Some Warning Behaviors Discriminate Between School Shooters and Other Students of Concern

J. Reid Meloy
University of California, San Diego
School of Medicine

Jens Hoffmann and Karoline Roshdi
Institute of Psychology and Threat Management,
Darmstadt, Germany

Angela Guldimann
University Hospital of Psychiatry, Zurich

A typology of 8 warning behaviors for targeted violence—dynamic and superordinate patterns which may indicate accelerating risk of violence—were tested in a small sample of German school shooters ($n = 9$) and students of concern ($n = 31$) to see if any warning behaviors would be significantly different between the groups. Five warning behaviors were found to occur with significantly greater frequency in the school shooters and discriminate between the samples: pathway, fixation, identification, novel aggression, and last resort. All effect sizes were large ($\phi > .50$). The findings are discussed in the context of school-shooting data from Germany and the United States and their implications for threat assessment.

Keywords: threat assessment, violence risk, school shooting, mass murder, targeted violence, warning behaviors

A typology of warning behaviors was published in the violence risk and threat assessment literature as a "useful means of conceptualizing behavioral patterns indicating increasing threat" (Meloy, Hoffmann, Guldimann, & James, 2012, p. 260). The concept of "warning behaviors" was advanced in the studies of the Fixated Research Group (http://www.fixatedthreat.com/) concerning abnormal communications and approaches to the British Royal Family during the previous decade (James et al., 2007, 2008, 2009, 2010, 2011), and has been termed by others as "signaling the attack" in the U.S. Secret Services (USSS) Safe School Initiative (Vossekuil, Reddy, Fein, Borum, & Modzeleski, 2000, 2002), "tell-tale behaviors" or "high-risk indicators" (Calhoun & Weston, 2003), "stalking-type behavior" (Mullen et al., 2009), "preattack signals" (Dietz & Martell, 1989), and "red-flag indicators" (White & Meloy, 2007).

This typology, however, is not another list of risk variables, but instead captures superordinate behavioral or psychological *patterns* that constitute change and may evidence accelerating risk. This approach, although shorn of the mathematical complexity of contemporary research on pattern recognition and analysis (Duda, Hart, & Stork, 2004), finds its roots in early 20th century Gestalt psychology. Humans appear to be naturally inclined to organize patterns from various data points, and the German psychologists Wertheimer (1938), Köhler (1929), and Koffka (1921) experimentally confirmed their theory that visual perception of the whole, or the Gestalt, may be primary and is often different from and greater than the sum of its parts. The risk in our evolved psychobiological propensity to recognize patterns in data, however, is referred to as apophenia: patterns are discerned among data when, in fact, the data

J. Reid Meloy, Department of Psychiatry, University of California, San Diego School of Medicine; Jens Hoffmann and Karoline Roshdi, Institute of Psychology and Threat Management, Darmstadt, Germany; Angela Guldimann, University Hospital of Psychiatry, Zurich.

Correspondence concerning this article should be addressed to J. Reid Meloy, Department of Psychiatry, University of California, San Diego, School of Medicine, 9500 Gilman Drive, La Jolla, San Diego, CA 92093. E-mail: reidmeloy@gmail.com

are random. Statistically this is referred to as a Type I error, or a false positive. Such cognitive error is also most clearly seen psychopathologically in paranoid disorders when personal meaning is attributed to random events (ideas of reference) or random associations among people are perceived as conspiracies (a "paranoid pseudocommunity;" see Cameron, 1959). With such cautions in mind, these warning behaviors may point toward behavioral, cognitive, and emotional processes within an individual that signify a greater determination to act violently. It is not expected that each and every warning behavior will be present before an attack of any kind. Instead, different targeted violent acts may be preceded by typical patterns of warning behaviors in various domains of targeted violence.

Warning behaviors contain within them dynamic rather than static variables, the former typically offering more substantial contributions to the assessment of short-term violence risk (Gray et al., 2004; Nicholls, Brink, Desmarais, Webster, & Martin, 2006; Skeem & Mulvey, 2001). The typology was generated to carefully define and systematize such patterns. The original study reviewed in detail the previous research, which attempted to identify these acute and dynamic variables among attackers and assassins of celebrities, politicians, and other public figures; psychiatric patients; adolescent mass murderers and school shooters; adult mass murderers; spousal homicide perpetrators; workplace attackers; and federal judicial threateners and attackers (Meloy et al., 2012). A subsequent study graphically displayed some of these different configurations (Meloy et al., 2014) in various domains of targeted violence. The patterns identified in the typology were gleaned from the research on targeted or intended violence, discussions with colleagues, and the casework experience of the original authors. It is a rationally derived typology.

