Sexual Assault and the Brain

Understanding the brain under attack, and implications for justice and healing

Jim Hopper, PhD

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"Reflexes and Habits" Is Much Better Than "Fight or Flight"

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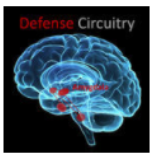

In Most Sexual Assaults, "Defense Circuitry" Runs the Show

We need to know this circuitry and its impacts, even if it doesn't sound as cool as "amygdala."

The Brain Under (Sexual) Attack

Is the brain's response to being attacked basically the same, whether the attack is a sexual assault, physical assault, or enemy fire in military combat?

https://www.psychologytoday.com/us/blog/sexual-assault-and-the-brain/201712/the-brain-under-sexual-attack

The Brain Under (Sexual) Attack

Why people don't fight, why memories are fragmentary – and some big implications.

Jim Hopper, PhD – December 14, 2017

Why don't many people fight or yell during sexually assaults, even rapes? Why are their memories so often fragmentary and confusing?

Is the brain's response to being attacked basically the same – whether it's sexual assault, physical assault, or enemy fire in military combat? Can sexual harassment also be stressful enough to significantly impact brain functioning?

The answers to these questions have huge implications for people who've been attacked sexually, for those who investigate, prosecute and adjudicate such crimes, for policy makers, and for everyone who knows or works with someone who's been sexually assaulted or harassed.

But do we really need to focus on the brain? Can't we just believe survivors, or at least conduct really good investigations, without knowing about the neurobiology of stress and trauma? In theory, maybe, but often the ways people report reacting to assaults can be baffling, even totally opposite of what we'd expect, and their memories can sound confused or unbelievable. Once we understand how the brain works when it's under attack, those behaviors and memories make much more sense.

That's why many sexual assault survivors, police officers, and prosecutors are finding that understanding what's happening in the brain during an assault is extremely clarifying and helpful. For many, it's a revelation that completely transforms how they understand, investigate, and prosecute sexual assaults.

Still, some fear that focusing on the brain can obscure important social and power dynamics. Of course, neurobiology doesn't explain everything about survivors' behaviors and memories. Yet understanding how human brains respond when attacked sheds light on accounts of sexual assault that – *because* of social, cultural, and political ignorance, oppression, and polarization – have been misunderstood and dismissed for far too long.

I find that by focusing on the brain, and staying grounded in the science, I'm able to point out practical implications and new practices that can truly change lives, institutions, and ultimately cultures. At least that's the feedback I've been getting for years now, and not only from feminist activists but also from police officers, military commanders, and many others.

Let's return to those key questions about why many people don't fight or yell, why memories can be fragmentary and incomplete, and whether those are totally normal brain-based responses. The answers,

it turns out, are the same in every culture. Around the world, the most common responses of people being sexual assaulted are basically the same.

Why? Because evolution sculpted them into our genes and brains – long before we were sophisticated enough to create cultures, long before we began to misunderstand and misjudge people with our culturally embedded beliefs about how women and men "should" respond during sexual assaults and remember them later.

This blog will introduce key "brain circuitries" affected by sexual assault (and military combat and any major attack or stress). I'll explain how stress and trauma can rapidly and massively alter brain functioning, for example impairing rational brain regions, leaving only reflexes and habits. I'll explain how stress and trauma can alter the way memories are encoded and stored, and why effective trauma-informed investigative interviewing methods are essential to treating victims justly, conducting fair investigations, and holding perpetrators accountable.

And of course, given the revolution and wrenching questions we're all confronting just about every day now, I'll shed light on issues dominating the headlines and blowing up in readers' private lives.

Wherever you're coming from, and whatever you're trying to learn, or do, about sexual assault, I hope I've piqued your interest and that you'll find my blog enlightening and useful.

For now you can learn from what I've already shared online, including Sexual Assault & the Brain on my website, pieces published by *The Washington Post* and *Time* on Why many rape victims don't fight or yell and Why rape and trauma survivors have fragmentary and incomplete memories, and my in-depth but highly-engaging YouTube video, Neurobiology of Trauma & Sexual Assault.

In Most Sexual Assaults, "Defense Circuitry" Runs the Show

A key to understanding and supporting survivors, and doing great investigations

We need to know this circuitry and its impacts, even if it doesn't sound as cool as "amygdala."

Jim Hopper, PhD – December 19, 2017

When I teach military professionals the basic neurobiology of sexual assault trauma, I'm mainly connecting the dots and turning on those proverbial light bulbs in their heads.

They already know that people respond to gunfire and explosions with reflex and habit behaviors (hopefully effective habits learned in combat training). Most already know, all too well from their own combat experiences and after-action reviews, just how incomplete traumatic memories can be.

When it comes to sexual assault, though, many haven't yet thought about this: Thanks to how our brains evolved, people respond in the same basic ways to an acquaintance sexually assaulting them as they do to enemy fire and, going back to where it all started, to being attacked by a large predator that's hell-bent on eating them.

Natural selection has given our brains a *defense circuitry* to defend against all manner of attacks and high-stress situations. And that circuitry is running the show during most sexual assaults, just as it is during military combat and other experiences of attack or extreme stress.

A few clarifications: Not every sexual assault, as it's happening, involves severe stress or trauma. But most do, as do many experiences of sexual harassment, and that's what I'm focusing on here. Second, the brain isn't a computer, but most neuroscientists see it as composed of "circuitries" (or "networks"), that is, collections of brain areas that work together to perform certain functions. Third, the old term "fear circuitry" is on the way to being replaced by "defense circuitry," because different brain circuitries underlie subjective experiences (e.g., feeling afraid) and objective behaviors (e.g., freezing), and because researchers can't ask animals if they're afraid but can certainly measure defensive behaviors and brain activity.

You may not have heard of the defense circuitry before, but you've probably heard of the amygdala. It's a small, almond-shaped part of the brain with subregions that receive and send information from and to many other brain areas and circuitries. Contrary to conventional wisdom, the amygdala is not the brain's "fear center." New research shows it may not even detect threats. The amygdala can, however, have big impacts on stress-related behaviors and memories, and it's definitely a key component of the defense circuitry.

So let's remember the "defense circuitry," even if it doesn't sound as cool as "amygdala."

Importantly, we don't need to know exactly which parts of the defense circuitry perform exactly which functions and have exactly which effects on behavior and memory. (Neuroscientists can worry and fight about those details. If you're interested, the references below give entry into recent debates.)

It's much more helpful to know some key facts: The defense circuitry is always on, scanning for danger. When an attack is detected or stress is high, it can rapidly dominate the brain, including by impairing the rational prefrontal cortex and by controlling attention, shifting behavior to reflexes and habits, and determining what gets into memory.

For example, as I'll explain in a future post, research on animals and humans has shown that stress shifts the brain to dependence on behaviors of the habit circuitry. Again, this is something the military totally understands, and why combat training involves repeatedly loading, cleaning, and firing weapons and repeatedly practicing combat tactics, so those behaviors get burned into the habit circuitry.

Once we've absorbed these key facts about the defense circuitry, we won't be surprised when an intelligent woman says it never occurred to her, while being raped, to yell for her roommate. We'll know it's likely that her prefrontal cortex was impaired. We won't be surprised if a Navy recruit, while being held down and sodomized in a "hazing incident," responded just how he always did when his stepfather beat him up. We'll know that his brain's defense circuitry is perfectly capable of cueing up, in a flash, those old habits of submission.

Nor will we misjudge a woman who, while held down on a bed in a state of confused terror, fell back on polite habits she has long used to successfully resist unwanted advances from men who *aren't rapists*. When she recalls repeatedly saying, "My boyfriend will find out," until finally collapsing in defeat, we won't be puzzled by the apparent disconnect between the words she was speaking and the shock and fear she was feeling. We won't assume from her polite words that, "actually," she had "mixed feelings" at the time, and only later "called it rape" because she was afraid her boyfriend would find out.

Instead, we won't make such assumptions. If we're an investigator who understands these things, we'll ask non-leading and non-judgmental questions, listen with genuine curiosity and willingness to learn something new about how people can respond to sexual assault, and then objectively piece together her recollections with all of the other available evidence.

A key moment in most sexual assaults, when the defense circuitry begins to dominate the brain.

Outdated approaches to investigating push survivors for sequential narratives, even when their memories aren't recalled that way. They expect accounts of clearly rational and strategic behavior in the midst of being attacked. They lead to misunderstanding what happened, re-traumatizing survivors, and letting perpetrators get away with it (and do it again).

In contrast, investigators who understand how brains function in traumatic situations listen for the moment the attack was detected by the victim's defense circuitry, perhaps accompanied by a brief "freeze" response. They

know that's a key moment in most sexual assaults, when brain functioning suddenly and radically changes, with major consequences for thinking, behavior, and memory. They understand why only *some* details of the experience (e.g., "central details" the defense circuitry gave the most attention and significance, whether a hand on the throat or a spot on the wall) were burned into memory, while other details (that were "peripheral" for the victim but may be central to the investigation) never got encoded or faded soon thereafter.

In summary, knowing what happens when the defense circuitry detects an attack and rapidly dominates brain functioning enables us to have *realistic expectations* about victims' behaviors and memories. We can understand that those behaviors and memories, however confusing and implausible they may seem at first, are normal, brain-based responses to being attacked, whether sexually or physically, by an enemy or anyone else. And we can respond to every account of someone reporting sexual assault with a mind and heart that are well-prepared, compassionate, and truly objective, not prone to misinterpretations and misjudgments of their behaviors and memories.

In my teaching I've found that, along with survivors of sexual assault, military professionals and police officers are the quickest studies. Because they too have *experienced* what happens when their defense circuitry runs the show, they can suddenly connect all kinds of dots they'd never connected before.

In future posts I'll explain all of this in more detail and unpack those bullet points on the left. In the meantime, you can check out Sexual Assault & the Brain on my website, my brief writings on why many sexual assault victims don't fight or yell and have fragmentary memories, and my engaging in-depth video, Neurobiology of Trauma & Sexual Assault. (All published before the most recent amygdala research and before I replaced "fear circuitry" with "defense circuitry.")

