

Pain is Weird

Pain science reveals a volatile, misleading sensation that is often more than just a symptom, and sometimes worse than whatever started it

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by [Paul Ingraham](#)

audio version available

SUMMARY

Modern pain science shows that pain is a volatile, complex sensation that is completely tuned by the brain and often overprotectively exaggerated, so much so that sensitization often becomes more serious and chronic than the original problem. All of this has complicated “all in your head” implications: if the brain controls all pain, does that mean that we can think pain away? Probably not, but we do have some “neurological leverage” of great value — we can influence pain, if we understand it.

full article 11000 words



Pain is not just a message from injured tissues to be accepted at face value, but a complex experience that is thoroughly tuned by your brain. The results are often strange and counter-intuitive, like quantum physics, but the science is clear: every painful sensation is 100% Brain Made®, and there is no pain without brain.

Does that mean can we think pain away? Just how much power does the mind have over pain? Can confidence and education cure?

Articles on this topic are now common, but most of them tease readers with the tantalizing idea that pain can be treated with the mind... while failing to explain *how*. In this article, I get specific about what's realistic and practical with “mind over pain.” There's bad news, but there's also good news — *if you understand how pain actually works.* **1** Many discoveries about the physiology of pain **2 3** have been painfully slow to reach the public, or even health professionals. This is useful stuff, and it needs to be shared.

Mostly we need to stop thinking of pain in terms of single causes or cures: “It's all coming from the ____, I know it!” It almost never is. **4** Pain is not reliable sign of what's really going on. Chronic pain is a witch's brew of different factors, complex by *nature* (not just coincidence or bad luck). At the very least, pain always has a layer of brain-generated complexity. At the

worst, the pain system can malfunction in several colorful ways, causing pain that is much more intense and interesting than just a symptom — sometimes the pain is the problem.

The biology of pain is never really straightforward, even when it appears to be.

~ “Reconceptualising pain according to modern pain science”, Lorimer Moseley

One of the principle qualities of pain is that it demands an explanation.

~ Plainwater, by Anne Carson

Perception is the brain’s best guess about what is happening in the outside world. Perception is inference.

~ Scratching an itch through the scalp to the brain,
by Atul Gawande

Watch it! 3 good videos on this topic

This well-produced short video neatly summarizes many of the key points of the content of this article. I have quibbles with the advice they give — some nitpicking on that below.

[Understanding Pain and what to do about it in less than five minutes](#)  5:00

Another fine video “summary” of a different sort: this hilarious TED talk about a snake bite and pain neurology. No, really, you will actually laugh! It’s like stand-up comedy. Australia’s Lorimer Moseley, Professor of Clinical Neurosciences and tireless pain researcher, is one of the best public speakers I’ve ever seen — a must-watch for anyone with chronic pain, and the professionals who care for them. Does he say “groovy” just a couple times too many? Maybe! But it is groovy ... mate.

[Why Things Hurt](#)  14:33

Ramachandran’s excellent phrase

Ramachandran said that “pain is an opinion” — which sounds like a flaky New Age mind-over-matter theory. But Ramachandran is no mystic or guru: he is a neurologist and scientist. This passage is mainly known for the first few words, a pithy statement of the modern understanding of how pain works:

See also: Attack of the neutrophils! Our immune system unnecessarily attacks our own tissues every time we have an internal injury. See [Why Does Pain Hurt?](#)

Pain is an opinion on the organism’s state of health rather than a mere reflective response to an injury. There is no direct hotline from pain receptors to ‘pain centers’ in the brain. There is so much interaction between different brain centers, like those concerned with vision and touch, that even the mere visual appearance of an opening fist can actually feed all the way back into the patient’s motor and touch pathways, allowing him to feel the fist opening, thereby killing an illusory pain in a nonexistent hand.

~ [Phantoms in the brain](#), by VS Ramachandran and Sandra Blakeslee

He then tells the story of an extraordinary cure of a man with phantom limb pain, tortured by agony in a clenched fist that was not there. With a clever arrangement of mirrors, Ramachandran created the illusion that the man’s amputated arm was restored — a sort of “virtual” limb. The mere *appearance* of his phantom hand opening and closing normally cured his agonizing “spasms.” He felt better because of the illusion that he *was* better — because he *thought* he was better. The mirror-cure of phantom limb pain is one of the most curious anecdotes in all of pain science. In all of medicine, in fact.

The mirror-cure of phantom limb pain is one of the most curious anecdotes in all of pain science. In all of medicine, in fact.

