes are best considered as serving a social positive function of NSSI (Nock & Prinstein, 2004). This may occur within the context of signaling distress, such as in the case of a group of self-injurers cutting themselves while together or sharing accounts of their self-injury (Whitlock, Powers, & Eckenrode, 2006), signaling strength, such as in the case of fraternity

members branding their skin to signify their brotherhood or becoming ‘blood brothers,’ and in the context of other forms of harmful behaviors, such as among people bonding over drinks.

## Conclusions and needed research directions

An increasing amount of research has focused on the automatically reinforcing nature of NSSI, while much less work has examined the socially reinforcing nature of this behavior. At first blush, such an imbalance in research focus may seem warranted given that many people who engage in NSSI report doing so for automatic reinforcement (e.g., affect regulation). However, it is important to bear in mind that many self-injurers report using this behavior as a means of social influence, and it is likely that studies using self-report data to identify the functions of NSSI provide an under-estimate of the importance of the social functions due to obvious issues related to social desirability.

Drawing on prior research on animal signaling and idioms of distress, it was proposed that NSSI may be used as a display of either strength or stress when language and less intense forms of behavior fail to elicit a desired outcome. Toward this end, an elaborated model of our earlier four function model of NSSI was presented that described how the two social functions of NSSI could explain the reinforcement of both signals of strength and distress. Prior research on NSSI provides some support for the social positive reinforcement of signals of distress as well as social negative reinforcement of signals of strength and fitness. The two alternative cells in this four-part elaborated model may occur less frequently (i.e., signals of distress for social negative reinforcement and signals of strength for social positive reinforcement); however, to my knowledge they have not been examined in prior work and so await empirical investigation.

Given the early stage of research on the social functions of NSSI, many key research questions remain unaddressed. The theoretical and empirical work reviewed throughout this paper provides several excellent points of departure for future investigations in this emerging area. First, many studies have examined the extent to which people who have engaged in NSSI report doing so in the service of a particular group of functions over an extended period of time (e.g., past year, lifetime). Moreover, most studies have revealed medium to large correlations among functions. It remains unknown, however, whether NSSI serves multiple functions simultaneously, or whether functions differ over time or across contexts. For instance, it is possible that self-injurers begin engaging in this behavior for social functions but the behavior becomes automatically reinforcing over time. However, it is equally plausible that people most often begin to engage in NSSI for automatic reinforcement in private, but that the behavior becomes increasingly under the control of social factors due to the reinforcement or affiliation experienced from others. Such information will help elucidate the nature of NSSI and also may greatly inform assessment and treatment efforts. Testing the temporal overlap among the different functions will require repeated assessment of such functions over time, a strategy not often employed in this area, but one that is quite possible with emerging technologies such as web-based or electronic diary assessment methods.

Second, virtually all prior work on the functions of NSSI has relied on self-report of the reasons for engaging in NSSI. There are at least two problems with this approach. One is that people are not always able to report on the processes influencing their behavior (Nisbett & Wilson, 1977). Therefore, whatever answers they can provide are likely to be incomplete. Another problem is that self-reported reasons for engaging in NSSI are likely to be biased toward more socially acceptable responses (i.e., automatic reinforcement). Moreover, reporting that one is engaging in NSSI for social influence can compromise the credibility or honesty of one's behavior and thus undermine the signaling behavior, making people even less likely to endorse social functions. Nevertheless, virtually all studies that have asked about social functions have

found at least some support for these functions, suggesting that NSSI most certainly serves a social function in at least some instances, and estimates based on self-report are likely to underestimate the extent to which this is the case. Future research examining the extent to which social desirability influences reporting of the social functions of NSSI is required; and perhaps more importantly, objective methods for assessing NSSI and its functions are sorely needed.