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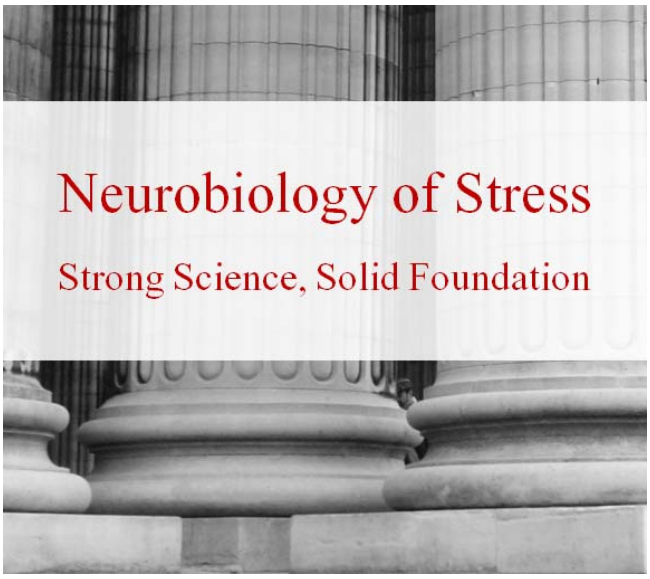
Sexual Assault and Neuroscience: Alarmist Claims vs. Facts

The science is strong, a solid foundation for trainings and fair investigations.
A misleading article in *The Atlantic* provides an opportunity to clarify key facts about the well-established neurobiology of stress and trauma.

Jim Hopper, PhD – January 22, 2018



As a psychologist who has researched the neurobiology of trauma and regularly teaches military and civilian police and prosecutors, higher education staff and others, I can expand a public conversation started in *The Atlantic* the unfortunately titled and highly misleading September 2017 story, "The Bad Science Behind Campus Response to Sexual Assault." In fact, the science on the neurobiology of stress and trauma is actually quite good, and the real issues are how that science is taught to university staff who aren't scientists and how they, in turn, apply that teaching on their campuses.

There are two parts to author Emily Yoffe's misleading discussions of neuroscience, one on sexual assault victims' behaviors and the other on their memories, and I address both here. For each, I begin with *realities* of sexual assault – realities known all too well by millions of people who have been sexually assaulted, and by victim advocates, clinicians, and investigators who truly listen and have been documenting them for decades. Then I cite well-established science on the neurobiological causes of those realities.

Whether or not you've read the article, this post will bring clarity to issues that Yoffe has clouded with confusion and alarmist claims.

Let's start with realities of how people often respond to sexual assaults that are extremely stressful or traumatic as they are happening. People respond just as they do to many experiences of military combat and police shootings – with mostly reflex and habit behaviors, not rationally chosen ones.

Reality: Reflex Responses

One extreme reflexive response that, contrary to the article's claim, people definitely experience is *tonic immobility*. It's a fear-based state of rigid paralysis, which can render one mute as well (and is very different from the transient *freeze* response associated with detection of attack). While research is still accumulating on how often tonic immobility occurs during sexual assaults, much is known about what

can trigger it, like being pinned down and terrified. And we know from direct reports that it happens to soldiers too, even if they're less likely to tell anyone.

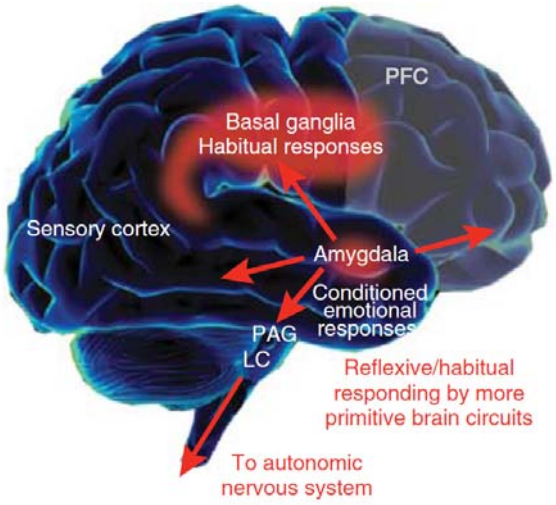
Sometimes people experience *collapsed immobility*, a different survival reflex that sends heart rate and blood pressure plummeting. The brain's loss of oxygen brings on faintness or even passing out as the body goes limp. Again, extreme fear and physical restraint, both features of some sexual assaults, can release this evolutionarily old response. (A brief *YouTube* video shows someone going in and out of this terror-triggered state on an amusement park ride.)

In 2015, the *Harvard Review of Psychiatry* published a thorough review of behavioral and neuroscience research on tonic and collapsed immobility (and freezing) in animals and humans. That peer-reviewed article includes multiple examples of how people have experienced those extreme reflex responses, drawn from lead author Kasia Kozlowska's many years of clinical work, and references over 200 scientific publications, including many neurobiological studies.

Of course, the reflexive "cornered animal" response also exists, and people sometimes respond with "fight or flight" behaviors that may thwart a sexual assault. But many don't – and not because there's something wrong with them or they're to blame, but simply because of how brains respond to being attacked.

Reality: Habit Responses Are Very Common

As I've been teaching for years, although some people go into those extreme survival reflexes, the more common brain-based reactions during sexual assault (and military combat) are *habit* responses. Again, let's start with the realities and then address the science.



Stress shifts brain functioning to habits and reflexes. Image from review by the world's leading researcher on the topic (see Arnsten 2015 in references).

Habit responses may include effective ways of fighting or fleeing, perhaps first learned in battles with siblings or on the playground. But the habit behaviors that emerge during sexual assaults are commonly passive ones, which can avert additional violence or retaliation, but tend to be ineffective at stopping assaults.

For example, habits of submission learned from childhood experiences of sexual, physical, or emotional abuse can suddenly reappear when a perpetrator becomes violent or ignores yet another clearly implied or unmistakable "no." Especially common are habitual behaviors socialized into girls and women for nicely saying "no" to unwanted advances, or for clearly sending that message without actually saying "no" (to avoid hurting feelings or incurring wrath). Also common during sexual assaults are habits we've all learned for politely dealing with aggressive people, especially those with power over us.

Such habits for saving face and moving on may help with navigating a relatively safe workplace or fending off a pushy date, but are unlikely to prevent or end a sexual assault. (Effective habits learned from self-defense or "resistance" training may reduce the odds, but are no guarantee: more ingrained habits may still take over, just as a well-trained soldier, in that first real battle, may assume the same fetal position he did during brutal childhood beatings.)

The Shift to Reflexes and Habits Is Well-Established Neuroscience

There is *very solid science* on how stress, such as that of being sexually assaulted, can impair the rational prefrontal cortex and leave the brain dependent on such reflexes and habits. Amy Arnsten, an influential Yale neuroscientist and the world's leading researcher on the topic, reviewed much of that science in 2009 and 2015.

Just two months ago, Arnsten wrote, "Stress tends to promote simple decision-making strategies that depend on ingrained habits, at the expense of more thoughtful, goal-directed actions," and, "Uncontrollable stress flips the brain from a more 'reflective' state, mediated by the more recently evolved PFC [prefrontal cortex], to a more 'reflexive' state, mediated largely by subcortical structures." European neuroscientist Lars Schwabe recently published a review focusing, in part, on how stress shifts the brain to habit behaviors. Not only is the science strong – it keeps getting stronger.

Reality and Neuroscience: Fragmentary Memories

Now let's address the other focus of the *Atlantic* article. Do *fragmentary memories* of sexual assault exist? Are there well-known brain bases of those too?

Unfortunately, the author confusingly entangles the issue of memory fragmentation with the issue of accuracy and the scientifically irrelevant red herring of "recovered memories." While a full clarification of her distortions is not possible here, it's critical to understand two key points.

First, fragmentary memories definitely exist, as the author admits when she acknowledges that military personnel *might* have them due to stress hormone effects "in conditions of the most extreme stress." In fact, military commanders hear them *all the time* in subordinates' combat after action reports, where different collections of fragments are like the proverbial hands on different parts of the elephant. In reality, police and district attorney investigators *routinely* contend with the fragmentary memories of police officers involved in shootings, as do the attorneys who defend them in court.

Are we to believe that the brains and memories of survivors of sexual assault, on campus or anywhere else, are fundamentally different from those of people serving in the military and law enforcement?

Second, we have a pretty good understanding, including from the extensive neuroscience literature, of *how* stress can cause incomplete or fragmentary memories. Lots of research shows how stress can enhance memory for details close to the onset of stress and then impair it for details that come later, as reviewed in depth by Diamond and colleagues in 2007 and Schwabe in 2017. Many studies have shown that "central details," which had the most attention and significance at the time, can be strongly encoded and stored, while "peripheral details" may not get into memory and, even if they do, may fade quickly or be recalled inconsistently.

Fragmentary Memories Should Be Expected

Such gaps and inconsistencies are normal, especially when a victim's central details seem peripheral to an investigator, and vice versa. As shown by a realistic and disturbing scene from *Mad Men*, a person may reflexively "check out" (or dissociate) from the terrible body sensations of being raped and focus on a sofa across the room or the sounds of traffic on the street below. Later, when asked for details of what the perpetrator did after he began raping her, she may draw a blank, recall details incompletely, or recall some (peripheral) details inconsistently.

Such gaps and inconsistencies should be *expected*, especially when investigators or attorneys ask leading and "gotcha" questions about peripheral details that sexual assault victims or police officers weren't focused on at the time. *Was his hand on your face or your neck when you claim he was raping you? That's not what you said before reviewing the body cam video of you shooting that innocent man, is it?*

Remembering always involves reconstruction and is never totally complete or perfectly accurate. Such gaps and inconsistencies are simply how memory works – *especially* for highly stressful and traumatic experiences like sexual assaults and shootings, where the differential encoding and storage of central vs. peripheral details is the greatest.

Such gaps and inconsistencies are never, on their own, proof of *anyone's* credibility, innocence, or guilt.

(Alcohol can prevent storage of peripheral details, and at higher levels of impairment central details too, and in blacked out or passed out states all is lost. But as with stress, there's no scientific basis for assuming the inaccuracy or accuracy of any details that do survive alcohol's effects.)

How the Neuroscience Is Taught and Used

Finally – and most importantly, given the polarized politics of campus sexual assault – it's vital to clarify what Ms. Yoffe is actually trying to critique in her article.