Since then, “mirror therapy” has been studied and applied in many ways. A good quality 2007 study showed that mirrors aren’t actually necessary to achieve this effect.⁵ Mirror therapy is probably just a “fun” way to visualize healthy movement — which also works quite well without a mirror!⁶

Stranger still are tales of severe pain without injury, illustrating that pain can be *entirely* in the mind. (Technically, it always is.) One of the strangest of these was reported in the *British Medical Journal* in 1995:

A builder aged 29 came to the accident and emergency department having jumped down on to a 15 cm nail. As the smallest movement of the nail was painful he was sedated with fentanyl and midazolam. The nail was then pulled out from below. When his boot was removed a miraculous cure appeared to have taken place. Despite entering proximal to the steel toecap **the nail had penetrated between the toes: the foot was entirely uninjured.**

J.P. Fisher, senior house officer, D.T. Hassan, senior registrar, N. O’Connor, registrar, accident and emergency department, Leicester Royal Infirmary⁷

His pain was a “nocebo” — the opposite of a placebo. **8** Extreme examples like this are rare, but probably not as exotic as you might think. More to the point, even if they are rare, for every case like this there must be hundreds more where the injury is real but the patient is convinced that the damage is much worse than it really is — with proportionately exaggerated pain. And indeed there is evidence of this: in a 2012 experiment, for instance, *fear of pain* made people more sore for longer after a workout. **9**

See below for [more examples of pain weirdness](#)

Happily, it also works the other way: people may feel much *less* pain than they “should” when they are confident for any reason, such as not realizing how bad the damage is.

Injury and pain are not in lock step with each other. And yet that is exactly what nearly everyone assumed for a long, long time. And many professionals, even though they may “know” better, often seem to forget how powerfully pain is influenced by perception.

The perception of the perception of pain in olden times (and not so olden times)

For most of the history of medical science, pain was believed to work more or less the way the French philosopher René Descartes described it: a simple signalling system.

1. The flesh is wounded. (“It’s just a flesh wound!”)
2. Nerves send an unambiguous message to the brain about the damage. The intensity of the message is *directly proportionate* to the severity of the injury.
3. The brain interprets that message at face value — that is, if the message says, “There’s some bad damage here,” *we believe it.*

Based on this model, almost everyone still — today, in 2018 — still assumes that *any* message sent to the brain by a certain kind of nerve will always cause pain. Health care professionals everywhere still believe that the nerve is “sending pain,” that the signal *is* pain — and therefore these nerves are habitually called “pain fibers” and their messages are called “pain messages,” an equivalence between signalling and pain baked right into the language. This is wrong! And it’s worse than an oversimplification.

The labeling of nociceptors as pain fibers was not an admirable simplification, but an unfortunate trivialization under the guise of simplification.

~ [The relationship of perceived pain to afferent nerve impulses](#), by Patrick Wall and SB McMahon, 254–255

For several decades now, it’s been clear to pain scientists and neurologists that this simplistic, pain-fiber model is hopelessly inaccurate. In fact, they call it “*the naïve view*”! **10** Even microscopic worms with only two trouble-detecting nerves, compared to our *billions*, have richer pain experiences than *that*, with ways in which their pain is an “opinion” — an interpreted experience, with some surprising sensitivity to context. **11** And of course it makes complete evolutionary sense. Pain is clearly more useful as an experience when it is “smarter.”

So the way pain really works is much more complicated, interesting, and in some ways *useful*. A nerve should never be called a “pain” nerve. It doesn’t detect “pain.” It only detects *some kind of stimulus* in the tissue ... and the *brain* decides what to make of it, how to feel about it, and what to do about it, if anything.

Hallucinating pain *Acute* pain usually correlates well with tissue damage (although even horrible tissue damage can be surprisingly painless in the right context). As pain gets more *chronic*, the relationship often gets messier, and in some cases breaks down altogether. For instance, with severe [central sensitization](#), pain ceases to have anything to

What goes up, must come down

do with tissue damage: these patients are *hallucinating pain*.

Pain is less painful when we are confident that we are safe. This principle was demonstrated early in the history of pain research by a famous paper about wounded soldiers in WWII, which showed that they experienced surprisingly little pain considering the severity of their injuries — probably because they were so glad to be off the battlefield.¹² Ever since, researchers have been trying to understand just how that actually works. Although many questions remain to be answered, we *do* seem to have a rough outline.

The brain is not just a passive, gullible receiver for whatever messages the peripheral nerves send upstairs. And, if you think about it, it's kind of strange that we would ever have thought of it that way, because this is, after all, *the brain* we're talking about: seat of consciousness, the generator of your reality. The brain critically evaluates every danger message it receives — considering it in context, sizing it up before deciding whether or not to take it seriously.

Once a danger message arrives at the brain, it has to answer a very important question: “How dangerous is this really?” In order to respond, the brain draws on every piece of credible information — previous exposure, cultural influences, knowledge, other sensory cues — the list is endless.

~ *Pain really is in the mind, but not in the way you think.* Moseley (*TheConversation.com*)

As if that didn't complicate things enough, once your brain has made up your mind, it also *sends messages downwards* that actually affect the sensitivity and behaviour of the nerves.¹³ Thus everything that hurts involves a conversation, a sort of debate between the central and peripheral nervous systems. It could be dramatized like this:

NERVES Got problems here! Bad problems! Red alert!