One possibility for using more objective methods for studying NSSI is to directly examine the effect of experimentally applying various antecedents and consequences on NSSI. Interestingly, prior research on NSSI among people with developmental disabilities has done just this with very intriguing findings. Iwata and colleagues (1994) reviewed 152 single-case experimental studies of individuals with a history of engaging in NSSI that systematically applied and removed different stimuli and observed the effect on NSSI behavior. Across all of these analyses, NSSI was determined to be maintained most often by social negative (38.1% of the time) and social positive (26.3%) reinforcement, and less often by automatic reinforcement (25.7%), with multiple controlling functions in a small percentage of instances (5.3%). These results are intriguing in that they provide compelling, experimental evidence for the social functions of NSSI, and actually suggest that social factors may have a stronger effect over NSSI than do intrapersonal factors. Although the more stereotypic and less severe nature of NSSI among people with developmental disabilities permits functional analytic studies such as these, this is not the case with NSSI among people without developmental disabilities. However, clinical researchers can build upon these findings by systematically examining the therapeutic effect of removing different social contingencies over time and observing the rate of NSSI using single-case experimental designs (Barlow, Nock, & Hersen, in press). Such studies would provide a more objective and accurate measure of the social functions of NSSI, and may lead to the development of more effective treatments for NSSI (Muehlenkamp, 2006; Nock, Teper, & Hollander, 2007; Wallenstein & Nock, 2007).

Another possible strategy for more objectively assessing the functions of NSSI is to use performance-based methods of the constructs involved. For instance, in our own recent research we have used the implicit association test (IAT)—a reaction-time test that measures the associations people hold between different concepts and attributes—to measure adolescents' implicit cognitions about suicidal and non-suicidal self-injury (Nock & Banaji, 2007a, 2007b). This work has shown that adolescents who have recently engaged in these self-injurious behaviors more strongly identify with self-injurious behavior and that they believe it to be a more favorable behavior than do non-injurers. Perhaps the greatest strength of this approach in the study of self-injurious behaviors is that it overcomes the obstacles associated with relying on self-report of how a person thinks about such behaviors, and that there is initial evidence that performance on this test can help predict self-injurious thoughts and behaviors (Nock & Banaji, 2007a, 2007b). In studying the social functions of NSSI, this earlier work could be expanded to examine the extent to which people that engage in NSSI associate this behavior with “strength” vs. “distress,” or associate NSSI with getting help. Of course, the IAT is only one performance-based strategy that could be used. Other methods such as the Stroop test, dot-probe task, lexical decision tasks, and so on could all be used to circumvent self-report and advance understanding of the cognitive and affective processes associated with NSSI.

It also is important to incorporate the use of more ecologically valid approaches into this effort. For instance, in attempting to understand the social functions that may be served by NSSI it would be informative to examine the extent to which self-injurers actually injure themselves in places on their body that are likely to be easily observed by others (versus more private places, such as within the “bikini line”), as well as the extent to which self-injurers tell others about their NSSI. In addition, research could test whether self-injurers show greater and more rapid behavioral escalation in response to stress, and also whether self-injurers are better able

to get themselves into a state of crying than depressed non-injurers. Each of these would provide an interesting test of the signaling model outlined above. The development of more objective methods for studying NSSI is a hugely important task for future work in this area.

Another needed direction is the further testing for potential problems or deficits in the communication abilities of people who engage in NSSI, as well as for problems (such as poor signal detection or receptivity) in their environment. Recent work suggests that self-injurers have deficits in their ability to generate positive social solutions need to adaptively communicate with others (Nock & Mendes, 2008) and that there are some potential problems in their family environment (Wedig & Nock, 2007). Importantly, these earlier studies have all been cross-sectional in nature and so questions of directionality and causality remain open. For instance, although the parents of self-injurers display significantly greater criticism toward their children than do the parents of non-injurers, it is unclear whether this criticism is the cause or the result (e.g., due to “cry wolf” effects) of NSSI. Overall, studies of a broader range of communication problems, of the potential for engaging in help-seeking or other behavioral signaling strategies, of the tendency to escalate to more intense communication strategies, and those using experimental and prospective designs, would go a long way toward helping to clarify the nature of the social functions of NSSI.

The elaborated model of the social function of NSSI presented in this paper benefits from the support of some prior theoretical and empirical work; however, several facets of the model suggest novel hypotheses that remain to be tested. It is hoped that the ideas and recommendations presented in this paper will help foster research progress in this neglected but—by all early accounts—important aspect of self-injurious behavior.

## Acknowledgements

The writing of this paper was supported by awards from the National Institute of Mental Health (MH077883) and the Talley Fund of Harvard University. I am grateful to Marc Hauser for his helpful comments on an earlier version of this manuscript.

