



Mental Fatigue: Adjust or Stop?

Fatigue is a complex syndrome with many causes.

We may discover ourselves without energy for many reasons. Because of this, fatigue is not a simple problem. For example, one kind of fatigue is sleepiness – yet lack of sleep is *not* the only cause of drowsiness and more sleep isn't consistently the solution.

Drowsiness is commonly caused by motion, social stress, or chemistry (alcohol, fumes, drugs, medication), as well as by inadequate sleep or poor-quality sleep.

Fatigue – feeling as though we lack energy – may be due to muscular work, illness, stress, metabolic disturbance, or many other things. In this column, I want to focus on *mental* fatigue.

This goes way beyond soaring: it's involved in every activity or profession that requires judgment, knowledge, and skill. It affects doctors and nurses, teachers, managers, investment professionals, engineers, and so on without end.

What is mental fatigue?

The *causes* of mental fatigue vary, interestingly, from too little to excessive mental work, from boredom to high-demand work requiring high social or intellectual performance. Anxiety or worry about real or imagined trouble amplifies mental fatigue, while ironically hindering rest.

Thus, mental fatigue may as readily be caused by *lack* of mental work as by an excess – boredom is vitiating, while highly demanding mental work may be exciting or delightful and thereby energizing, though eventually fatiguing.

Highly repetitive mental work, especially sustained over long periods of hours, is very fatiguing. Obvious examples include monotonous work, such as standing guard duty or working on an

assembly line. Pilots often are required to do sustained and repetitious mental work while flying. It's amazing how tired we can get from sitting in that airborne chair for a few hours merely supervising the autopilot on a long direct-to clearance. Gliders, happily, don't have autopilots.

Taxing intellectual work creates mental fatigue, such as managing a contest flight, beginning with preflight preparation, writing an essay such as this one, problem-solving, learning complex new knowledge, or continually doing complex analysis.

Social pressure, time pressure, or performance anxiety create mental fatigue. All these things can be part of sailplane racing or long cross-country tasks. Other examples are entertainment, work supervision, or interacting with the public.

The *experience* of fatigue is feeling that we somehow lack adequate energy resources to complete an activity we could choose to do. The *fact* of fatigue is reduced capacity, for example, for work, reduced efficiency (the action takes longer to plan or carry out) or reduced accuracy.

The 'go / no-go' decision

We often say that each of us should check our readiness for flight before launching, and make a 'go / no-go' decision. This is good advice. But fatigue is typically least during the excitement of pre-launch preparations, and is common late in a long flight, or early in a flight under difficult conditions or with social pressure.

The "no-go" decision is not really an option in flight: we're not going to bail out or land out just because we feel a little tired, are we? In truth, we may have begun the flight excited but primed for fatigue, the feelings masked by pre-launch distractions and chores. We may be

deep into a flight before we start feeling strongly fatigued.

What to do?

Adjust to fatigue

It's my belief, after a fairly long life, that we don't give enough attention – in all performance activities, from sports to professions – to the need to *adapt* to fatigue and adaptation techniques. For example, if I'm on call at 1:30 am, and I'm psychologically spent, there is simply no one to take my place, and Mrs. McGillicuddy's septicemia is simply not going to wait. The secret to avoiding mistakes then is to be disciplined, to trudge through the cognitive steps as if I were back in training again, stay with the checklist, stick to basics; and take no impulsive action, take no risks.

Throughout life, whether it's deep into the far leg of a racing task, a sick child after an exhausting day at work, or an urgent crisis on the night shift, we simply do not bail out. It's not that quitters are despised (though they may be), it's that the work has to be done; there is no standby assistant. We get through by intelligently *adapting* to our fatigue.

The key to this adjustment is understanding just what fatigue does.

What does mental fatigue do to performance?

Mental fatigue impairs both physical and cognitive performance. How do we see this manifested?

An article on automobile driving, *Detecting Fatigue States of a Car Driver* by Bittner, et al, lists the typical impairments: "During long periods of driving or as a result of [long-term monotonous activity, when] a human being becomes tired, loses motivation, and his effectiveness as a controller deteriorates considerably, motivation for steering declines, reaction time extends, short-term memory deteriorates, attention drops, variability of control actions as a response to the same impulse increases, important signals are ignored, decision errors and short-term failures of memory occur. In extreme cases, a microsleep comes on. This can have fatal consequences."

As I read research articles on mental fatigue in preparing to write this, two impairments are consistent:

Impaired *executive functioning* and



Slowed response.

Besides this, some work has shown that mental fatigue decreases maximum athletic endurance and skill (accuracy). It's easy to conceive that discouragement or tedium may decrease drive to succeed, but the truth is that the brain is a unit, initiating and organizing every voluntary physical action as well as intellectual activity and emotional response. Many things affect the brain globally – apparently including mental fatigue.

The most important impairment of mental fatigue, and the most difficult to recognize, I think is impaired executive function.

What is executive function?

My mother called it “self-control.” Psychologically, it's observing ourselves and our thoughts, checking our impulses before we speak or act. We monitor both thought and action, judge the possible consequences, and modify ideas and behavior accordingly. We also call this “judgment.”

Planning is an executive function. Peo-

ple stuck in the dregs of society (as distinct from those who've fallen in) generally have difficulty anticipating consequences, lack patience (don't “defer gratification”), and are short on emotional restraint.

When our executive function is inadequate, we act more impulsively, more based on emotion or reaction and less after careful thought, are less prone to first think through the effects of what we may do.

One of the important tasks of parenting is to model and teach executive functioning to our children. Becoming a professional involves adopting higher-order executive functioning as we learn to fit that role.