BRAIN Yeah? Hmm. Okay, so noted. But you know what? I have access to information — sorry, it's classified, you'll just have to take my word for it — that suggests that we don't have to worry about this much.

NERVES I'm telling you, this is serious!

BRAIN Nope, I don't buy it.

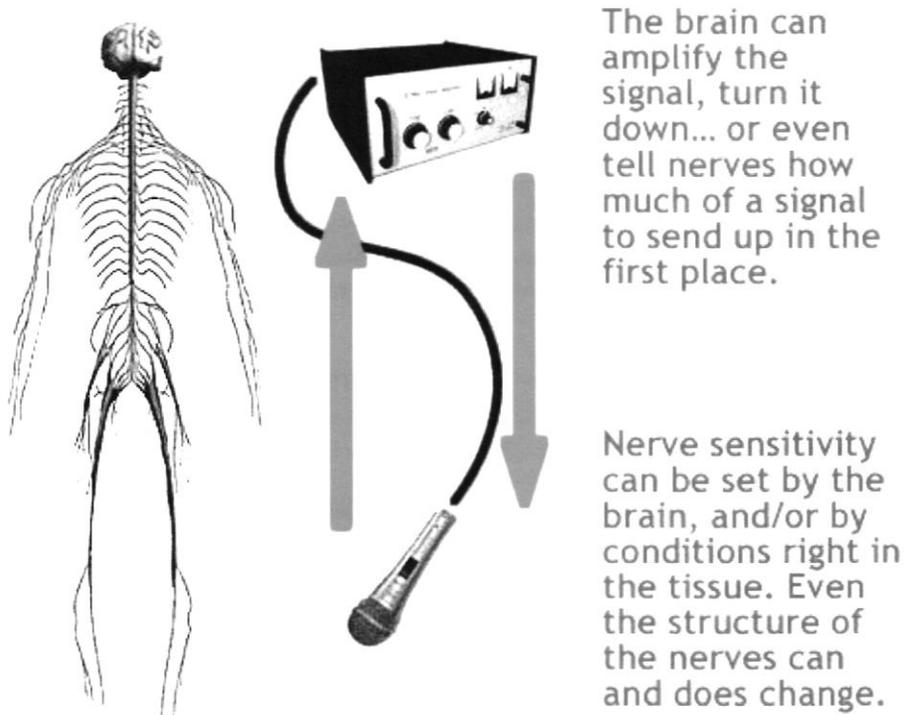
NERVES Look, I may not have access to this “information” you're always talking about, but I know tissue damage, and I am not kidding around, this is a credible threat, and I am going to keep telling you about it.

BRAIN Actually, you're having trouble remembering what the problem is. You're going to send me fewer messages for a while. Also, these aren't the droids you're looking for.

NERVES Uh, right. What was I saying? Gosh, it seems like just a second ago I had something important to say, and it's just gone. I'll get back to you later I guess ...

The brain can boss the nerves around, tell them how sensitive to be. When anxious, the brain might request “more information” from the peripheral nerves, ordering them to produce more signals in response to smaller stimuli. Or it might do exactly the opposite. There is extensive recent evidence that the peripheral nerves can even physically, chemically change,

perhaps in response to brain requests, tissue conditions, or both. To extend the analogy, this isn't just twiddling the volume knob, but changing the equipment, changing the signal before it even gets to the "amplifier."



(Just for fun, have a look at the complex version of that diagram.)

In short, messages don't just go up to the brain, *they go down*. This two-way functionality in the pain system is the main difference between modern pain science and old-school pain science.

But most of the modulation is probably central: we only feel what our brains allow us to feel. Even "loud" sensory messages can be filtered down to almost nothing by the central nervous system ... or, conversely, "quiet" sensory messages can be amplified. The quality and intensity of the final experience is clearly the product of an elaborate set of neurological filters.

Perhaps many patients whom doctors treat as having a nerve injury or a disease have, instead, what might be called sensor syndromes. When your car's dashboard warning light keeps telling you that there is an engine failure, but the mechanics can't find anything wrong, the sensor itself may be the problem. This is no less true for human beings. Our sensations of pain, itch, nausea, and fatigue are normally protective. Unmoored from physical reality, however, they can become a nightmare ... hundreds of thousands of people in the United States alone suffer from conditions like chronic back pain, fibromyalgia, chronic pelvic pain, tinnitus, temporomandibular joint disorder, or repetitive strain injury, where, typically, no amount of imaging, nerve testing, or surgery manages to uncover an anatomical explanation. Doctors have persisted in treating these conditions as nerve or tissue problems—engine failures, as it were. We get under the hood and remove this, replace that, snip some wires. Yet still the sensor keeps going off.

So we get frustrated. "There's nothing wrong," we'll insist. And, the next thing you know, we're treating the driver instead of the problem.