## References

- APA. Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition. Washington, DC: American Psychiatric Association; 1994.
- Barlow, DH.; Nock, MK.; Hersen, M. Single case experimental designs: Strategies for studying behavior change (3rd edition). Boston, MA: Allyn and Bacon; in press
- Baumeister RF, Vohs KD, Funder DC. Psychology as the science of self-reports and finger movements: What ever happened to actual behavior? *Perspectives of Psychological Science* 2007;2(4):396–403.
- Blumberg MS, Sokoloff G. Do infant rats cry? *Psychological Review* 2001;108(1):83–95. [PubMed: 11212634]
- Brockman B. Food refusal in prisoners: a communication or a method of self-killing? The role of the psychiatrist and resulting ethical challenges. *Journal of Medical Ethics* 1999;25(6):451–456. [PubMed: 10635497]
- Brown MZ, Comtois KA, Linehan MM. Reasons for suicide attempts and nonsuicidal self-injury in women with borderline personality disorder. *Journal of Abnormal Psychology* 2002;111(1):198–202. [PubMed: 11866174]
- Buchanan KL, Spencer KA, Goldsmith AR, Catchpole CK. Song as an honest signal of past developmental stress in the European starling (*Sturnus vulgaris*). *Proceedings of the Royal Society of London. Series B, Biological Sciences* 2003;270(1520):1149–1156.
- Caro TM. The functions of stotting in Thomson's gazelles: Some tests of the predictions. *Animal Behaviour* 1986;34:663–684.
- Carroll ST, Riffenburgh RH, Roberts TA, Myhre EB. Tattoos and body piercings as indicators of adolescent risk-taking behaviors. *Pediatrics* 2002;109(6):1021–1027. [PubMed: 12042538]

- Chapman AL, Gratz KL, Brown MZ. Solving the puzzle of deliberate self-harm: The experiential avoidance model. *Behaviour Research and Therapy* 2006;44(3):371–394. [PubMed: 16446150]
- Clark MH. Nevra in a Greek village: Idiom, metaphor, symptom, or disorder? *Health Care for Women International* 1989;10(23):195–218. [PubMed: 2768092]
- Cote IM, Cheney KL. Animal mimicry: Choosing when to be a cleaner-fish mimic. *Nature* 2005;433(7023):211–212. [PubMed: 15662402]
- Deliberto TL, Nock MK. An exploratory study of correlates, onset, and offset of non-suicidal self-injury. *Archives of Suicide Research*. in press
- Dellinger-Ness LA, Handler L. Self-injurious behavior in human and non-human primates. *Clinical Psychology Review* 2006;26(5):503–514. [PubMed: 16713051]
- Durkheim, E. *Suicide: A study in sociology*. Simpson, G., editor; Spaulding, JA.; Simpson, G., translators. New York: Free Press; 1897. p. 1951
- Enquist M. Communication during aggressive interactions with particular reference to variation in choice of behaviour. *Animal Behaviour* 1985;33:1152–1161.
- Fisch M. The suicidal gesture: A study of 114 military patients hospitalized because of abortive suicide attempts. *American Journal of Psychiatry* 1954;111(1):33–36. [PubMed: 13158632]
- Gilbert P. Evolution and depression: issues and implications. *Psychological Medicine* 2006;36(3):287–297. [PubMed: 16236231]
- Glassman LH, Weierich MR, Hooley JM, Deliberto TL, Nock MK. Child maltreatment, non-suicidal self-injury, and the mediating role of self-criticism. *Behaviour Research and Therapy*. 2007
- Goldney RD, Schioldann JA. Evolution of the concept of altruistic suicide in pre-Durkheim suicidology. *Archives of Suicide Research* 2004;8(1):23–27. [PubMed: 16006396]
- Granic I, Patterson GR. Toward a comprehensive model of antisocial development: a dynamic systems approach. *Psychological Review* 2006;113(1):101–131. [PubMed: 16478303]
- Gratz KL. Risk factors for deliberate self-harm among female college students: The role and interaction of childhood maltreatment, emotional inexpressivity, and affect intensity/reactivity. *American Journal of Orthopsychiatry* 2006;76(2):238–250. [PubMed: 16719643]
- Gross JJ, Frederickson BL, Levenson RW. The psychophysiology of crying. *Psychophysiology* 1994;31(5):460–468. [PubMed: 7972600]
- Guarnaccia PJ, Farias P. The social meanings of nervios: A case study of a Central American woman. *Social Science & Medicine* 1988;26(12):1223–1231. [PubMed: 3206244]
- Hagen, EH. The bargaining model of depression. In: Hammerstein, P., editor. *Genetic and cultural evolution of cooperation*. Cambridge, MA: MIT Press; 2003.
- Hagen EH, Watson P, Hammerstein P. Gestures of despair and hope: A view on deliberate self-harm from economics and evolutionary biology. Manuscript submitted for publication. 2008
- Haines J, Williams CL, Brain KL, Wilson GV. The psychophysiology of self-mutilation. *Journal of Abnormal Psychology* 1995;104(3):471–489. [PubMed: 7673571]
- Hauser, MD. *The evolution of communication*. Cambridge, MA: MIT Press; 1996.
- Hauser MD, Chomsky N, Fitch WT. The faculty of language: What is it, who has it, and how did it evolve? *Science* 2002;298(5598):1569–1579. [PubMed: 12446899]
- Hendriks MC, Rottenberg J, Vingerhoets AJ. Can the distress-signal and arousal-reduction views of crying be reconciled? Evidence from the cardiovascular system. *Emotion* 2007;7(2):458–463. [PubMed: 17516822]
- Hilt LM, Cha CB, Nolen-Hoeksema S. Non-suicidal self-injury in young adolescent girls: Moderators of the distress-function relationship. *Journal of Consulting and Clinical Psychology* 2008;76(1)
- Hilt LM, Nock MK, Lloyd-Richardson E, Prinstein MJ. Longitudinal study of non-suicidal self-injury among young adolescents: Rates, correlates, and preliminary test of an interpersonal model. *Journal of Early Adolescence*. in press
- Hinton DE, Chong R, Pollack MH, Barlow DH, McNally RJ. *Ataque de nervios: Relationship to anxiety sensitivity and dissociation predisposition*. Depression and Anxiety. 2007
- Hooley JM. Expressed emotion and relapse of psychopathology. *Annual Review of Clinical Psychology* 2007;3:329–352.