Contrary to her story's title and subtitle, Yoffe does not discredit or even assail the well-established neuroscience on how severe stress and trauma can, in fact, "impede the ability to resist or coherently remember sexual assault." Instead, she raises concerns about the *teaching* of that science to campus staff, police, and others who are striving for best practices in responding to reports of sexual assault.

She also raises concerns about how that teaching – or rather, an extremely selective and harsh characterization of one particular person's past teaching – has been received by campus staff and put into practice. There, she offers only anecdotes and alarmist claims to suggest that some problems with some practices are creating widespread harm on campuses across the country.

Flawed as the argument and article are, we can thank the *Atlantic* for providing an opportunity to clarify some key facts. And like my colleagues who teach "the neurobiology of trauma" to campus staff, police, military commanders and other professionals, I welcome constructive suggestions for improving how I teach the established and growing science on stress, behavior and memory, and the practical implications of that science for sexual assault investigations and campus, civil and criminal proceedings.

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Freezing During Sexual Assault and Harassment

Three brain-based responses, keys to understanding experiences and behaviors.
Understanding the neurobiology of freezing can be very helpful – in making sense of one's own experiences, supporting others, and investigating or prosecuting.

Jim Hopper, PhD – April 3, 2018

People often say "I froze" when trying to describe or explain why they didn't fight or flee during a sexual assault – or school shooting, military ambush, or very stressful experience of sexual harassment.

At first glance "freezing" seems like a simple enough idea. It's a common word with a meaning that we seem to grasp right away, because it conveys what *wasn't* done.

Yet what's meant isn't always clear, and scientists have discovered not only complexity, but *active brain processes* underlying freeze responses. (As I'll discuss in another post, scientists distinguish freezing from other states of immobility under attack, including "tonic immobility," in which one can't move or speak despite trying to do so.)

We needn't make things too complex or simple, but we can understand different forms of freezing and the basics of their neurobiology. Then, by applying that knowledge to sexual assault and harassment, we can better understand the experiences of those who've frozen.

In this way, greater clarity can help promote healing and justice: supporting survivors, conducting fair and effective investigations, and increasing the odds of holding perpetrators accountable.

Defense Circuitry in Control

As I've explained before, the brain's "defense circuitry" is a network of regions that constantly scans incoming sensory information for signs of danger and, once an attack is detected or stress otherwise escalates, can rapidly dominate brain functioning.

That circuitry includes the amygdala and several other structures (e.g., specific brainstem areas). That's why it's called a *circuitry*. And it can trigger many responses in the brain and body – much more than could ever be conveyed by the phrase "fight or flight" (or the newly popular "fight, flight, freeze").

Some of those brain responses are part of *any* reaction to danger and being attacked, including all freeze responses. Others are unique to particular types of freezing.

Three Types of Freezing

Scientists broadly define *freezing* as a response to threat characterized not only by immobility, but also *inhibition* of behavior. In the laboratory researchers evoke freezing in different ways, some involving the ability to escape and others inescapable. (To dig into the leading research, use the references below.)

By reading the scientific literature closely, and listening carefully to people describing responses they've had to sexual assault, severe harassment, and other attacks, it's possible to differentiate three types of freezing: *detection*, *shocked*, and *no-good-choices*.

As we'll see, someone who says "I froze" may have experienced one, two, or all three forms. And for neurobiological reasons, if more than one happens, they typically unfold in a set order.

Detection Freezing

In sexual assaults and severe harassment there's often a critical moment when the attack is detected and brain and body instantly and automatically enter a completely different state.

In detection freezing, movement instantly stops and brain and body are primed to receive potentially life-saving information.

Up to that point, the person may have experienced what was happening (even if it was unpleasant, unwanted, and somewhat stressful) as basically normal and consistent with their expectations of how things go in such situations: how people tend to kiss and touch each other in (awkward) romantic situations, how pushy dates can act, and how boorish bosses can be inappropriate.

But then something happens that flips the script or massively escalates the stress, and the brain's defense circuitry not only detects an unexpected *attack*, but automatically and involuntarily triggers strong brain and body responses.

This is *detection freezing,* and to describe it people often say, "I froze for a second."

I've heard accounts of this freezing response many times, like anyone else who talks with people who've been sexually assaulted or severely harassed. I've encountered it as an expert for legal cases, in police reports and in recordings and transcripts of investigative interviews. Military and law enforcement personnel report this freeze response too, especially to ambushes and other unexpected attacks.

People can have this detection freeze response at different times – some when they first sense something's wrong, before clear aggression, and others not until the fourth or fifth time their resistance is ignored or overpowered. It can happen when an arm is grabbed, a shirt forcibly unbuttoned, or a rapist flashes a look that says, "You can't stop me." Or when someone getting a massage is inappropriately touched the first or second (definitely-no-accident) time.

The potential triggers are limitless, but the detection freeze response is basically the same: Instantly and involuntarily, sometimes with a jolt, everything stops and everything changes.

This response can be fleeting, and may not be recalled later – at least not initially, especially if more disturbing experiences happened right before and afterward, or the person is generally avoiding bad memories. Often investigators don't ask the right questions, or even know it's a common response and a key moment in many sexual assaults. (It's a key moment because – from then on – brain, body, attention, thinking, behavior, and memory processes are all dramatically altered in particular ways.)

The detection freeze response doesn't happen in every sexual assault or incident of severe harassment, especially if escalation and recognition unfold gradually. But when it does, a variety of other brain-based processes tend to follow.

Stopping Behaviors and Thoughts

Obviously the detection freeze response involves stopping all movement (aside from breathing and visual scanning). That's why it's called *freezing*.

Immobility helps prey avoid the attention of predators. Just as importantly, stopping whatever behaviors were happening just before attack was detected also makes room – literally, in terms of brain network functioning – for *new and unplanned* behavior options that could prevent injury or death.

Over millions of years, evolution sculpted a specific defense circuitry pathway which carries out that stop-movement or "behavioral inhibition" component of freezing.

Simultaneously, the defense circuitry also instantly stops any *thought processes*. Research suggests this happens via rapid chemical and electrical changes in regions underlying verbal and visual thinking.

Those sudden cessations of behavior and thought can be understood as a "network reset" (which is initiated by a brainstem area, the locus coeruleus). That reset prepares the brain to receive new and potentially life-saving information – and generate options for responding to it.

Shocked Freezing

The sudden stopping of all movement and thinking may last a fraction of a second, a couple of seconds, or even longer. When it lasts a couple of seconds or less, that's the detection freezing response.

But when it lasts *longer* than a couple of seconds, additional brain processes are involved, and it's a big deal. People tend to remember it.

Shocked freezing, which often immediately follows detection freezing, is a massive "reset." The mind is blank and no behavior options are being generated (yet).

That's why many people who've been sexually assaulted or severely harassed say that, at some point, "I was in shock" or "My mind went blank," and of course, "I froze." Again, some military personnel and police officers say the same things about having frozen in this way (although understandably they seldom admit such things).

I've named this remarkable, disturbing, and memorable state the *shocked* freeze response.

It usually comes right after the detection freeze response, as a continuation of that "network reset" – and a massive amplification of it. For several seconds a person may feel shocked, dumbfounded, their mind utterly blank, at a loss for words and actions. Trying to describe it later, people say things like, "It made no sense," "It just didn't compute," "I couldn't even think," or "I had no idea what to do."

Basically, in this form or phase of freezing, no options for responding even arise in the brain or awareness. It's not that people experience themselves as having options but can't decide among them (we'll get to that). Instead, their brains, at least for a time, are literally *not generating* any behavior options to choose from, let alone execute.

Research suggests that the strength and length of this shocked freeze state depend on how much norepinephrine the defense circuitry (i.e., its locus coeruleus) has just released into brain regions that generate thoughts and behaviors.

Whatever the exact brain causes, it's a helpless and horrifying state of being, especially when unwanted and disturbing things are being done to one's body.

It's a state that people commonly describe later as having been "frozen." And like the other two freeze responses, it's a state that can be listened for, explored with non-leading questions, and put together with other information and evidence – whether to conduct a more effective investigation or simply to validate the experience of someone who feels safe enough to share it with us.

Co-Activating the Autonomic Nervous System

I hope you're appreciating this fine-grained analysis of what often happens in the first few seconds after freezing has been triggered by a sexual assault or other attack. It gets more interesting and illuminating.

As movement and thought cease and brain networks are reset, the defense circuitry simultaneously activates the autonomic nervous system by slamming on its sympathetic "accelerator" and its parasympathetic "brake." Scientists call this a "co-activated mode of autonomic control." (The parasympathetic brake is almost always on to some extent, not just during rest and relaxation – otherwise we'd have resting heart rates of around 110 beats per minute.)

The parasympathetic (vagus) nerve has an insulating sheath (of myelin) that speeds its input to the heart. So when detection freezing kicks in, parasympathetic input is the first to reach the heart, and when it does it *slows it down*. Once the sympathetic signal finally arrives, over a second later, the heart still doesn't speed up much, if at all, as long as that parasympathetic brake stays engaged.

In all forms of freezing the parasympathetic branch plays a dominant role. The heart massively accelerates only if the defense circuitry (i.e., the amygdala's central nucleus) *releases* that super-fast parasympathetic brake, letting loose full sympathetic activation and surges of oxygenated blood to the muscles.

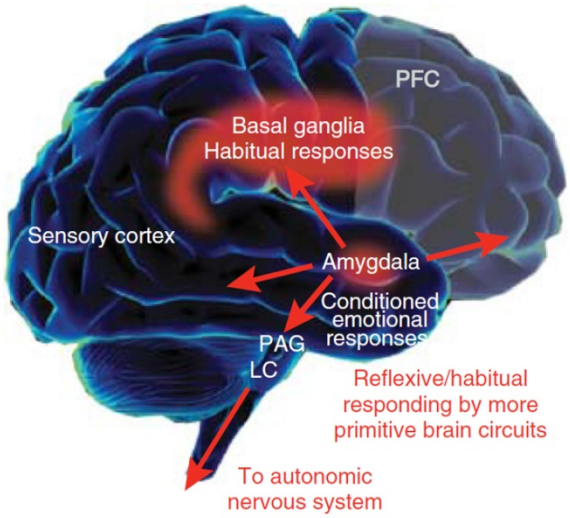
If you're heading for a deer in your headlights and the deer's brain doesn't snap out of it and let off that parasympathetic brake in time, there's going to be a crash. And if you're in shocked freezing during a sexual assault, your brain is *not* cueing up defensive behaviors, let alone unleashing them while yanking off the autonomic brake.