~ [Scratching an itch through the scalp to the brain](#) by Atul Gawande

Explain Pain: myths and misconceptions

Many moons ago I started trying to understand and explain pain, gradually producing this article, only dimly aware as I worked that I was *re*-producing some much more mature ideas. I knew that modern pain science and treatment has deep roots, insights and research going back to the 1960s and Melzack, gate control theory and cognitive behavioural therapy, but my *explaining* was eerily similar to a recent and popular “packaging” of pain science known as Explain Pain (EP), from Drs. Lorimer Moseley and David Butler: “a range of educational interventions that aim to change one’s understanding of the biological processes that are thought to underpin pain as a mechanism to reduce pain itself.”¹⁴ There’s a book of that name — *Explain Pain* — and many other interpretations and riffs on the key ideas (like this article). It’s not that I invented my own version of Explain Pain independently, I was just trying to *explain pain*, you know? Lowercase!

Explaining Pain according to Dr. Moseley is about “wanting people to actually understand how and why they can be in horrible pain yet not in horrible danger.” According to me, *explaining pain (might) help to reduce it*, and it’s inherently fascinating even if it doesn’t do a lick of good.

There have also been a *lot* of misunderstandings. Because explaining pain is tricky. (There are still plenty of unanswered scientific questions, too.) And because Explain Pain as a “brand” might be a little bit of an over-hyped upstart, maybe given too much credit by too many people too soon — especially the idea that it actually *reduces pain*, which remains highly speculative. Nevertheless, for the record, here are some key misconceptions about EP..

- Explaining pain is not about *managing* or *coping* with pain. That’s another (important) kettle of fish.
- It’s not just about chronic pain. Acute pain needs splainin’ too.
- Explaining pain does not encourage people to move *despite* their pain — it’s just about teaching them that pain is often “overprotective.” Just because the brain worries too much doesn’t mean it’s wrong.
- It’s not about the regulation of “pain messages” or “pain signals,” because there are no such things. It’s about the regulation of *danger* messages, and how only the brain can amplify or mute pain.
- The point is not to reassure people that pain is “just” a perception and not real (ugh) — it’s about reassuring people that the *danger* implied by pain *may* be exaggerated. *Tissue damage is real & pain arising from it is real. But they have an “it’s complicated” relationship.*
- Many people seem to think that Explain Pain ignores biology, biomedical, and structural factors in pain. Nope: the point of explaining pain is to explain the “it’s complicated” *relationship* between these things and pain. Tissue damage is real, and pain arising from it is real... but it’s complicated. **15**
- It’s not just about central sensitization (for which there is no known cure). Sensitization is an important sub-topic, but it’s important to explain *unsensitized* pain too. **16** And the explain pain movement is actually rather optimistic (maybe even *too* optimistic) that learning the right things can actually change pain — even when it’s the product of sensitization.

But the mother of all misunderstandings is the popular idea that if pain is an output of the brain, then we must be able to *think our way out of it*. It’s such an important and difficult topic that most of the rest of the article is devoted to it.

Can we think pain away?

If all this is true... and it is... **17**

100% of the time, pain is a construct of the brain.

~ Lorimer Moseley, from his surprisingly funny TED talk, [Why Things Hurt](#)  14:33

...does that mean can we think brain-built pain away? If the brain can build pain, can it un-build it? Yes and no, because, as Dr. Moseley explains, “Pain really is in the mind, but not in the way you think.”¹⁸ It’s a good news, bad news kind of thing. Let’s get the bad news out of the way first.

Pain is a motivator. It exists to get us to act. We hurt when our brains reckon we should do something differently, for safety... but safety is not always possible. The nature of the danger isn’t always clear, or avoidable.

And the brain worries too much: from hangnails to fibromyalgia, it overstates the danger.

And the brain can’t be manipulated simply by wishing, force of will, or a carefully cultivated good attitude. The brain powerfully and imperfectly controls how we experience potentially threatening stimuli, but I’m sorry to report that *you do not control your brain*. Consciousness and “mind” are *by-products* of brain function and physiological state. (Deep, eh?) It’s not *your* opinion of sensory signals that counts, it’s what your *brain* makes of them that counts — which happens quite independently of consciousness and self-awareness. The dominance of the brain is obvious with something like blushing:

Blushing occurs when the blood vessels of the head and neck dilate and become infused with blood. It is an instantaneous physical change seen on the surface but reflecting a feeling of embarrassment or happiness that is held inside. When it happens I can’t control it. That point is important. My blushes betray a feeling and, even when they increase my embarrassment, I cannot stop them.

~ [It’s All in Your Head](#), by Suzanne O’Sullivan

But it is also true of pain. As Todd Hargrove put it, “Pain is sometimes immune to logic,” because pain is handled by a part of the brain that is not easily over-ruled by other brain “modules” — like an optical illusion that you can’t “un-see” even when you understand it.¹⁹ As he put it elsewhere:

Humans don’t get to decide what they find threatening, stressful or painful any more than a cat does. That decision is left to ancient unconscious systems that can’t really be reasoned with.