- Huband N, Tantam D. Attitudes to self-injury within a group of mental health staff. *British Journal of Medical Psychology* 2000;73(Pt 4):495–504. [PubMed: 11140790]
- Hussong AM. Social influences in motivated drinking among college students. *Psychology of Addictive Behaviors* 2003;17(2):142–150. [PubMed: 12814278]
- Iwata BA, Pace GM, Dorsey MF, Zarcone JR, Vollmer TR, Smith RG, et al. The functions of self-injurious behavior: An experimental-epidemiological analysis. *Journal of Applied Behavior Analysis* 1994;27(2):215–240. [PubMed: 8063623]
- Joiner TE Jr, Metalsky GI. Excessive reassurance seeking: Delineating a risk factor involved in the development of depressive symptoms. *Psychological Science* 2001;12(5):371–378. [PubMed: 11554669]
- Joiner TE Jr, Schmidt NB. Excessive reassurance-seeking predicts depressive but not anxious reactions to acute stress. *Journal of Abnormal Psychology* 1998;107(3):533–537. [PubMed: 9715588]
- Kleinman A. Neurasthenia and depression: A study of somatization and culture in China. *Culture, Medicine, and Psychiatry* 1982;6(2):117–190.
- Klonsky ED. The functions of deliberate self-injury: A review of the evidence. *Clinical Psychology Review* 2007;27(2):226–239. [PubMed: 17014942]
- Koob G, Kreek MJ. Stress, dysregulation of drug reward pathways, and the transition to drug dependence. *American Journal of Psychiatry* 2007;164(8):1149–1159. [PubMed: 17671276]
- Kraemer GW, Schmidt DE, Ebert MH. The behavioral neurobiology of self-injurious behavior in rhesus monkeys. Current concepts and relations to impulsive behavior in humans. *Annals of the New York Academy of Science* 1997;836:12–38.
- Linehan, MM. *Cognitive-behavioral treatment of borderline personality disorder*. New York: Guilford Press; 1993.
- Lloyd-Richardson EE, Perrine N, Dierker L, Kelley ML. Characteristics and functions of non-suicidal self-injury in a community sample of adolescents. *Psychological Medicine* 2007;37(8):1183–1192. [PubMed: 17349105]
- Lundh LG, Karim J, Quilisch E. Deliberate self-harm in 15-year-old adolescents: a pilot study with a modified version of the Deliberate Self-Harm Inventory. *Scand J Psychol* 2007;48(1):33–41. [PubMed: 17257367]
- Maynard Smith, J.; Harper, D. *Animal signals*. New York: Oxford University Press; 2003.
- Maynard Smith J, Harper DGC. Animal signals: Models and terminology. *Journal of Theoretical Biology* 1995;177(3):305–311.
- Muehlenkamp JJ. Self-injurious behavior as a separate clinical syndrome. *American Journal of Orthopsychiatry* 2005;75(2):324–333. [PubMed: 15839768]
- Muehlenkamp JJ. Empirically supported treatments and general therapy guidelines for non-suicidal self-injury. *Journal of Mental Health Counseling* 2006;28:166–185.
- Nesse RM. Is depression an adaptation? *Archives of General Psychiatry* 2000;57(1):14–20. [PubMed: 10632228]
- Nichter M. Idioms of distress: Alternatives in the expression of psychosocial distress: A case study from South India. *Culture, Medicine, and Psychiatry* 1981;5(4):379–408.
- Nisbett RE, Wilson TD. Telling more than we can know: Verbal reports on mental processes. *Psychological Review* 1977;84(3):231–259.
- Nock MK, Banaji MR. Assessment of self-injurious thoughts using a behavioral test. *American Journal of Psychiatry* 2007a;164(5):820–823. [PubMed: 17475742]
- Nock MK, Banaji MR. Prediction of suicide ideation and attempts among adolescents using a brief performance-based test. *Journal of Consulting and Clinical Psychology* 2007b;75(5):707–715. [PubMed: 17907852]
- Nock, MK.; Favazza, A. Non-suicidal self-injury: Definition and classification. In: Nock, MK., editor. *Non-suicidal self-injury: Current science and practice*. Washington, DC: American Psychological Association; in press
- Nock MK, Joiner TE Jr, Gordon KH, Lloyd-Richardson E, Prinstein MJ. Non-suicidal self-injury among adolescents: Diagnostic correlates and relation to suicide attempts. *Psychiatry Research* 2006;144(1):65–72. [PubMed: 16887199]