If you're in shocked freezing, that assault is going to continue, and later you're likely to say, "I froze."

(What about that "adrenaline surge" people talk about? It takes much longer, 2-3 minutes from attack detection or stress onset for the adrenal glands to release adrenaline into circulation and reach the heart with another wave of sympathetic activation on top of the sympathetic nerve's direct input. Thus any adrenaline surge has nothing to do with detection freezing, which kicks in instantly, or shocked freezing, which happens within a second or two.)

Impaired Prefrontal Cortex

So the defense circuitry stops all behavior and thought, and slams on the autonomic accelerator and dominant brake. In addition to all of that, it's also simultaneously unleashing a surge of stress chemicals that can rapidly impair the brain's rational prefrontal cortex.



With an impaired prefrontal cortex, only very simple thoughts arise, about reflex and habit responses that are extremely reactive or passive. (Image from Arnsten 2015; see references.)

To engage in rational thinking our brains must draw on memories and plans, weigh options, and make informed decisions. But that takes time – precious time that could mean life or death in dangerous situations. Evolution has selected brains that can quickly shift control *away from* the rational-but-slow prefrontal cortex and *to* fast-acting circuitries that run well-programmed habits and hard-wired reflexes.

Within just a few seconds of attack detection (or stress becoming extreme) the prefrontal cortex can be massively impaired, even effectively taken offline. That's why the military and police repeatedly train and drill. When they come under attack and their "rational brains" go out the window, *habits and reflexes are all that's left*. So their training must burn in *effective* habits they can access later (although even the best training is no guarantee).

That's also why, when thoughts *do* begin to arise again – after detection or shocked freezing have passed – they're usually *very simple* thoughts, not complex rational ones.

Not only that, they're usually very simple thoughts about *extreme behaviors* that the defense circuitry *has just cued up but not yet released into action* (just as it hasn't yet released the parasympathetic brake).

***No-Good-Choices* Freezing**

Many sexual assault survivors recall how, just seconds after registering the perpetrator's behavior as an attack or upon emerging from a brief state of shock, *their thinking was severely limited*.

They remember having few thoughts of any kind. They recall, "All I could think was…," and complete that sentence with a thought or two that – later, from the perspective of a relatively functional prefrontal cortex – seem remarkably simple, even useless or ridiculous.

Some remember being fixated on a *single* thought. All they could think was, "This can't be happening, this can't be happening…" or "It's almost over, it's almost over…" or "God please help me..." They had no other thoughts in their minds. Indeed, they had no ability to rationally *generate* and then *choose* from other thoughts (about how to respond effectively).

Other survivors find themselves thinking only of *two completely opposite responses* – both extreme and horrifying: Scream and bring people running to a humiliating scene in my dorm room vs. lie still and quiet. Jump off the massage table and run naked out the door vs. wait for the violations to end. Fight back and risk even worse violence vs. offer no resistance at all.

In short, an impaired prefrontal cortex leaves many people – whether within seconds of the initial detection freeze response, or upon emerging from the shocked freeze response, or otherwise being extremely stressed or terrified – with thinking that's been reduced to extreme lose-lose options, to "choices" that are *no real choices at all*.

This is the third form and often the final phase of freezing during sexual assault, severe sexual harassment, and other experiences of violence and trauma. For the reasons explained above, I call it *no-good-choices* freezing.

As explained in a 2015 article in the *Harvard Review of Psychiatry*, all freezing is "fight-or-flight put on hold." The *no-good-choices* freeze response, with prefrontal cortex impairment and fight-or-flight options cued up but on hold, corresponds to neuroscientist Karen Roelofs' phrase, "freeze for action."

What's held back from release into action? Habit behaviors and survival reflexes that have been automatically cued up by the same defense circuitry that's also impaired the prefrontal cortex (thereby ensuring that only habits and reflexes are available).

More *rational* and potentially *effective* thoughts and behaviors – assuming that any are possible, which is unlikely if the perpetrator is bigger, stronger, willing to escalate the violence – don't even arise as options in the brain or mind.

In no-good-choices freezing, with an impaired prefrontal cortex and only extreme options in mind, no resistance happens. It's a dark place and no one should be judged for getting stuck there.

Unlike well-trained soldiers, who learn effective habits from extensive combat training, most people being sexually assaulted *have no effective habits for responding*, because they've had no good self-defense training specifically for resisting sexual assault, especially by someone they know. With brains that have no effective habit behaviors to automatically call up and choose from, it's no wonder they do nothing.

Later, others may ask or think, "Why didn't you _____?" The answer: *Because it never even occurred to them.* Again, in response to that "why didn't you" question, sexual assault survivors commonly say, "I froze. All I could think was…," and complete that sentence with a simple thought or two about potential behaviors *that were not even good options*.

(Sometimes in no-good-choices freezing, the parasympathetic braking influence on the heart is outgunned by the sympathetic nerve and a late-arriving surge of adrenaline. People say things like, "my heart was pounding out of my chest!" or "I was in a total panic!" But even then, even if the parasympathetic brake came off, in no-good-choices freezing those cued-up extreme behavior options were *still* inhibited from release. The body was still "frozen.")

For these biological reasons, we should never expect people to behave rationally and strategically in such states. We shouldn't be surprised if they froze because they were stuck on simple thoughts about extreme behaviors that were either wildly over-reactive or totally passive.

Freezing Responses: Keys to Understanding Many Incidents of Sexual Assault and Harassment

Freezing happens in many sexual assaults and incidents of severe harassment.

In all three freeze responses, the brain's defense circuitry orchestrates massive shifts in brain functioning that have huge effects on experience and behavior. Later, attempting to understand and explain what happened, survivors say things like, "I froze," "I was in shock," and "All I could think was…"

In detection freezing, all movement and thinking suddenly stop. In shocked freezing, there's a blank mind and no behaviors to choose from. In no-good-choices freezing, the brain has cued up only extreme behavior options and there's little or no prefrontal cortex capacity for rationally choosing among them or coming up with potentially more effective ones.

Sure, some people immediately fight or flee when sexually assaulted or otherwise attacked. But many don't.

Many victims are suspended for critical seconds in frozen shock, with no thoughts at all – but plenty of terrible sensations bombarding them. Others are stuck with simple thoughts and useless "choices" of extreme behaviors – as the parasympathetic brake stays on, no decision is made, and no action is taken. In

many cases, *only after* one or more of these freeze responses does fight or flight happen, if either happens at all.

Like the brain of every survivor, every incident of sexual assault or severe harassment is unique, and people's responses can unfold in unique and complex ways. In the aftermath, it can be hard to figure out what happened, especially when memories are incomplete due to the effects of stress, trauma, alcohol or other drugs.

Confronted with that complexity, understanding the three different freeze responses can be very helpful – whether we're supporting some who's been sexually assaulted or harassed, trying to make sense of our own experiences, or investigating or prosecuting such violations of others.

While it may take some time and effort to absorb and apply this knowledge, including through study, training, and practice, it's definitely worth it. This knowledge can help all of us to listen with less confusion and more understanding, with less judgement and more empathy. And those are keys to supporting survivors, conducting effective and fair investigations, and holding perpetrators accountable.

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Why It's Time for Sexual Assault Self-Defense Training

Not just physical skills but brain-based, culture-changing mental habits.

Scientifically supported ways to resist assault and coercion – especially habits of owning sexual desires, values, and rights.

Jim Hopper, Ph.D. – September 5, 2018

In this #MeToo era there are many perspectives and debates, often across generational and political divides, about how to prevent sexual assaults and the difference between assault and "bad sex." As an expert in psychological trauma who regularly teaches about brain-based responses to sexual assault, I can shed light on something that's been missing from most public and policy conversations: self-defense training.

When I explain to higher education administrators how self-defense training could play a major role in preventing sexual assaults on their campuses, responses typically range from surprise to strong resistance. With military commanders, it's different story. Before I even mention self-defense, light bulbs go on in their heads. They've long understood how people respond to being attacked, even if they don't know the brain causes, and once they've connected the dots from combat to sexual assault, those serious about prevention commonly ask, *Can't self-defense training prevent sexual assaults? Can't we "harden the targets"?*

Yes, but It's complicated, I say. Focusing on self-defense can shift attention and accountability away from perpetrators, away from bystanders who might prevent assaults, and away from powerful people (e.g., generals and college presidents) with influence over institutional factors that can increase or decrease assaults. Furthermore, even the very best self-defense training may not prevent or stop an assault, and some will try to discredit victims who've received the training or blame them for "failing" to fight off an attack.

Those are legitimate and important concerns. Nonetheless, self-defense training is an essential tool for preventing sexual assault and a great policy option that – when properly understood for its potential to change culture – could be embraced by people of all cultural and political stripes, including those with allegiance to feminist and libertarian ideals, so often at war these days.

To see why, we need a deeper understanding – one grounded in neuroscience – of what makes both combat training and sexual assault self-defense training effective.

Lessons from the Military

No one knows better than military commanders that when people are under attack, their ability to mount an effective defense depends on *the nature of their training*.

One key component of effective combat training is *repetitiveness*, literally drilling in new habits: how to fire weapons, execute combat formations, etc. Without sufficient practice, the training won't deeply ingrain essential habits in young recruits.

But without a second component, that is, lots of practice in the *specific situations* where those habits must be applied, such training is useless and even dangerous. That's why the military has spent so much on simulating the streets and buildings of Iraqi and Afghan cities and villages, and on replicating enemy strategies and tactics.

Effective combat training requires repetitive drilling in situations resembling those where the skills will be needed.

Lessons from Neuroscience

Why are repetitive drilling and practice in simulated combat environments critical to effective training? Because of how our brains work.

With or without such training, people respond to being attacked – whether enemy fire or sexual assault – in ways programmed into all human brains by eons of evolution and by repeated life experiences. As shown by decades of neuroscience research, *highly stressed brains run on reflexes and habits*.

When the brain's defense circuitry (including the amygdala) detects danger or attack, it suddenly and profoundly alters brain functioning, often beginning with brief freeze responses. It unleashes a surge of chemicals that can *rapidly impair the prefrontal cortex* – the brain region most responsible for the "executive functions" that otherwise make us rational beings, not mere creatures of stimulus and response. Then, the defense circuitry dominates behavior with rapidly deployable *reflexes* and *habits*.