~ Todd Hargrove, [Treat Your Client Like a Wild Animal](#)

Your brain modulates pain based on factors that are completely out of your control. Or rather difficult to control, or even just impractical to control.

This is why *many wise, calm, confident optimists still have chronic pain*. Here are three examples of ways that the mind definitely has power over pain, but without much practical value, at least so far: being in love, looking through filters, and not looking at all!

Romance! Thanks to a quirky 2014 study, science has confirmed that that *being in love* relieves pain — a wonderful example of the potential power of the mind over pain. ²⁰ Falling head-over-heels is not exactly a convenient solution. As researcher Dr. Sean Mackey put it, “We can’t give you a prescription for love” — not one that’s easy to fill, anyway. Closely related: pain is also muted when romantic partners hold hands. Aw. ²¹

Weird illusions! Starting with *de-magnification*: If you view a painful hand through a magnifying glass, it will actually get more swollen and inflamed — that is, if you make it *look bigger*, it will *feel* like a bigger problem. ²² And the reverse is true too! Use optics to make it look smaller, and swelling will go down. Incredible, right? Jedi pain tricks! But ... do you have a *de-magnifying* glass handy? Where do you buy even one of those, let alone a big one? (They really are hard to find. How about looking backwards through binoculars? Not a great solution. ²³) And what happens if the pain isn’t in a place that’s so easy to de-magnify, like your low back?

The de-magnification trick is dang interesting, but it’s obviously not a practical approach to most pain. The effect is real under the right circumstances, but trying to use it as a treatment is like trying to take a magician’s trick home with you.

Maybe someday virtual reality tech will make “visuotactile illusions” like this a lot more accessible and convenient. A nifty proof-of-concept study demonstrated that a couple of other illusions can reduce osteoarthritis pain by up to 40%, at least temporarily. ²⁴ So what visual sorcery can kill more pain than any other known treatment for that condition? Two similar illusions, using virtual reality goggles to make it look like the knee was either *shrinking* or *stretching*. ☹️ Whoaa, duuuuude...

Not looking! Getting an injection actually hurts less when you don’t watch. ²⁵ Out of sight, out of mind: if the brain can’t see the threat, it is less sensitive to it. That’s interesting, and like the magnification/stretching/shrinking experiments, it clearly demonstrates that the brain modulates pain and, in that circumstance, we can modulate it. It’s easy to look away from a needle, but with most chronic pain, what is there to avoid looking at? We usually can’t see the threat.

Although it is technically the brain’s prerogative to ignore painful signals from your tissues, that doesn’t mean that there’s any way we can convince it to do so — if there is a destructive disease process going on, for instance, the brain will usually not ignore those signals! The pain system evolved to report problems, and you can count on it to do so most of the time.

Power of the central nervous system, exhibit A

Three-legged cat Isaac, trying to scratch himself with his missing leg:

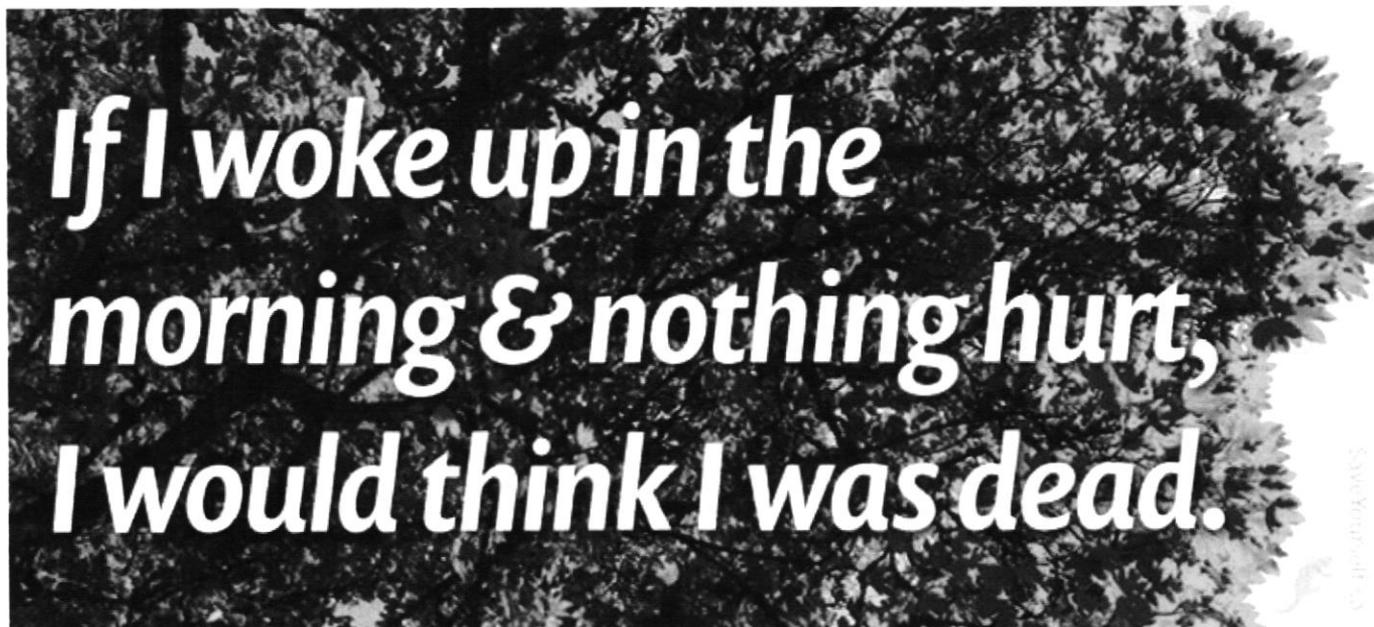


Now a little to the left ...

That has got to be *super* frustrating! The pathetic futility of Isaac’s scratching does not stop his brain from *trying*. Poor little guy. His brain has a picture how things should be, and acts accordingly. The impulse is like a freight train, even when it’s blatantly ineffective.

So it is often is with pain: if the brain believes there’s a threat, you’re going to hurt, no matter how pointless it is or how intensely you focus on trying to have more reasonable and rational sensations. It’s mostly just not up to you.

But that doesn't mean that we're completely powerless. Mind has *some* influence over brain. Below I suggest some ways that you can "hack" pain neurology.



Quibbles with the advice in the Australian video

At the beginning of the article, I shared [this lovely Australian video about chronic pain](#). Its main messages are mission critical stuff, and overall it gets an A-grade from me. But I am concerned that some of its advice is a little too trite and dumbed down — and it's a good example of a common problem with this topic.

It's certainly extremely important to emphasize the psychology of pain, but the video comes dangerously close to advising patients to "don't worry, be happy," and the dreaded "all in your head" — and that's really *not* what we want here.

Yes, pain is a brain thing, but this must not be simplified so much that people have no idea what to do with it or, worse, feel blamed for it. People with chronic pain feel bad enough already! ²⁶ This is tricky! "There's fun stuff in pain science and neuroimmunology that's slippery to adapt to practice without reaching too far" ([Sandy Hilton, Physical Therapist](#)).

To the extent that the video is encouraging, I fear it's for the wrong reasons: it portrays pain as a problem with a dysfunctional brain that can be "retrained," which is definitely too optimistic. *Brains are not terriers*. Although it makes sense to *try*, there is no good evidence that it actually works, and it is virtually certain that it often does not. There are many possible reasons why.



For instance, stressors and mood disorders (depression, anxiety) can be virtually invincible. Most people with chronic pain aren't just a little stressed, they are *a lot stressed*, and often by major life challenges and social problems that they literally cannot solve. ²⁷ Even when their problems are theoretically more manageable, most people find it extremely difficult to troubleshoot their own mental health. So while it's correct to tell patients to "learn to reduce stress" and "consider how your thoughts and emotions are affecting your nervous system," that advice is impractical without more and better information. "Consider" is just not concrete enough.

Most people find it extremely difficult to troubleshoot their own mental health.

The video's low point is a recommendation to "recognize deeper emotions" — even more impractical, to the point where many patients will dismiss it as a flaky talk, far too touchy-feely. I understand what they were going for, and it's the tip of an iceberg of an important concept — healing by "growing up" — that I will discuss below, but the video simplifies it to the point of absurdity.

I certainly applaud the emphasis on psychological and social factors, but it's also really important to *keep it real* and *make it practical*. Because, properly approached, in some ways it is possible to "think pain away," to the extent that stress, fear, and anxiety about a painful problem can actually be reduced.

It's time for the good news.

How do we convince people in pain that we understand that they are in pain but it's not *just* about the tissues of their body? A key conceptual shift that we think is really important is that you can understand that pain is the end result, pain is an output of the brain, designed to protect you ... it's not something that comes from your tissues.

~ Lorimer Moseley, from his surprisingly funny TED talk, [Why Things Hurt](#)  14:33

Science says confidence cures

One of the top five questions I am asked by email, about any condition, is simply *Is there hope?* The answer is nearly always the same: yes, there's hope. There's *never* a guarantee, but there's *always* hope, and recovery from most kinds of severe chronic pain is not only possible but fairly common. Unless you have a known serious aggravating factor — a major trauma, for instance — there is almost never any reason to fear that recovery from any chronic pain problem is impossible. For the same reason that pain can be absurdly persistent and out of proportion to any clear cause — because it is so brain-tuned — it also never rarely loses the potential to finally shift and evaporate.

For instance, just a change in confidence can make a big difference.