- Nock MK, Kessler RC. Prevalence of and risk factors for suicide attempts versus suicide gestures: Analysis of the National Comorbidity Survey. *Journal of Abnormal Psychology* 2006;115(3):616–623. [PubMed: 16866602]
- Nock MK, Mendes WB. Physiological arousal, distress tolerance, and social problem-solving deficits among adolescent self-injurers. *Journal of Consulting and Clinical Psychology* 2008;76(1):28–38. [PubMed: 18229980]
- Nock MK, Prinstein MJ. A functional approach to the assessment of self-mutilative behavior. *Journal of Consulting and Clinical Psychology* 2004;72(5):885–890. [PubMed: 15482046]
- Nock MK, Prinstein MJ. Clinical features and behavioral functions of adolescent self-mutilation. *Journal of Abnormal Psychology* 2005;114(1):140–146. [PubMed: 15709820]
- Nock MK, Prinstein MJ. The structure and function of self-injurious thoughts and behaviors: An ecological momentary assessment study. Manuscript submitted for publication. 2008
- Nock MK, Teper R, Hollander M. Psychological treatment of self-injury among adolescents. *Journal of Clinical Psychology* 2007;63(11):1081–1089. [PubMed: 17932981]
- Nock MK, Wedig MM, Holmberg EB, Hooley JM. Emotion reactivity scale: Psychometric evaluation and relation to self-injurious thoughts and behaviors. *Behavior Therapy*. in press
- Nock, MK.; Wedig, MM.; Janis, IB.; Deliberto, TL. Self-injurious thoughts and behaviors. In: Hunsely, J.; Mash, E., editors. *A guide to assessments that work*. New York: Oxford University Press; 2008.
- Nowak MA. Five rules for the evolution of cooperation. *Science* 2006;314(5805):1560–1563. [PubMed: 17158317]
- Parsons CD, Wakeley P. Idioms of distress: somatic responses to distress in everyday life. *Culture, Medicine, and Psychiatry* 1991;15(1):111–132.
- Patterson, GR.; Reid, JB.; Dishion, TJ. *Antisocial boys: A social interactional approach*. Medford, OR: Castalia Publishing Company; 1997.
- Peet, B. *Cock-a-doodle-Dudley*. New York: Houghton Mifflin; 1990.
- Photos, VI.; Nock, MK. Impairments in executive functioning among self-injurious adolescents; Paper presented at the Annual convention of the Association for Behavioral and Cognitive Therapies; Chicago, IL. 2006.
- Photos VI, Nock MK, Prinstein MJ. Peer victimization and non-suicidal self-injury among adolescents. Manuscript submitted for publication. 2006
- Pinker, S. *The language instinct: How the mind creates language*. New York: Harper Perennial Modern Classics; 2000.
- Pinker, S. *The stuff of thought: Language as a window into human nature*. New York: Viking Adult; 2007.
- Price JS, Gardner R Jr, Erickson M. Can depression, anxiety and somatization be understood as appeasement displays? *Journal of Affective Disorders* 2004;79(13):1–11. [PubMed: 15023475]
- Prinstein, MJ.; Guerry, JD.; Browne, CB.; Rancourt, D. Interpersonal models of self-injury. In: Nock, MK., editor. *Non-suicidal self-injury: Current science and practice*. Washington, DC: American Psychological Association; in press
- Rodham K, Hawton K, Evans E. Reasons for deliberate self-harm: Comparison of self-poisoners and self-cutters in a community sample of adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry* 2004;43(1):80–87. [PubMed: 14691363]
- Rottenberg J, Wilhelm FH, Gross JJ, Gotlib IH. Vagal rebound during resolution of tearful crying among depressed and nondepressed individuals. *Psychophysiology* 2003;40(1):1–6. [PubMed: 12751799]
- Searcy, WA.; Nowicki, S. *The evolution of animal communication*. Princeton, NJ: Princeton University Press; 2005.
- Sher, L.; Stanley, B. The neurobiology of non-suicidal self-injury. In: Nock, MK., editor. *Understanding non-suicidal self-injury: Current science and practice*. Washington, DC: American Psychological Association; in press
- Silverman MM, Berman AL, Sanddal ND, O'Carroll PW, Joiner TE. Rebuilding the tower of Babel: A revised nomenclature for the study of suicide and suicidal behaviors. Part 2: Suicide-related ideations, communications, and behaviors. *Suicide and Life-Threatening Behavior* 2007;37(3):264–277. [PubMed: 17579539]