1. *Pathway warning behavior*—any behavior that is part of research, planning, preparation, or implementation of an attack (Calhoun & Weston, 2003; Fein & Vossekuil, 1998a, 1998b, 1999).
2. *Fixation warning behavior*—any behavior that indicates an increasingly pathological preoccupation with a person or a cause (Mullen et al., 2009). It is measured by (a) increasing perseveration on the person or cause; (b) increasingly strident opinion; (c) increasingly negative characterization of the object of fixation; (d) impact on the family or other associates of the object of fixation, if present and aware; and (e) angry emotional undertone. It is typically accompanied by social or occupational deterioration.
3. *Identification warning behavior*—any behavior that indicates a psychological desire to be a "pseudocommando" (Dietz, 1986; Knoll, 2010), have a "warrior mentality" (Hempel, Meloy, & Richards, 1999), closely associate with weapons or other military or law-enforcement paraphernalia, identify with previous attackers or assassins, or identify oneself as an agent to advance a particular cause or belief system.
4. *Novel aggression warning behavior*—an act of violence that appears unrelated to any targeted-violence pathway warning behavior committed for the first time. Such behaviors may be engaged to test the ability (de Becker, 1997) of the subject to actually do the violent act, and may be a measure of response tendency, i.e., the motivation to act on the environment (Hull, 1952), or a behavioral tryout (MacCulloch, Snowden, Wood, & Mills, 1983). When homicide occurs within this warning behavior, it may be "proof of kill" (G. Deisinger, personal communication, February, 2011).
5. *Energy burst warning behavior*—an increase in the frequency or variety of any noted activities related to the target, even if the activities themselves are relatively innocuous, usually in the days or weeks before the attack (Odgers et al., 2009).
6. *Leakage warning behavior*—the communication to a third party of an intent to do harm to a target through an attack (Meloy & O'Toole, 2011).
7. *Last resort warning behavior*—evidence of a "violent-action imperative" or "time imperative" (Mohandie & Duffy, 1999); increasing desperation or distress through declaration in word or deed, forcing the individual into a position of last resort. There is no alternative other than violence, and the consequences are justified

([de Becker, 1997](#)). The subject feels trapped (S. White, personal communication, October, 2010).

8. *Directly communicated threat warning behavior*—the communication of a direct threat to the target or law enforcement beforehand. A threat is a written or oral communication that implicitly or explicitly states a wish or intent to damage, injure, or kill the target or individuals symbolically or actually associated with the target.

Each of these eight patterns has within it discrete behaviors that have often been considered risk variables for targeted violence. For example, within the pattern of *last resort* could be the appearance of "final acts" as enumerated by Calhoun and Weston (2003); within the pattern of *identification* could be accumulation of weapons and other military paraphernalia as noted by Dietz (1986); and within the pattern of *leakage* could be multiple postings to social media in the hours before the planned attack, as discussed by Meloy and O'Toole (2011). The typology appears to have face validity, and may capture most of the universe of warning behaviors in intended and targeted violence which are now known and are described in the literature (see Meloy et al., 2012, 2014). However, further empirical research is necessary to advance understanding of its reliability and validity. Perhaps the most important research question is whether the typology has any predictive validity in relation to acts of targeted violence. In other words, does it serve a useful purpose in the real world by classifying warning behaviors that have preceded acts of targeted violence, and discriminating between those who prompt the concern of threat assessors but have shown no intention to act, and those who carry it out?

Hypothesis and Method

The null hypothesis of this study is that no warning behaviors will significantly discriminate between a sample of school shooters in secondary schools and other students who have shown behaviors of concern that could be related to an intended school shooting. The universe of German cases of school shooters, in which the offender carried out an attack with a lethal weapon ($n = 9$), was identified between 1999 and 2010. A nonrandom convenience sample of German students of concern was also identified. In the students-of-concern sample, cases were only included in which authorities found no serious intention to commit a school shooting. In most cases, the students of concern came to the attention of others because of some form of threatening or worrying communication. In the terminology of the typology, this would be described as a directly communicated threat or leakage warning behavior.