There's been a lot of indirect evidence about this for a long time, but one of the first really good, direct scientific tests was finally published in 2013 by Vibe-Fersum *et al.* ²⁸

Classification-based cognitive functional therapy (CB-CFT, or just CFT) for low back pain is a "body/mind approach to understanding and managing this complex problem" that "targets the beliefs, fears and associated behaviours" of patients (what I have called the "confidence cure" for many years). The big idea of CFT is that the cycle of pain and disability can be broken by easing patient fears and anxieties, specifically "reframing the persons' understanding of their back pain in a person-centred manner, with an emphasis on changing maladaptive movement, cognitive and lifestyle behaviours contributing to their vicious cycle of pain." Translation: pretty much anything strategy that restores confidence.

Disabling back pain can change for the better with a different narrative & coping strategies.

CFT was tested on 62 patients with moderate back pain, and compared to 59 who were treated with manual therapy and exercise. Three months and a year later, the CFT group was much better off. ²⁹ CFT was "more effective at reducing pain,

disability, fear beliefs, mood and sick leave at long-term follow-up than manual therapy and exercise.” As the authors put it for BodyInMind.org, “Disabling back pain can change for the better with *a different narrative and coping strategies*.”

There were some blemishes on the study methods, but nothing dire; the results can be safely regarded as quite promising while we wait for replication from bigger studies.

Just learning about this could be therapeutic, but how else can you apply this good news? How else can you CFT yourself, and otherwise get your brain to downgrade your pain?

Whilst the problem is superficially a physical one, the real challenges faced by someone with chronic pain are mental. Mental state is the biggest modulator of physical pain. Things hurt more when you're stressed or sad, and the increased pain makes you both stressed and sad. The way out of this vicious circle is a wholesale change to how you perceive fear, suffering and setbacks.

~ [How chronic pain has made me happier](#), by Rob Heaton

Jedi pain tricks! What are the practical applications of this knowledge?

Chronic pain is not all about the body, and it's not all about the brain — it's everything. Target everything. Take back your life.

~ Dr. Sean Mackey, [Pain & the Brain lecture](#)

Pain is “another *%\$@!! growth opportunity” — another provocation to mature as a person, and a particularly intense one. For many people with severe and chronic pain, learning coping skills is a necessity. But personal growth is probably a much greater opportunity than merely *cop*ing with pain. We may not control our brains, but we do have considerable *indirect* leverage. We can't micromanage every sensation, but we can tinker on a large scale. We change the context and direct our experience of life on a large scale. For instance ...

Huff, puff, and blow your pain down. We can alter our physiology with deep, vigorous breathing, instantly creating new feelings — and your brain will go along for that ride, and perhaps re-interpret your experience of pain. For more about this odd idea, see [The Art of Bioenergetic Breathing](#).

Create new social contexts by doing something as simple as playing a team sport — because other people are counting on you, the painful consequences of intense exercise are usually re-contextualized as tolerable, even desirable, and you can put up with quite a lot more. You can't *think* your way to that kind of pain tolerance — but you can *place yourself in a situation* where it is a likely outcome. This is why [Haven](#) — a counselling school, which many people go to just to learn more about themselves — uses “experiential” workshops, putting people through a lot of interesting and intense experiences together. They tinker with your social context, because humans beings are so interested in each other that our social experiences utterly dominate our consciousness. Change your social experience, change your brain!

Reduce fear and anxiety, increase confidence, especially with education. Fear and anxiety probably have more power to aggravate pain than any other emotional state, and acquiring knowledge and perspective are superb treatments. A confident and happy brain amplifies danger signals less than an anxious, miserable brain. This explains lots of interesting

results in pain research (not to mention clinical observations), like the cognitive functional therapy results in the last section, and the fact that the most powerful factor predicting how soon people return to work after an episode of low back pain is whether or not they *expect* to return to work,³⁰ and the fact that education alone probably helps to resolve neck pain.^{31 32} So do not let health professionals get away with any fear-mongering.³³ Seek out as much information as you can find, because nothing causes more anxiety than uncertainty. These are real defenses against pain.

Early intervention is critical to prevent acute pain from turning into chronic pain.³⁴ It is clear that chronic pain involves significant neurological changes, both in nerves and in how pain is processed in the brain. Once those changes occur, recovery is much more difficult, at an incredible cost in suffering and medical expenses. Persistent pain should *not* be ignored. Deal with it sooner, not later.

The brain cells that produce pain get better and better at producing pain. They become more and more sensitive...

Lorimer Moseley, pain researcher, [Why Things Hurt](#)

You Tube 14:33

Firmly reject the self-hating idea that your pain is “just” psychological or merely psychosomatic.

Paradoxically, even though pain is strongly regulated by your CNS, it is certainly not “all in your head.” The idea has always been disrespectful to pain patients, but now it is also scientifically obsolete and can be thrown out with yesterday’s trash. Any health professional talking like that should just be ignored. We know better these days: pain does not have to be driven by easily diagnosed tissue damage to be “real” and serious, and it can have major psychological dimensions without being *just* psychological.