- Spencer KA, Buchanan KL, Goldsmith AR, Catchpole CK. Song as an honest signal of developmental stress in the zebra finch (*Taeniopygia guttata*). *Hormones and Behavior* 2003;44(2):132–139. [PubMed: 13129485]
- Thapar, V. *Tigers: Portrait of a predator*. London: Collins; 1986.
- Tibbetts EA, Dale J. A socially enforced signal of quality in a paper wasp. *Nature* 2004;432(7014):218–222. [PubMed: 15538369]
- Tucker GJ, Gorman ER. The significance of the suicide gesture in the military. *American Journal of Psychiatry* 1967;123(7):854–861. [PubMed: 6016857]
- Tzeng WC, Lipson JG. Fan: An idiom of distress among suicidal patients in Taiwan. *Family & Community Health* 2007;30(1):74–83. [PubMed: 17149034]
- Wallenstein MB, Nock MK. Physical exercise for the treatment of non-suicidal self-injury: Evidence from a single-case study. *American Journal of Psychiatry* 2007;164:350–351. [PubMed: 17267807]
- Walsh, BT. *Treating self-injury: A practical guide*. New York: Guilford Press; 2006.
- Watson PJ, Andrews PW. Toward a revised evolutionary adaptationist analysis of depression: the social navigation hypothesis. *Journal of Affective Disorders* 2002;72(1):1–14. [PubMed: 12204312]
- Wedig MM, Nock MK. Parental expressed emotion and adolescent self-injury. *Journal of the American Academy of Child and Adolescent Psychiatry* 2007;46(9):1171–1178. [PubMed: 17712240]
- Weierich MR, Nock MK. Posttraumatic stress symptoms mediate the relation between childhood sexual abuse and non-suicidal self-injury. *Journal of Consulting and Clinical Psychology* 2008;76(1):39–44. [PubMed: 18229981]
- Whitlock JL, Powers JL, Eckenrode J. The virtual cutting edge: The internet and adolescent self-injury. *Developmental Psychology* 2006;42(3):407–417. [PubMed: 16756433]
- Wood RM, Gustafson GE. Infant crying and adults' anticipated caregiving responses: Acoustic and contextual influences. *Child Development* 2001;72(5):1287–1300. [PubMed: 11699671]
- Yates TM. The developmental psychopathology of self-injurious behavior: compensatory regulation in posttraumatic adaptation. *Clinical Psychology Review* 2004;24(1):35–74. [PubMed: 14992806]
- Young R, Sweeting H, West P. Prevalence of deliberate self harm and attempted suicide within contemporary Goth youth subculture: longitudinal cohort study. *Bmj* 2006;332(7549):1058–1061. [PubMed: 16613936]
- Zahavi A. Mate selection—a selection for a handicap. *Journal of Theoretical Biology* 1975;53(1):205–214. [PubMed: 1195756]
- Zahavi, A.; Zahavi, A. *The handicap principle: A missing piece of Darwin's puzzle*. New York: Oxford University Press; 1997.
- Zeifman DM. An ethological analysis of human infant crying: answering Tinbergen's four questions. *Developmental Psychobiology* 2001;39(4):265–285. [PubMed: 11745323]