That's why military service members' brains must be able to access and execute – instantly and automatically – deeply-ingrained habits from effective combat training. That's what enables them to survive and prevail in battle.

Missing Training, Courtroom Travesties

Yet those same service members can't depend on effectively trained habits to kick in when someone *sexually* attacks them. Wait, you might think: *What about hand-to-hand combat training? What about military martial arts?* Indeed, in military courtrooms around the world, defense attorneys routinely tell juries that service members could not possibly have been raped because they've had such training.

Unfortunately, that training is no more useful in most sexual assaults, especially those committed by known and trusted fellow service members, than it is in fixed-wing aerial combat. If it were, then military sexual assault rates would be much lower than civilian rates, but they aren't.

Most girls and women have habits for politely resisting unwanted sexual advances, but those are useless during assaults.

While a small percentage of service members receive training in self-defense tactics specific to sexual assault, that training is usually very brief and lacking in those two essential features: lots of practice, in situations closely resembling those where it must be applied.

Despite those realities, I've seen a defense attorney cross-examine a young Marine by reading out loud, line after line, from her service's military martial arts training manual. He rapidly fired more than 200 questions about particular techniques she had learned – each a leading question that compelled the answer "yes." *Choke hold?* Yes. *Eye poke?* Yes. On and on until the judge finally cut him off.

If his client had even *attempted* to rape her, the attorney claimed, surely she could have fought him off with those techniques. Surely, he implied, she *would* have fought him. She may *claim* she said "no" several times as he forcibly removed her clothes, but given her martial arts training, the attorney suggested, there's simply no way it could have been rape. She must be lying.

Habit-Based Responses to Sexual Assault

Just before the attorney's sustained verbal assault on her credibility, the young Marine had described how she *actually* responded during the sexual assault.

Like so many girls and women, she had never received effective sexual assault self-defense training, and therefore she had fallen back on the only deeply ingrained habits she had for dealing with unwanted sexual advances from men she knew. After the perpetrator suddenly shoved her onto the bed and right up to when he began raping her, she had politely, but with increasing urgency and desperation, repeated the words *no* and *stop*, and the phrases *You're married. You don't need to be doing this.*

By the time most girls leave high school, uttering such phrases is a habitual strategy for warding off unwanted sexual advances – for politely avoiding boys' hurt feelings or anger, for appealing to their self-interest. For the young Marine, those behaviors had worked in the past, as they have for millions of girls and women. But when the other person *ignores* those polite signals, they're useless.

The defense attorney's argument, routinely used against victims of sexual assault in the military, is baseless. It's contradicted by decades of research on how stress, especially extreme stress, leaves the brain dominated by reflexes and habits. It doesn't square with *what the military itself knows* – about

how people (and their brains) typically respond to attack and function in states of extreme stress, and about the kind of training required to replace old habits with new ones.

Lessons from Campus Research

Fortunately, there's growing evidence, not from the military but from college campus researchers, on self-defense training that can reduce not only sexual assaults but all kinds of coercive sex.

Girls, women, and all genders have the right to take ownership of their sexual desires, values, and choices. Good self-defense training cultivates the mental habits for doing so, especially when someone is trying to coerce them.

A watershed study was published in 2015 by *The New England Journal of Medicine*. Charlene Senn and her colleagues randomly assigned more than 800 women entering Canadian universities to sexual assault "resistance training" versus a more typical and limited intervention (i.e., brief information session and brochures). Over their first year of college, 5% of women in the program reported being raped, which was *half* the 10% rate of the control group. For attempted rape the rate was 63% lower in the resistance training group, and it was 34% lower for *any* experience of non-consensual sexual contact. Follow-up findings through the second year of college included 20% to 63% lower rates among the women who got the training than those who didn't.

That's big and welcome news, and warrants replication studies on American campuses, where Senn's program, also known as "Flip the Script," is now being offered at some universities.

But no young woman should have a 1-in-20 chance of being raped in her first year of college. I certainly don't want my daughter and her friends facing those odds.

Can we do better? To answer that question, we must again consider *the nature of the training*, and get into a few details.

New *Mental* Habits Are Key

Senn's relatively successful program is only 12 hours long, with *only about six hours* for learning and realistically practicing verbal and physical resistance skills. That's not nearly enough to ingrain new habit behaviors that can be accessed automatically while under attack. Would the U.S. military send people into combat with only six hours of training?

One way to improve self-defense training, then, might be more intensive training in the same skills. Such programs exist. Jocelyn Hollander has published promising findings on a 10-week program with two hours of realistic practice every week, and research is needed on shorter versus longer programs.

Still, how might the shorter program reduce sexual assaults? Senn has offered an answer to that question – and to another question as well, namely, how did her program also reduce *attempted* assaults and *any experiences of coercion* that fall short of assault?

The answer, Senn suggests, is found in the program's final 3-hour unit, *sexuality and relationships*, based primarily on a program of the Unitarian Universalist Church. That unit "puts women's own values and desires at the center" of discussions about two things: *how to assess risks* of being sexually assaulted, and *how to overcome internal barriers* to acknowledging and resisting unwanted sexual behaviors from men they know.

This is key: Such discussions can *jump-start the formation of new habits* – of experiencing, reflecting upon, and making decisions about one's own sexual desires and values, especially in sexual interactions and relationships.

Ingraining new *physical* habits requires practice in realistic scenarios, and lots of it, certainly more than six hours. But burning in new *mental* habits of relating to one's sexual desires, values, and rights – that's a different story, because young people can practice those habits just about anywhere, anytime. Most young people also have many opportunities to practice new mental habits for responding to *other people's* sexual behaviors. That includes peers who are drunk, impulsive, sexually awkward, and apt to "miss signals" – as well as those who *simply don't care*, at least once aroused, about others' signals, wishes, or well-being.

Critically, such mental habits can be engaged in *before* interactions become so coercive or forceful that the resulting stress impairs the brain's rational prefrontal cortex. That makes those habits protective in another way too: by preventing or at least delaying such escalation they can *safe-guard rational and flexible thinking*, thereby increasing the odds of responding effectively to unique and complex situations (e.g., manipulative coercion coming from someone you thought you could trust).

In short, that "relationships and sexuality" unit of Senn's program can foster processes that *deeply ingrain new mental habits* – habits not only for preventing rape and sexual assault, but for resisting and effectively responding to sexual coercion of any kind. Indeed, it can initiate and reinforce new mental habits, many already promoted by consent and bystander training, for relating with greater awareness, authority, and maturity to all things sexual. *What are my sexual desires? Do I really want to do that? Do I want him to do that? Does that square with my (Christian/Jewish/Islamic/Army) values?*

Culture Change, Mature and Healthy Sex

That's where the bigger picture comes into view: Those mental habits, when routinely expressed in speech and behavior, can help create new social norms and transform culture – on college campuses and in other communities, both civilian and military.

That's the true promise of giving young people effective tools for exercising authority over their own sexuality; for asserting their own freedom, dignity, and rights in relationships; and for helping each other move from adolescent ignorance, awkwardness, and alcohol-induced impulsivity (and potential coercion or violence) to mature and healthy sexual values and behaviors.

Those are goals that can be embraced not only by feminists and progressives, but also by libertarians and many social conservatives, and by anyone focused, like Betsy DeVos, on victims of false accusations and unfair campus investigations and tribunals. That is, if programs like Senn's can foster habits of *proactive* sexual awareness, power, and morality (e.g., less likely to engage impulsively in drunken loveless sex), then they can also reduce later *reactive* misinterpretations and false accusations by misguided students or campus staff.

Caveat: The Best Training May Not Be Enough

Of course, even the best self-defense training will not usher in some future utopia.

The most effective programs, on their own, will have limited impacts because they only focus on potential victims' thinking and behaviors. They must be part of comprehensive approaches that train bystanders, cultivate effective community leadership, and target those at risk to commit (and recommit) sexual assaults. Indeed, there will always be those who (at least when they're aroused, intoxicated, or both) treat other people as objects and could care less about their wishes, dignity, and well-being.

Also, despite getting great self-defense training, some people may still respond like those with no training at all – with ineffective old habits (e.g., from gender socialization or childhood abuse) or ancient survival reflexes that render them temporarily passive and helpless (as sometimes happens to well-trained military personnel in horrific combat situations). So we must always guard against the blaming of victims for their sexual assaults, no matter what self-defense training they've received.

Where Can We Go from Here?

I'll end with some suggestions for getting to a future in which scientifically proven self-defense training is widely available and helping to reduce sexual violence and coercion on campuses and other communities across the country and throughout society. These shouldn't be controversial.

It would really help if everyone understood the basic realities of attacked and stressed brains, whether it's military combat or sexual assault, and how sexual violence can be reduced by ingraining new mental habits for asserting authority over one's own sexual values, rights, and choices.

We also need to understand that boys and men are sexually assaulted and need training tailored to their needs, as do people who don't conform to traditional gender roles, for whom rates of sexual assault are very high. For some young people with histories of prior abuse or assault, the realistic practice scenarios of self-defense training are very challenging, so programs must be optional and it must be trauma-informed (as Senn's and Hollander's programs are). And some young people (e.g., from religiously conservative families) have values relating to sexuality that they (and their parents) sincerely believe are incompatible with such training; they must not be coerced into participation, nor judged for opting out.

State legislatures and Congress, the Centers for Disease Control, and the Departments of Education, Justice, and Defense can certainly help: by acknowledging and disseminating self-defense research; by providing more funding and incentives to implement and evaluate the most promising programs; and by including research-supported self-defense training as a critical component of sexual assault prevention efforts required of schools and the military services. (To date prevention efforts and funding have

focused almost entirely on bystander training, which is important but bystanders are only present for less than one-fifth of sexual assaults and the training may have the unintended effect of making men who are at high risk of committing sexual assaults even more likely to do so.)

The media and Hollywood can help, too, by realistically (not gratuitously) portraying sexual coercion and assault; by educating people about common but still widely misunderstood brain-based responses to sexual assault; by showing the skills and habits of effective resistance, and raising awareness of programs that teach them; and by telling more stories of how young people actually mature toward healthy and moral sexual behavior and relationships.