In a first step, a sample of students-of-concern cases was identified by researching news reports on the Internet. Then we contacted the courts that handled those cases, asking if they would provide court records and investigative files for a research project. Because there was an increase of threatening communications in secondary schools following a number of German school shootings after the U.S. Columbine school attack in 1999, almost every worrying incident was brought to a German court as a deterrent. The authorities wanted to demonstrate that threatening behavior in schools is no trivial offense but can have serious consequences. In a review of the files, any case was excluded in which (a) police, psychiatrists, or other experts formulated some sort of mild risk of committing a violent act; this was done to maximize the distinction between the sample of worrisome but low-risk students of concern and the school shooters with retrospectively the highest risk; (b) there was insufficient information in the files to determine both the presence *and* the absence of the eight warning behaviors; or (c) interventions played any role whatsoever in preventing a student of concern from becoming an attacker, for example, when weapons were found and confiscated by police. This resulted in the final nonrandom sample of $n = 31$ cases of students of concern, and a total combined sample of $N = 40$. The sample of students of concern was an extension of an earlier and smaller sized sample described and analyzed in Meloy et al. (2014).

Two statistical analyses were conducted. The first descriptive analysis consisted of displaying the warning behaviors identified in the two groups as graphs. The second inferential analysis compared warning behaviors that appeared to be different across the two groups when the figures were visually inspected by the researchers. Due to cell frequencies fewer than five,

Fisher's exact test was reported instead of a chi-square. Phi coefficients were calculated and interpreted as a measure of effect size according to Cohen (1988; .10 = small, .30 = medium, .50 = large).

Results

German School Shooters

All of the attackers were male, their age ranged between 15 and 23 years, with an average of 18 years. The majority were former students who returned to their schools for the rampage ($n = 5$; 56%); the others were students at the time of the attacks.

Thirty-seven victims died: 19 of them were teachers, 11 were students and one was a secretary. Six victims were from outside the school: one police officer, two former private-company supervisors, and three random victims were shot while the offender was on the run. Five of the offenders committed suicide (56%); two others tried to kill themselves immediately after the attack but survived (22%).

In 78% of the attacks, firearms were used, in 44% explosives and smoke grenades were the weapons of choice, and 22% of the attackers used knives. The highest international number of casualties per event in the last two decades in secondary schools committed by current or former students has been found in Germany: in the 2002 rampage school attack in Erfurt, 17 people died, and 16 people died in Winnenden in 2009 (Hoffmann & Roshdi, 2013); in both cases, the suicide of the offender is included in the total number of lives lost.

Other Students of Concern

The youngest was 12 years old, the oldest 22 years, and the average age was 16 years. In contrast to the group of school shooters who were all male, three of the students of concern were female (10%). In the vast majority of the cases (89%), the student of concern was currently in attendance at the school, unlike the school shooters who had been former students in more than half of the cases; this latter finding, however, could be an artifact of sampling.

Descriptive Results

Figures 1 and 2 show the configurations of warning behaviors for the two samples.

Pathway warning behavior was present in every school shooting and very rare in the concern sample ($p = .000$; $\phi = 0.875$). Statistically
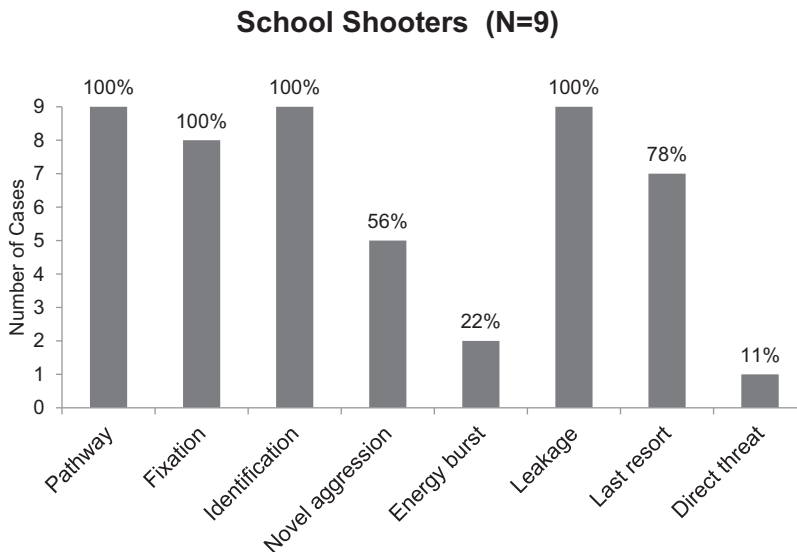
School Shooters (N=9)