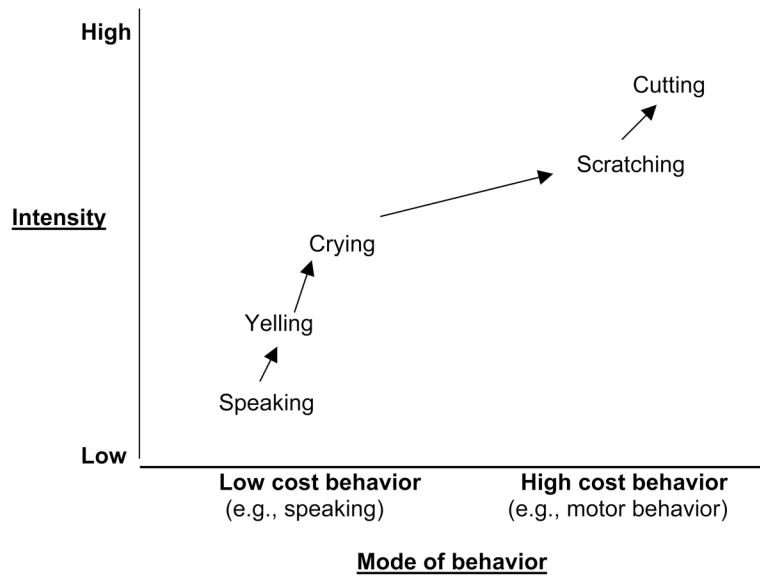
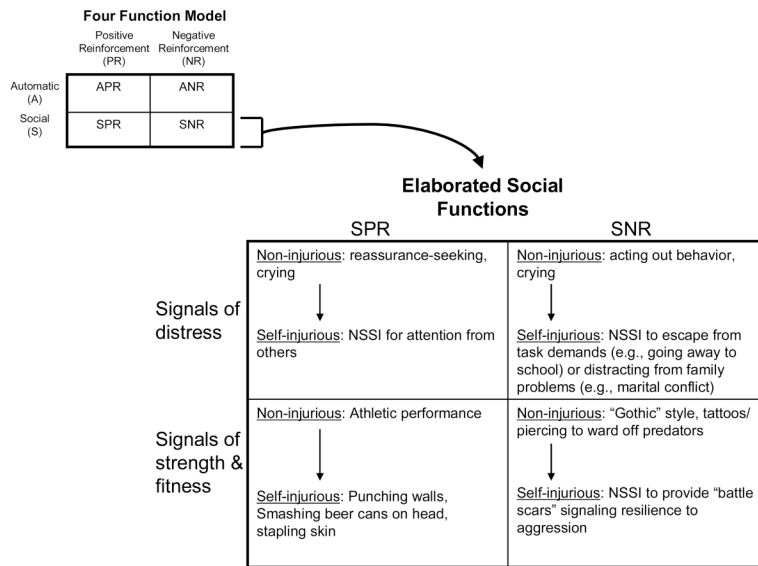


Figure 1. Schematic of how communication intensity and mode can escalate to NSSI



**Figure 2. Proposed functions of self-injurious behaviors**

*Note:* NSSI = Non-suicidal self-injury; APR = automatic positive reinforcement; ANR = automatic negative reinforcement; SPR = social negative reinforcement; SPR = social positive reinforcement.