It's time for everyone who wants to prevent sexual assaults (and relatively rare misguided or false accusations) to connect the dots from solid neuroscience and military commonsense to the growing research on self-defense and its benefits.

And maybe, in this #MeToo era, we're finally ready to decide: Are we going to offer *every* young person *all* of the tools they need to prevent sexual assault and foster mature sexual behavior? If yes, then we need to act, and act decisively, just like those military leaders I teach who are eager to take action once those light bulbs go on – but have yet to be given the necessary knowledge and resources.

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Why Incomplete Sexual Assault Memories Can Be Very Reliable

Just like memories of soldiers and police, and for the same brain-based reasons

Jim Hopper, PhD – September 28, 2018

Note: If I had been permitted to provide my expert testimony at the September 27, 2018 Senate Judiciary Committee hearing on Judge Kavanaugh's confirmation, these would have been my remarks. This is the first post of two on the memory science relevant to Christine Blasey Ford's reported memories, and those of all survivors of sexual assault and other traumas. The second is here.

Source: Colourbox, used with permission

Incomplete memories of sexual assault, including those with huge gaps, are *understandable* – if we learn the basics of how memory works and we genuinely listen to survivors.

Such memories should be expected. They are similar to the memories of soldiers and police officers for things they've experienced in the line of fire. And a great deal of scientific research on memory explains why.

I'm an expert on psychological trauma, including sexual assault and traumatic memories. I've spent more than 25 years studying this. I've trained military and civilian police officers, prosecutors and other professionals, including commanders at Fort Leavenworth and the Pentagon. I teach this to psychiatrists in training at Harvard Medical School.

As an expert witness, I review videos and transcripts of investigative interviews. It's like using a microscope to examine how people recall – and don't recall – parts of their assault experiences. I've seen poorly trained police officers not only fail to collect vital details, but actually *worsen* memory gaps and *create* inconsistences.

Ignorance of how memory works is a major reason why sexual assault is the easiest violent crime to get away with, across our country and around the world.

Yet when I teach military service members and police officers, it's mostly about making light bulbs go on in their heads and helping them connect the dots from their own traumatic memories to those of sexual assault survivors.

Soldiers and police know that traumatic memories often have huge gaps. They know it can be difficult or impossible to recall the order in which some things happened. They know they'll *never forget* some things from that alley in Ramadi where their best friend died – even though they *can't* remember many details of the battle, or which month of their third Iraq rotation it was.

That's why soldiers and police often approach me after trainings to say, "You get it," or "now I understand how it's no different for people who've been sexually assaulted."

In short, what I'm talking about here today are *realities*, not theories or hypotheses – realities known all too well by our nation's defenders and its millions of sexual assault survivors.

The science helps us understand why people have incomplete and fragmentary memories, including the brain structures and processes involved, while revealing complexities we would not otherwise discover. And science gives us conceptual tools – mental spotlights, if you will – that help us to see reality more fully and clearly.

Now, briefly, I will use scientific knowledge and concepts to shed light on how memory works, and to inform your understanding of other testimony you are hearing today.

Researchers divide memory processing into three stages: encoding, storage, and retrieval.

Encoding

Encoding refers to the temporary registration of sensations and thoughts into short-term memory, a kind of "buffer" or RAM that can hold information up to 30 seconds.

For *any* event we experience, including this one, we're not taking in every detail. From moment to moment, what our brain encodes is a function of what we're paying attention to, and what has emotional significance to us. Those details are called central details.

In contrast, what we're *not* paying attention to, or has little or no significance to our brain at the time, are called peripheral details. Those are encoded poorly or not at all.

Just a moment ago, was your attention on me, or someone or something else? Did that question I just asked have an emotional impact on you? Those factors are shaping what's being encoded into short-term memory right now.

Critically, whether it's an IED attack or a sexual assault, just because *we* – or an investigator, or even the survivor herself looking back later – believe some aspect of an event would or should be a central detail, that does not mean it was a central detail for the survivor's brain at the time. Many who have been sexually assaulted don't remember whether certain things were done to their body because, at that point, they were focused on the perpetrator's cold eyes, or traffic sounds on the street below. That tells us nothing about the reliability of the details they do recall, and nothing about their credibility.

Storage

Storage is the next stage. That's the transformation of encoded information so it can be *retained* in the brain, and the brain processes that keep things from being lost.

From the outset, storage of central details is stronger than storage of peripheral ones. Those peripheral details fade quickly, and if not remembered and re-encoded, are mostly gone within a day. We all *know*

this: What we pay attention to and has significance to us is what we're more likely to remember over time.

Even as we sleep, our brains are filtering stored details and *prioritizing* for *continued* storage only some of them – those central details. That's why all memories are incomplete and fragmentary. That's why all memories lack details that were initially encoded, even details that were stored for some time afterward.

Here's another factor that affects storage strength: Whether a detail's emotional significance to us is negative or positive. Evolution has selected brains that are biased to encode the negative more strongly, to enable survival in a world with predators and other grave dangers.

If you go on a Sunday morning show, which of the things you say will those watching be more likely remember? Which of the President's tweets? That "negativity bias" is shaping what our brains are right now working on storing — or not — as memories of this experience.

Most important of all, when it comes to what will remain stored in our brains, is this: How emotionally activated, stressed, or terrified we were during the experience. Decades of research have shown that stress and trauma increase the differential storage of central over peripheral details.

Soldiers know the tunnel-vision that can kick in during combat, the effects it has on their memories and what they can report to commanders in after-action reviews. They train to automate the habit of forcing themselves to move their head and upper body from side to side to escape the tunnel.

Whether it's an enemy ambush in an alley or a sexual assault in a bedroom, our brain will encode and retain what were – for us, moment-by-moment as the attack unfolded – the central details of our experience. Seeing an enemy suddenly appear and fire at us from 10 feet away, and fearing we will die. Struggling to breath with a hand over our face, and fearing we will die. Seeing the enemy's face as our bullets enter his chest. Seeing the face of a boy we know as he holds us down and tugs at our clothes. Such details can be *burned into our brains* for the rest of our lives.

Most of the other details will be lost, and over enough time, that includes even relatively central ones – at least if they haven't been retrieved and re-encoded.

Retrieval

Which brings me, finally, to memory *retrieval*. I only have time to say a few important things.

Yes, memories generally fade. That's partly because what starts out as a relatively detailed memory becomes more abstract over time. We remember the *gist* of what happened and a few of the most central details. When we remember or tell the story, our brain is literally piecing it together on the fly.

That's another reason why, as memory researchers love to say, memory is not like a videotape. Sometimes we get confused. Sometimes other people, or even movies we watch, supply inaccurate details that are inadvertently re-encoded into the overall memory and its abstract story.

But memories of highly stressful and traumatic experiences, at least their most central details, *don't* tend to fade over time. And while people may have the superficial abstract stories they tell themselves and others about their worst traumas, that's not because the worst details have been lost. It's often because they *don't want* to remember them, and don't (yet) feel safe to remember them.

What if that soldier is asked by a friend back home, “Did you ever kill someone close-up in Iraq?” If he doesn’t ignore the question, he may just say, “Yeah, once some guy jumped out in front of me and started firing but I blew him away.” He won’t describe the look on that man’s face as he died – and he may succeed at keeping it out of his mind’s eye, at least that time.

The same is true for many victims of sexual assault. They have bland abstract descriptions they tell themselves and others, for example, their husband early in the marriage, before they feel safe enough to share the painful details, and feel that sharing some of those is necessary for other reasons. They might not have retrieved the horrific central details for months or years. But that doesn’t mean those vivid sensory details and wrenching emotions aren’t still there, never going away, ready to be retrieved under the right (or wrong) circumstances.

Yes, peripheral and less central details can get distorted more easily than many people realize. But decades of research have shown that the most central details are *not* easy to distort, which typically requires repeated leading questions from people in authority or a very strong internal motivation for doing so.

But without compelling evidence of such influences, there is no scientific or rational basis for *assuming* that such distortions have occurred, especially for those most central and horrible details the person has been both tormented by and trying to avoid, sometimes successfully and sometimes not, for years or even decades.

Thank you for your attention, and I am happy to answer any questions about how the science of memory can help you understand and evaluate the memories reported by the people involved in this matter.

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Why Christine Blasey Ford Can't Remember How She Got Home

Time-dependent effects of stress and trauma on the hippocampus and memory

Jim Hopper, PhD – October 6, 2018

Note: This is my second post of two on the memory science relevant to Christine Blasey Ford's reported memories, and those of all survivors of sexual assault and other traumas. The first is here.

Source: Pexels/Joshua Teichroew

On Monday October 1, Republican senators released "Analysis of Dr. Christine Blasey Ford's Allegations," a memo written by Rachel Mitchell, the prosecutor they hired to question Christine Blasey Ford and review other evidence. Ms. Mitchell's "analysis" includes descriptions of Ford's memories as not "consistent," lacking "key details," and uncorroborated by people she said were at the "party."

In the final two weeks of September, many Americans learned from the media (e.g., *USA Today*, *Rolling Stone*, *Vox*, *NBC News*, *NPR*) the distinction that memory researchers make between "central" and "peripheral" details, terms that reflect the commonsense understanding that we remember things that had significance to us and got our attention.

Many people have also learned that stress and trauma greatly enhance the differential storage of central over peripheral details, and that the central details of traumatic experiences can get burned into our brains for the rest of our lives. But most people already knew that too, even if they hadn't stopped to think about it.

These past few weeks, I've tried to help with that learning, by talking with reporters and sharing the expert testimony on trauma and memory that I could have provided to senators and the country, which was published by *Scientific American* and here on my blog. There I explain central versus peripheral details, that stress amplifies their differential encoding and storage, and how sexual assault survivors – like traumatized soldiers and police – may protect themselves by clinging for years to superficial descriptions of events, which keep the most disturbing details out of their minds. (If you're at all interested and have time, I highly recommend reading that article/post first, because it has great information and lays a foundation for this one.)

Now, I would like share some very important scientific knowledge about stress and memory that, with two exceptions, has not been shared by the media.

Even among scientists who study memory, many are not yet aware of this knowledge, and it's certainly not intuitively recognized by the rest of us. But it is critical to understanding a large gap commonly found in the memories of those who have suffered trauma, including, apparently, Ford.