Performing any skill at a high level requires refined executive functioning, to observe and integrate knowledge, events, and intentions into an optimal plan and then carrying it out flexibly, responding to the unexpected.

Classically, alcohol intoxication (and other intoxication, including social delight) decreases executive functioning, and all types of fatigue do as well. The

result is that we are more likely to show poor judgment, do foolish things, and make uncharacteristic errors.

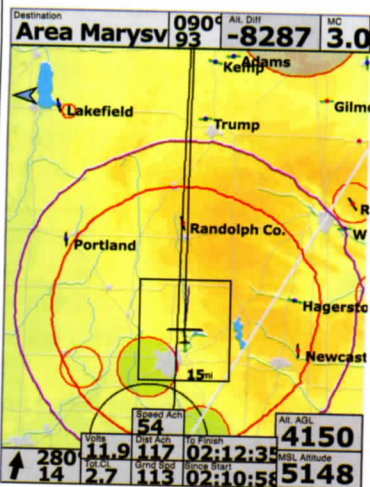
For example, I am witty. When mentally fatigued, I am more likely to be insensitive, or to insert humor inappropriately into a difficult situation, or to carry a flat tone of voice that betrays the humorous intent. (And, when we're mentally fatigued, it's harder to *see* humor in situations, but that's “decreased performance,” not “decreased executive function.”)

So: mental fatigue helps us look stupid

From time to time, highly skilled soaring pilots like you or me do things that seem unbelievably stupid, sometimes breaking ships or bodies. We wrote last month about two racing pilots: “Quent,” whose fatal end-of-task decisions on a hot day seemed like ridiculous fiction to Tim, who died when he made his own inexplicably poor decision while struggling to get away to start a task.

These were *not* stupid people, not fools; were skilled and knowledgeable. What could be going on?

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It's the brain, not our character.

Let's be elementary: if I do something dumb, either I didn't know better, or something diminished my brain's function (this is, after all, where all decisions and plans form).

When reviewing others' mistakes, we tend to focus on the "didn't know better" aspect of the situation, as that's easy to analyze, and education is a straightforward intervention. And it's always appropriate to do this.

Yet often the real problem is that existing skill and knowledge weren't exercised, the brain didn't work right. There are many things that may interfere with brain function, from simple distraction to brain tumors, but an important and often invisible one is mental fatigue.

Too Late Smart, Too Soon Old

As we saw two months ago in the discussion of cognitive impairment from drugs, our own *sense* of fatigue or impairment may occur hours after performance actually begins to decline measurably – we may blunder along feeling fine for hours.

Thus, the first lesson we must learn is to recognize the *conditions* in which mental fatigue – or other fatigue – may be induced, and plan to compensate for it. William Bridgeman, in his book *The Lonely Sky*, points out several times that a key to survival as a bomber pilot in war and as a test pilot afterward was to have at least three alternative actions for any emergency.

It's been shown years ago that the pilot

who has a plan will follow the plan even if impaired; the pilot without a plan won't form one when the pin drops, and reliably picks a poor choice. So we need to *expect* fatigue (and its impairment) and plan how we will adjust to it.

What to do?

It's also true that psychological factors are important in diminishing the performance loss caused by fatigue. Managing ourselves psychologically – getting "psyched up" or finding extra motivation, creating extra interest, or a false crisis – is well known to improve performance during fatigue. Mental imagery is a well-documented technique of improving performance and endurance.

In this regard, it's interesting that a recent study found that having a partner improves endurance, having a cheerleader decreases it. People were asked to do as many pushups as they could – those who had someone else working alongside lasted longer than when working alone. And when the partner simply stood by and cheered them on, their endurance was less than when alone.

So, you see, the benefits of team flying probably go beyond just having two people to find thermals.

The one drug that appears clearly safe for most people, caffeine, consistently is associated with small but measurable performance improvements. Caffeine has appropriate limits, but caffeine toxicity is usually mild because it's easily recognized, and then we lay off – shaky

muscles, a sense of weakness, and that peculiar buzz. Taken within 4–6 hours of bedtime, though, it can decrease the length and quality of sleep, and so can result in sleep deprivation next day.

Discipline on fundamentals

As we indicated earlier, discipline on fundamentals – going back to basics – is important in adjusting safely to cognitive degradation. When we look at any accidents, in aviation or elsewhere, often we realize that the victim's actions, regardless of circumstances, add up to a departure from standard piloting practices, from the fundamentals we learn in training.

Discipline on risk-taking is important, too. When we feel fatigued, or are in a fatiguing situation, we must assume that our skills and perceptions are imperceptibly degraded, and add margin for this. A loop or a wingover is not a difficult procedure, but the end of a four-hour cross-country is not the time to find out whether we can do one well.

I'm convinced that *practice is very important, too. It is easy to practice unusual situations close to home, while rested and alert, so that they are familiar to us if we get ourselves into one; then we are performing a familiar task instead a new one that we've only heard about, whether it's using a runway sidestep procedure to avoid an obstruction, using ground effect to move our touchdown point down the runway, or making turns at low altitude, where all the visual cues are different than they were when we were On High.* ✈



The advertisement features a white glider with a black nose and tail section, flying horizontally across the frame. A large, stylized red outline of a bell is positioned behind the glider, with the glider's wings and tail passing through it. To the right of the glider, the words "BELL" and "STEMME" are written in large, bold, red, sans-serif capital letters, stacked vertically. Below the brand name, the text "Glider Sales Exclusively Serving the United States" is written in a smaller, black, sans-serif font. At the bottom of the advertisement, the website "www.BellStemme.com" and the phone number "803.822.4114" are listed in a black, sans-serif font.