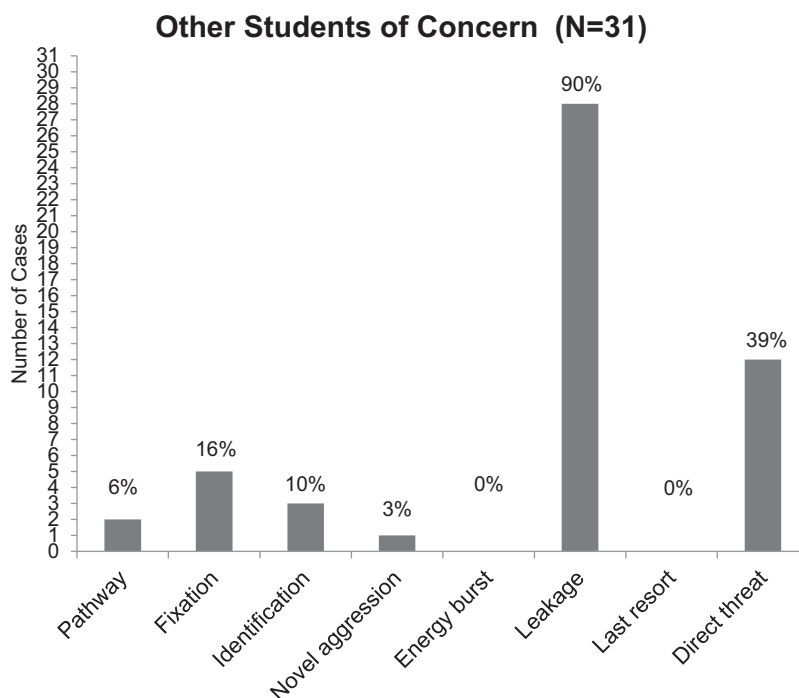*Figure 1.* Warning behaviors of German school shooters.

Figure 2. Warning behaviors of other students of concern.

significant differences between the two groups also occurred in *fixation* warning behavior ($p = .000$; $\phi = .718$), *identification* warning behavior ($p = .000$; $\phi = .823$), *novel aggression* warning behavior ($p = .001$; $\phi = .612$), and *last resort* warning behavior ($p = .000$; $\phi = .855$). The effect sizes were all large. A difference with a medium effect size was present in *energy burst* warning behavior ($p = .046$; $\phi = .426$, see Table 1).

Discussion

To our knowledge, this is the first time—other than our smaller sample study (Meloy et al., 2014)—students of concern but without identifiable actual intent and school shooters who committed violence have been retrospectively analyzed to statistically test the null hypothesis that there would be no differences between the two groups. A number of U.S.

Table 1
Comparison of Warning Behaviors for German School Shooters and Other Students of Concern

	School shooters	Other students of concern		
	($n = 9$)	($n = 31$)	Significance	Effect size
Pathway	100% (9/9)	6% (2/31)	$p = .000$	$\phi = 0.875$
Fixation	100% (8/8)	16% (5/31)	$p = .000$	$\phi = 0.718$
Identification	100% (9/9)	10% (3/31)	$p = .000$	$\phi = 0.823$
Novel aggression	56% (5/9)	3% (1/31)	$p = .001$	$\phi = 0.612$
Energy burst	22% (2/9)	0% (0/31)	$p = .046$	$\phi = 0.426$
Leakage	100% (9/9)	90% (28/31)	$p = 1.00$	$\phi = 0.153$
Last resort	78% (7/9)	0% (0/31)	$p = .000$	$\phi = 0.855$
Direct threat	11% (1/9)	39% (12/31)	$p = .226$	$\phi = 0.246$

studies have taken a closer look at warning behaviors in mass murders (Meloy et al., 2001, 2004) and school shootings (Newman, 2004; O'Toole, 2000), but without any comparison groups. The USSS Safe School Initiative analyzed 37 incidents of targeted school violence involving 41 attackers (Vossekuil et al., 2000, 2002), but again, without any comparison group. Important similarities in four domains were found, however, when data from the Safe School Initiative were compared to the profile of the warning behaviors in our smaller German sample of school shooters.