No, That's Not a "Detail"

Of all Ford's memory gaps, including for what Mitchell calls "key details of the night in question," her compete inability to recall how she got home is the only one that Mitchell calls "important." Indeed, she goes further, writing, "Perhaps most importantly, she does not remember how she got from the party back to her house," and claiming, "Her inability to remember this detail raises significant questions" (p.3, italics added).

How Ford got home is not a "detail." Rather, her return home was a series of events, each with many details. As I will show, this more accurate and precise description allows us to make good use of what science has revealed about the time-dependent effects of stress on memory.

Time-Dependent Effects: Not Obvious or Intuitive

The distinction between central and peripheral details is intuitive and commonsensical, and so is the reality that stress and trauma *enhance* the differential storage of central details over peripheral ones.

But most people, and even some memory researchers, don't understand that the impacts of stress and trauma on memory *change over time.*

When we're attacked or otherwise stressed, at first memory encoding and storage, especially for the central details, are *enhanced.*

The hippocampus immediately enters a super-encoding mode. As it does, central and even some peripheral details already in the buffer of short-term memory (of around 30 seconds) are selected for burning into long-term memory. As that super-encoding state continues (for around 5 to 20 minutes) the encoding and storage of central details, but not peripheral ones, are greatly strengthened. (To what extent depends on a variety of factors, including genetics and ovarian hormones.)

But once that initial super-encoding phase ends, stress *impairs* memory encoding and storage.

That's because the hippocampus then enters a minimal-encoding mode. Depending on how long a sexual assault lasts, this phase of impairment and minimal encoding may arrive before or after the assault has ended.

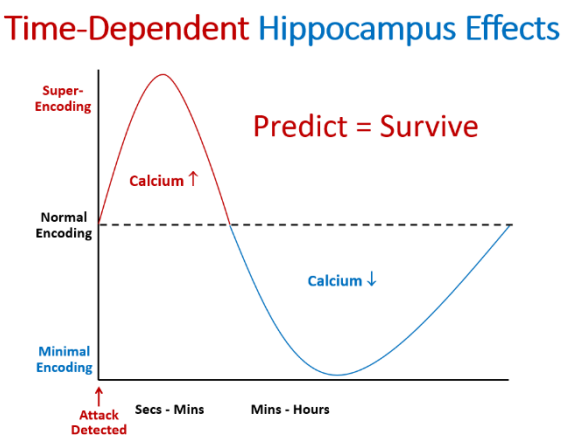
Remarkably, during that minimal-encoding phase *even some central details* are not reliably being encoded or stored – and more complex information, like how things were sequenced in time, is unlikely to get stored at all. (See reviews by Diamond and colleagues, Zoladz and colleagues, and Schwabe.)

Knowledge of these time-dependent effects of stress on memory, especially the existence of that minimal-encoding phase of hippocampal functioning, is essential for understanding the memories and credibility of people who have experienced trauma – including military personnel, police officers, and sexual assault survivors like Ford.

Why Does the Brain Go Into Minimal-Encoding Mode?

I imagine you're curious about *why* the hippocampus goes into that minimal-encoding mode. I can provide the scientific explanation without making it too complex.

First, it's about brain cells and the mineral calcium. To enter and remain in the super-encoding mode, cells in the hippocampus must absorb much higher than normal amounts of calcium from the fluid surrounding them. But that same calcium, if it stays too long inside the cells, could kill them.



Effects of stress on memory encoding and storage by the hippocampus over time. (Adapted from Zoladz et al., 2014, p.24.) Source: Nova Science Publishers, used with permission

Second, it's about learning and *prediction*. Our ancestors who survived passed down genes and brains that prioritize the storage of information that might enable our brains to predict things that are vital to our survival – like where to find our next meal and how to avoid becoming the next meal of a larger predator.

Imagine it's 10,000 years ago, and, while drinking from a stream recently, your friends and you were attacked by a pack of wolves. They seemed to appear out of nowhere. A few of you were killed and those who survived were mostly lucky. Your brain would have entered the super-encoding mode the moment it detected the attack, then burned in things experienced moments before the wolves appeared: the silence of the birds stopping chirping, the appearance of that clump of bushes from where the wolves suddenly came running.

Your brain will burn into memory that image of dense bushes and that sound of silence, because detecting those sites and sounds could save your life in the future.

Iraq and Afghanistan veterans certainly get this. That pile of trash in the road could be hiding an IDE. That tense-looking kid with a cell phone could be poised to trigger it. Prior attacks that maimed and killed their buddies have burned in such little details, potential signals of an imminent blast. But back home, driving their daughter to soccer practice can be a harrowing experience, with every piece of trash and every nearby boy on a phone triggering fear and panic, even "irrational" speeding or road rage.

In short, the alterations that occur in each stress-induced phase of memory processing – in the first, strongly encoded central details and missing peripheral ones, in the second, even some central details getting lost – are indicators of *adaptive* brain functioning. Those alterations have been selected by evolution because they've helped us to predict, detect, and avoid future attacks, and because they protect our hippocampus from damage.

Implications for Ford's Biggest Memory Gap

With this knowledge, we can see that getting home from the party was not a detail but rather a series of events with many details, all of which happened while stress was having time-dependent effects on Ford's hippocampus and its abilities to encode and store information.

It's likely that soon after she escaped the house her hippocampus entered that minimal-encoding mode that both *protects* its cells from destruction and *prevents* those same cells from storing the details of

events. It's a state of the hippocampus similar to the blackout state that is caused by a sudden spike in the blood-alcohol level, which Kavanaugh and his friend Mark Judge may have entered before or soon after arriving at the gathering.

If so, that would explain Ford's only reported memories of what she experienced after leaving the house. In her written and spoken testimony to the Senate Judiciary Committee, Ford said, "I remember being on the street and feeling an enormous sense of relief that I had escaped from the house and that Brett and Mark were not coming after me." In her conversations with Emma Brown of *The Washington Post*, she recalled, "My biggest fear was, do I look like someone just attacked me?"

If the young Ford succeeded at hiding signs of the trauma she had just endured, that would explain why no one remembers picking her up and driving her home.

Finally, her relief at having escaped and her fear that someone might realize she'd just been attacked: those would be two highly significant central details, among the last to get in before her hippocampus, entering its own self-protective mode, lost its ability to store indelibly any of what came next.

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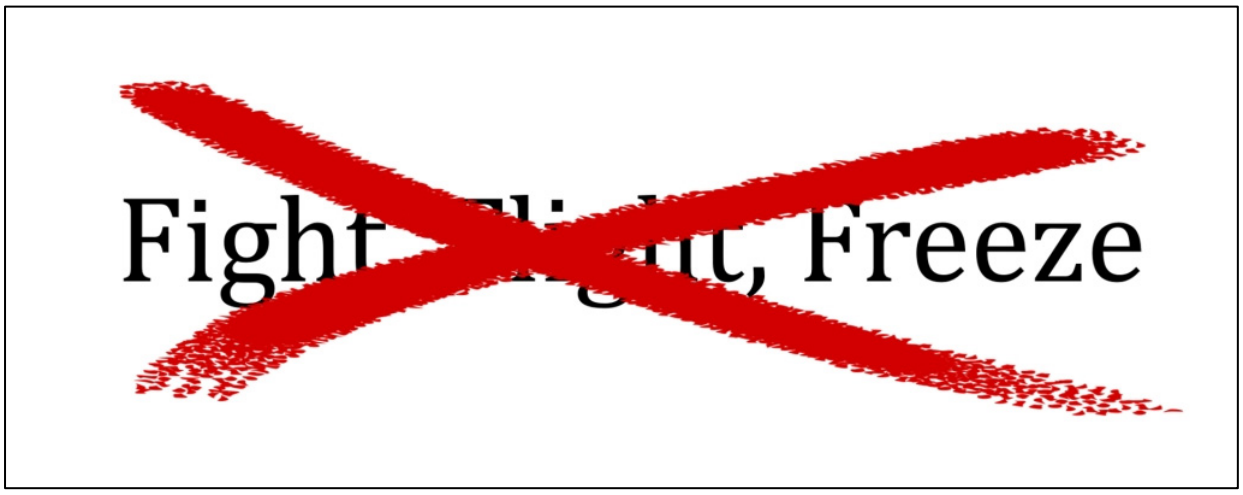
“Reflexes and Habits” Is Much Better Than “Fight or Flight”

Language that reflects the realities of sexual assault and its neurobiology.

Adding "freeze" can't salvage a phrase that harms sexual assault survivors.

Jim Hopper, PhD – February 12, 2021



Despite widespread use, “fight or flight” does not accurately reflect the typical behaviors of people during sexual assaults or the neurobiological impacts of stress and trauma. Adding “freeze” doesn’t help. In fact, using *any* version of “fight or flight” to sum up sexual assault responses can be harmful.

If you want accurate and scientifically sound terms for how people’s brains and bodies respond when they’re being sexually assaulted, here are two good ones: *survival mode,* and *reflexes and habits*.

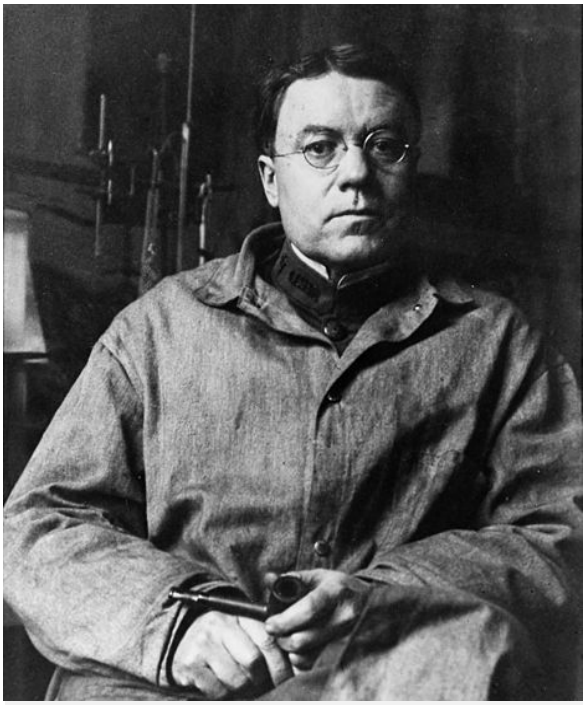
To see why those phrases are much better, we first need to understand the origins of “fight or flight” and how that phrase is still routinely misunderstood and misapplied to sexual assault survivors.

