White-Hat Hacking the TRAQ Methodology

By James Komen

Many people are familiar with the term "hacker" as it relates to someone who seeks to wreak havoc on computer systems. But not as many people are familiar with the more positive connotation of hackers. That is, making an important distinction between a black-hat hacker and a white-hat hacker. A black-hat hacker seeks to find system weaknesses out of malice—for selfish gain or with the intention of causing harm. A white-hat hacker works to anticipate such system weaknesses, with the intention of informing users and improving the system or how it is implemented.

In this article, I play the role of a white-hat hacker for the widely accepted Tree Risk Assessment Qualification (TRAQ) methodology. I will explore and describe the ways in which the outcome of a tree risk assessment can be distorted, either accidentally or intentionally. My intention is to aid readers of risk assessment reports and users of this methodology in reviewing or performing risk assessments with a critical eye.

Separating Targets

Target assessment requires assessors to identify targets: people who could be injured, property that could be damaged, or activities that could be disrupted. Targets are often grouped based on similar characteristics. For example:

1) The likelihood of impacting *any* person on the sidewalk, not *one specific person* (e.g., the chance that the tree will impact John).

2) The likelihood of impacting *any* parked vehicle, not *one specific car* (e.g., the chance that the tree will impact John's car).

3) The likelihood of impacting *any* structure (e.g., the chance that the tree will impact either John's house or his neighbor's house), instead of *one specific structure* (e.g., the chance that the tree will impact John's house).

But when target groups are separated, the likelihood of impact may be significantly lower. It may sound silly to perform a risk assessment for just John (Example 1) or his car (Example 2), but risk assessments are often performed on a tree between two houses where the direction of fall is not known.

If an individual were to assess the likelihood of impacting *any* house, the likelihood of impact would be *high*, because regardless of which way the tree falls it will impact a structure.

If an individual were to assess the likelihood of impacting the eastern house and the western house separately, then each house would have a *medium* likelihood of impact—the tree is as likely as not to impact one of the given houses, because the direction of fall is not known.

Let's suppose, in this scenario, that the whole tree had a *possible* likelihood of failure, and the consequence of impacting a house would be *significant*. With the two houses combined as one target, the overall risk rating for the tree would have been *moderate*. However, by separating the targets, the risk rating for the tree becomes *low*.

Separating targets can be done temporally as well as spatially. In the previous example, the targets were separated spatially (adjusting the risk rating from *moderate* to *low*). For a temporal example, let's consider a road used by both trucks and passenger cars. If the targets were aggregated into the likelihood of impacting *any vehicle*, the likelihood of impact rating may be higher than if they were split into the likelihood of impacting a passenger vehicle and the likelihood of impacting a truck. (There may even be traffic studies to support the data on vehicle occupancy rate!)

Similarly, consider a frequently-used path that is shared by cyclists and pedestrians. If cyclists and pedestrians

Likelihood of Failure	Likelihood of Impact			
	Very Low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Likelihood matrix, combining likelihood of failure with likelihood of impact.

are aggregated into the likelihood of impacting *any person*, then the likelihood of impact rating may be *medium*. However, if the targets are separated into the likelihood of impacting a cyclist and the likelihood of impacting a pedestrian, then the likelihood of impact rating of both of the individual targets may be *low*. In changing how targets are grouped, the outcome of the risk assessment may be changed.

Separating Tree Parts

A similar hack can be performed by separating tree parts.

During the data collection phase, the risk assessor must identify conditions of concern in the tree. In many cases, the condition of concern refers to multiple tree parts combined for relevance. For example, the assessor may evaluate the likelihood of failure of "a dead branch" instead of "*the dead branch on the eastern side of the canopy at a height of 20 feet (6.1 m)*." This distinction is important. The former refers to any dead branch that could potentially fail, while the latter refers to a specific dead branch.

Aggregating tree parts can be an important part of the process of producing relevant results. A risk manager doesn't care *which* dead six-inch (15.24 cm) branch will fail and hit a person. He or she wants to know the likelihood of *any* dead six-inch branch failing. Therefore, in a canopy with many dead or overextended branches with similar characteristics, the risk assessor may combine the tree parts.

Separating these tree parts may result in a distortion of the tree risk rating. For example, there may be a *probable* likelihood of *any* branch failing within the specified time frame. But for a specific branch, the likelihood of failure may be *possible*. The lower likelihood of failure results in a lower risk rating, too.

Separating tree parts does not have as large an effect as separating targets because tree part failures are not mutually exclusive in the way that target impacts are. The failure of multiple tree parts may be related. For example, the branch at 20 feet *and* the branch at 30 feet (9.14 m) could *both* fail within the specified time frame. In contrast, separating targets is more egregious because of mutual exclusivity of the events. If the tree falls to the east, it won't also fall to the west.

Changing Time Frame

The likelihood of failure of a tree part does not have relevance without an accompanying time frame. An assessor must specify the period of time for which the likelihood of failure is being defined. An example of the importance of time frame is given in the TRAQ training course. Asking for the likelihood of failure of a seemingly defect-free tree, it gives the unexpected answer of *probable*, and then qualifies it: *within the next 100 years*. It then gives the expected answer of *improbable*, qualifying it: *within the next 1 year*. The lesson is that choosing a relevant time frame is essential to making meaningful judgments with risk assessment.

Choosing a relevant time frame can be challenging in some assignments. It is supposed to be determined by the tree risk manager, but it is often chosen in consultation with or by the tree risk assessor. A shorter time frame can turn *probable* into *possible* and *possible* into *improbable*. A longer time frame can turn an *improbable* tree failure into *possible*.

Suppose a client asks a risk assessor for advice on selecting a time frame for the risk assessment of a tree growing in front of a house the client is in escrow to

A tree growing between two buildings where the direction of fall is not known. It has a *high* likelihood of impacting *at least one structure*, but it may only have a *medium* likelihood of impacting *one specific structure*.

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Risk rating matrix, combining likelihood of failure & impact with consequences of failure.

purchase. A relevant time frame may be one year, but it may also be three years, five years, or even more! The client may plan to live in the home for many years, and while the tree may have an *improbable* likelihood of failure in the next year, the tree may have a higher likelihood of failure over a longer time frame. Choosing a longer time frame may result in a higher risk rating and may change the risk manager's ultimate decision of how to mitigate the risk.

Risk ratings can also be distorted by separating the time frame into smaller intervals. Consider a tree with a *probable* likelihood of failure within the next one year, a *high* likelihood of impacting a structure, and *severe* consequences of impact. Now suppose that one of the proposed mitigation strategies is to retain and monitor the tree at weekly intervals. The risk assessor could potentially assess risk posed by the tree over the next one-week time frame. At the subsequent inspection, the risk assessor could re-assess the risk posed by the tree over the following one-week time frame. Each shortened one-week period of time would have a lower likelihood of failure than the aggregated time frame of one year. The likelihood of the tree failing within one week may be rated as *possible* or even *improbable*, resulting in a lower risk rating, even without performing any physical mitigation work on the tree.

Conclusion

Several different hacks can significantly change the outcome of a tree risk assessment, with potentially significant management outcomes. Separating targets spatially or temporally can reduce their individual likelihood of impact ratings. Separating tree parts can reduce their individual likelihood of impact ratings. Adjusting the time frame can have the dramatic effect of either increasing or reducing the likelihood of failure rating. To readers of risk assessment reports: read with a critical eye and be aware of potential distortions in the reporting outcomes. To writers: be aware of these potential pitfalls and avoid them in your practice.

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Photography courtesy of the author.