Comparing the USSS Safe School Initiative Findings to the German School Shooters

Almost all U.S. attackers (93%) planned and prepared their school shootings, a finding very similar to the German attackers, who all followed a pathway warning behavior, including the last steps of research, planning, preparation, and implementation (see Figure 1).

The very high frequency of U.S. school shooters who exhibited a history of suicidal attempts or thoughts (78%) was the same frequency as last resort thinking in the German sample of school shooters. This warning behavior is described as increasing desperation or distress through declaration in word or deed, forcing the individual into a position of last resort. Suicidal ideation appears to be a strong behavioral marker for last resort warning behavior—and the mediating variable may be depression Although last resort is a pattern, and suicidal ideation is an example of a more discrete clinical behavior, the relationship is worth contemplation given the finding that last resort had the second largest effect size (.855) as a discriminator between the two German groups. In almost every case in the U.S. and in Germany (Hoffmann, Roshdi, & Robertz, 2009), the offender experienced major losses before the attacks, which may be one discrete cause of this warning behavior. Again, it may not be the loss per se, but how the loss is emotionally processed by the subject.

Leakage was present in virtually all the German cases in the two samples, and also in 81% of the U.S. school shootings; at least one person, as a result of leakage, had information that the attacker was thinking about or planning the school assault. The rate of directly communicated threats was relatively low in both samples: 17% in the U.S. sample and 11% in the German sample. Neither directly communicated threat nor leakage distinguished the two groups, yet they are often the point of investigative entry into a case—especially leakage, given its higher frequency—as the first evidence of risk of targeted violence. Most cases in which leakage is present, however, do not result in targeted violence, but leakage is expected among most school shooters (Meloy & O'Toole, 2011; Vossekuil et al., 2002).

The analysis of warning behaviors yielded important findings. School shooters in the U.S. and Germany have produced similar warning behavior profiles despite differences in geography, language, culture, and history: frequent pathway, leakage, and last resort warning behaviors; and infrequent directly communicated threats. Pathway, fixation, and identification profiles were prominent and quite similar when the German school shooters and German and U.S. public figure attackers were compared (Hoffmann et al., 2011; Meloy et al., 2008; Meloy et al., 2014). This means that the results of this study not only have significance for Germany, but also for the U.S. and perhaps other Western countries.

Comparing the German School Shooters and Other Students of Concern

Our most important finding, however, is the striking differences in warning behaviors between the German school shooters and other students of concern. Whereas both school shooters and students of concern frequently leaked their intent to others, the warning behaviors of pathway, fixation, identification, novel aggression, last resort—and to a lesser degree, energy burst—distinguished the school shooters from those who showed no evidence of intent to act, and were suggestive patterns for high risk cases, especially in combination, although this latter assertion has been untested. Directly communicated threats may be a negative correlate for an attack to be carried out in some cases; however, 11% of the attackers did communicate a direct threat. This is a similar finding to the public figure

attack research (Meloy et al., 2008), but all direct threats should be taken seriously, especially given the contemporary work of Warren et al. (2014) concerning homicidal threats. The interactive and contingent nature of the warning behaviors typology may be operationally useful for single case assessment, but needs to be statistically tested with larger samples and more sophisticated decision-tree and regression statistical analyses.

Limitations

Our samples were very small and all findings in this study should be treated as preliminary. Our study was subject to Type I error (false positive), although we attempted to control for this by using Fisher's exact test for very small sample sizes in contingency tables—and in fact, found large effect sizes. Also, the researchers who coded the warning behaviors were not blind to whether the samples were students of concern who did not intend to act or school shooters, and there were no interrater reliability coefficients, only consensus, for assignment of warning behaviors due to the small sample size. The frequency of warning behaviors of directly communicated threat and leakage among the students of concern may have been inflated and contaminated due to their functioning as both independent (often the warning behaviors that prompted initial concern) and dependent variables—although neither discriminated between the groups and therefore are not operationally relevant, except for investigative points of entry. The samples were not matched on other variables, which may have influenced the presence or absence of warning behaviors, such as age and gender; and there may have been variables unknown to the researchers that also affected the frequency of warning behaviors. Most subtle is the possibility of other normal cognitive biases, such as confirmatory, availability, observational, and retrospective (hindsight) biases, and the heretofore mentioned concept of apophenia— the human tendency to see patterns where none actually exist. All these cautionary notes beg for further testing of the warning behaviors typology to see if these findings can be replicated (Ioannidis, 2005).

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