With the knowledge provided here, all of us can help sexual assault survivors to understand – and stop blaming themselves for – how their brains and bodies responded and didn’t respond during the assault.

“Fight or Flight” Was a Term for Physiology, Not Behavior

According to the conventional wisdom (including among scientists) “fight or flight” was coined in the early 20th century by Walter Cannon, a Harvard physiologist. But careful reading and electronic searches of Cannon’s writings fails to find it anywhere. (He came closest with “the necessities of fighting or flight” on page 211 of his book *Bodily Changes in Pain, Hunger, Fear and Rage*, first published in 1915.)

Cannon was a *physiologist,* not a behavioral scientist. He studied the body’s *internal* responses to stressful situations, not its outward behavior. He wrote about *preparations* within the body – specifically, preparations for *potentially* engaging in behaviors that might enable coping and survival. He focused on sympathetic nervous system activation, adrenalin release, and other physiological changes.



Although even scientists think it's true, Walter Cannon never wrote "fight or flight." He never even studied behavior.

Word-use data collected by *The New York Times* and Google show that when "fight or flight" began appearing in the late 1800s, it wasn't a scientific term and it didn't refer to what Cannon would later study. Around 1920, someone first used the phrase to reference Cannon's findings, and that usage appeared with increasing frequency starting in the 1940s. By the late 1990s its use had skyrocketed and over the past 20 years, as we've all noticed, it's become a very popular phrase.

But over those same decades, in the popular imagination "fight or flight" came to mean something very different from what Cannon studied. Although he never studied behaviors – not fighting, not fleeing, nor any others – many came to believe, incorrectly, that "fight or flight" refers to *behaviors* that may (or may not) accompany the physiological state he actually did research. Worse, many people came to believe, again wrongly, that fighting and fleeing are the *most common* behaviors in that state.

Why "Fight or Flight" Is Often Harmful

In reality, it's *unusual* to fight or flee while being sexually assaulted. Yet thanks to the popularity of "fight or flight" and the confusion about what it actually means, many people wrongly believe that fighting and fleeing are the two most natural and common responses.

That's harmful to sexual assault survivors because many people, including survivors themselves, wrongly believe it's unusual *not* to fight or flee. And that causes survivors to be misunderstood, even judged and blamed – again, including by themselves – for having "failed" to behave in supposedly normal ways when they were being assaulted.

Things are only made worse by thinking that "fight or flight" is a *science-based* description of typical behavior in such situations. Adding alliterative words such as "freeze" (and "fawn" and "faint") doesn't really help. As explained below, there is *no version* of "fight or flight" that accurately reflects scientific knowledge of brain and behavioral responses to being attacked, including sexually.

Much Better Terms: "Survival Mode" and "Reflexes and Habits"

Fortunately, there are equally simple phrases that reflect both the realities of victim behavior and scientific knowledge, phrases that everyone can start using now: *survival mode* and *reflexes and habits.*

"Survival mode" first appeared in the 1970s, in the technology and business worlds. Since the 1980s, it's been used increasingly as a biological and psychological term. "Survival mode" can refer to brain functioning in chronically stressful conditions, but also to a temporary state of brain and body in

response to being attacked or otherwise in immediate danger. So "survival mode" can easily replace "fight or flight" for referring to the *physiological state* that Walter Cannon studied.

Many victims don't fight or flee. Let's not increase their suffering with words that don't reflect their behaviors – or science.

Similarly, "reflexes and habits" easily and accurately covers the most common *behaviors* that people actually engage in when they're being attacked, including sexually. In fact, as explained below, "reflexes and habits" is far and away the *best* way to understand, including scientifically, the typical behaviors of people during sexual assaults. (Even when someone *does* fight or flee that behavior is usually reflexive or habitual, and best understood as just one of many possible reflexes or habits.)

With this terminology, behavioral language isn't used for a physiological state, and the behavioral words that *are* used, "reflexes and habits," don't leave out the most common responses to being assaulted. When you put the terms together, everything makes sense, everything reflects reality, and everything fits with the science: when they're being (sexually) assaulted, people's brains and bodies typically go into survival mode, and in that state their behaviors typically consist of reflexes and habits.

To appreciate more fully why "survival mode" and "reflexes and habits" are more accurate and much better than "fight or flight" and its new variants, it's helpful to know which reflexes and habits *are* common responses of people in the midst of sexual assaults, and the basics of their neurobiology.

Survival Reflexes

Reflexes are hard-wired, not learned, because evolution put them into our brains. They're triggered automatically, without thinking or choice. *Survival reflexes* exist because they helped our ancestors survive life-threatening situations, especially attacks by large predators. For millennia, they've also been common responses to predatory sexual assaults.

One survival reflex is *freezing*, as defined by scientists: an inhibition of movement that automatically arises in situations of attack or other danger. It's a kind of "network reset" that gets the brain to stop everything, receive information about the danger, and (hopefully) generate an effective response. It typically happens at the beginning of sexual assaults and lasts just a second or two. (As I've explained previously, freezing can be shorter or longer than that and can involve three types or phases.)

Two other and more extreme survival reflexes are *tonic immobility*, in which the body is literally paralyzed and muscles are rigid, and *collapsed immobility*, in which blood pressure and heart rate drop, the person may feel faint or pass out, and muscles go limp. To show what these survival reflexes look like, I've created playlists with brief videos of animals and people in tonic and collapsed immobility.

Another survival reflex is *dissociation*, in which awareness is automatically disconnected from disturbing and painful sensations and emotions arising in one's body. Not feeling pain means not writhing in agony, and not doing that can cause predatory animals to lose interest and walk away, which is why dissociation was selected by evolution. Sexual assault survivors often say they felt "numb," "in a dream," or "out of my body." For a realistic (but disturbing) depiction of dissociation during sexual assault, see this brief scene from the Emmy-winning *Mad Men* series.

Self-Protection Habits

Habit behaviors are even more common than reflexes during sexual assaults.

They can be habits of polite acquiescence or submission that we've all learned for dealing with aggressive and dominant people who have power over us (e.g., parents, teachers, supervisors). They can be habits of passivity learned in childhood – from repeated experiences of abuse, exploitation, or domination. While being sexually assaulted, otherwise strong and confident teenagers or adults can suddenly, in a flash, find themselves engaging in submissive behaviors that, long ago, enabled them to cope and survive in abusive relationships.

Especially for girls and women, being sexually assaulted can trigger polite and passive habit behaviors that they've learned for resisting unwanted sexual advances without causing a scene or bruising an ego. This includes gently but ineffectively pushing a hand away from one's breast only to find it right back there again, or saying things like "I have to go home" while the perpetrator escalates the assault. Such behaviors became habits because they worked, at least to some extent. But they're useless when a perpetrator could care less about the victim's experience and disregards the signals of "no" and "stop" being sent by those habit behaviors.

Children commonly respond to abuse with submissive behaviors. If this girl is sexually assaulted years later, her brain could automatically trigger this old habit.

When habit behaviors and reflexive dissociation overlap, very disturbing and confusing things can happen. People may engage in sex acts despite being severely stressed or traumatized – not because they want to, not because they're consenting, but because they've "checked out" and are in dissociative "autopilot" mode, just going through the motions of habitual sexual behaviors.

Without the more accurate and comprehensive understanding of reflexes and habits, survivors may say "I froze" as they attempt to name what were actually passive habit behaviors.

"Reflexes and Habits" Accurately Reflects Neurobiology and Evolutionary Selection

Neurobiologically too, "survival mode" accurately reflects the research on how stress and trauma typically impact the brain and *physiology;* and "reflexes and habits" accurately reflects the scientific research on how stress and trauma typically impact the brain and *behavior*.

Research on brain functioning and behavior in states of stress and trauma has shown that stress and trauma shift the brain to reliance on reflex and habit behaviors. Reflexive responses to stressful and traumatic situations are implemented by the brain's defense circuitry, including a brainstem area called the periaqueductal grey. Habit-based behaviors evoked by stress and trauma are implemented by the brain's habit circuitry, which is well-mapped and includes the dorsal striatum. (See the scientific papers in the references below.)

It's not just that sexual assault victims usually don't fight or flee. The brain *doesn't even have* a "fight circuitry" or a "flee circuitry." Again, even when people *do* fight or flee, those behaviors are usually reflexive or habitual, running on the brain's defense or habit circuitries.

Basically, in situations of stress and danger, the brain's defense circuitry tends to control behavior, either by directly generating survival reflexes on its own, or by indirectly triggering habit behaviors via

Quotes from activist Chessy Prout's trial testimony. Girls and women learn such "nice girl" habits because they work: the other person usually stops. Determined perpetrators don't. These habit behaviors are common during sexual assaults, because of how our brains work. (Photo: Darren Silva)

output to the habit circuitry. When a larger predator is coming at you or has you in its grip, thinking through a response with your rational prefrontal cortex is too slow and could get you killed. But reflexes and habits, which your brain can automatically cue up and execute in fractions of a second, could save your life. So evolution selected brains in which stress and trauma impair the prefrontal cortex, because that allows fast reflexes and habits to take over.

The Great Benefits of "Survival Mode" and "Reflexes and Habits"

For all of these reasons, understanding responses to sexual assault in terms of "fight or flight" – including attempts to salvage that phrase by adding more words – is at odds with reality and scientifically wrong. More importantly, it results in countless survivors being misunderstood and doubted, even accused of lying or wrongly blamed for the assaults perpetrated against them.

When we understand, instead, that the brain typically responds to being attacked by entering *survival mode,* and that behavior typically consists of *reflexes and habits*, then we're much better positioned to truly understand survivors and to avoid doing them harm.

Especially if we know the forms that reflexes and habits commonly take – including freezing, habits of polite resistance or submission, tonic or collapsed immobility, and dissociation – then we can listen more perceptively when survivors share their experiences and we can truly hear and understand them. If we're investigators or attorneys, we can gather more complete and accurate information about their experiences and behaviors, and put that information to good use.

When we finally learn to think about sexual assault responses in terms of "survival mode" and, mostly importantly, when we finally think about behavior in terms of "reflexes and habits," then we will much better understand survivors' experiences and much more effectively support their pursuits of healing and justice.

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