Be kind to your nervous system. Create pleasant, safe sensory experiences — positive inputs. Seek comfort. Be a hedonist. If your brain thinks you’re safe, pain goes down — and pleasure feels safe. So be “nice” to your CNS in every way that you can think of. Make your life — or a joint — feel safer, gentler, more pleasant. Do it in general ways (soak the whole system in a hot tub), but also more specifically: pleasantly stroke a sore knee, give a screaming shoulder the “comfort” of a sling for a while, or cautiously but thoroughly move a troubled joint to demonstrate to your brain that it’s okay. (*See, brain? We can do this! No big deal!*) Lorimer again...

*To reduce pain, we need to reduce credible evidence of danger
& increase credible evidence of safety.*

~ Lorimer Moseley. [Explainer: what is pain and what is happening when we feel it?](#)

TheConversation.com.

Change something — almost anything! — about how a painful area *feels*. Make it as feel different as you (cheaply) can. Sensation is *one* of the factors the brain uses to set pain levels. If you can make a body part feel significantly different in *any way*, it may help (but especially if you can make it feel safe, protected, stabilized). In fact, this probably explains why

many treatments for pain problems are popular and seem to help sometimes, despite being unreliable and generally minor. ³⁵ Classic examples: taping, bracing, strapping, splinting, salving, vibrating, heating, icing. Regardless of how they *supposedly* work — there are many overly complex explanations — most of these methods mostly just change how a body part *feels*. ³⁶ The benefit of *novel sensory input* is probably not much more profound than being distracted by a loud noise ... but we can add it to the toolkit, with reasonable expectations. Use any cheap, convenient, creative method — there's little reason not to.

We cannot trust our eyes (or our pain)

Japanese professor makes amazing 3D optical illusions  1:26

Pain is a lot like these amazing illusions — that is, it is *warped by our expectations and point of view*. Unlike these clever models, though, we can't turn it around to see what's *really* going on. And trying to see through the illusion, trying to believe that there's nothing much actually wrong with our tissues (often true), is even more difficult than seeing through these illusions. But that challenge is what recovery is all about: trying to change our expectations and point of view with interesting new sensations and movements.

Fix the fixable in your life — and be honest about what is fixable. Most people aren't quite as stuck as they think they are. Many problems really aren't fixable, of course, but some of your worst and oldest problems probably are — we tend to be our own worst enemies. And those problems are usually the source of most of our stress, anxiety and depression — which means that they also have a direct impact on how much we *hurt*. There are many examples of difficult problems that can usually be fixed with some hard work and maybe some leaps of faith: bad marriages and toxic friendships, bad jobs and bad bosses, a house or city or climate you don't like, poverty, addiction, insomnia and many more. Finally taking action to fix such problems is the most direct route to easing a brain's interpretations of pain.

Positive movement — One of the big ideas in evolutionary psychology is that our minds have many specific skills, rather than an all-purpose intelligence. If the part of the brain responsible for pain — the pain “module” — isn't easily swayed by the thinking module, are there other modules that might have more influence? Todd Hargrove: “The movement modules would be first on my list.” ³⁷ “Positive movement” may be more potent than “positive thinking.” And what is positive movement? Moving as if you are more comfortable than you are: build up your confidence with whatever movement you can reasonably handle. Move in ways that are as pleasant, fun, and/or inspiring as possible. Pain limits movement — so push against those limits gently, creatively, playfully.

Don't dramatize your pain. This one needs a whole section...

Don't be a pain drama queen!

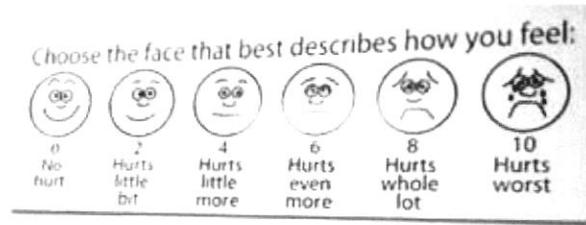
“It feels like a jagged, flaming, poisoned sword ripping through my body over and over again.”

People really talk like that, when they are in pain. (*My father* talks like that. And I have the impulse — perhaps genetic — to talk like that.)

But beware of colourful and extreme descriptions of your pain. They are tempting. There are quite a few reasons to exaggerate pain. For instance, pain is such a private experience — so often minimized or even denied by health professionals — that patients are often tempted to dramatize the pain to make it seem more real. But it's a trap! Before you know it, you'll believe your own story. When you exaggerate and dramatize your pain, you directly exacerbate the neurological end of the chronic

pain problem. The ability to weather emotional storms — being unflappable in the first place, or recovering relatively quickly — probably affects pain levels. ³⁸

The pain scale is the imperfect replacement for flaming, poisoned swords. If you have chronic pain, you've probably been asked many times to rate your pain, and probably on a scale of 1 to 10, and maybe with a visual aid like this:



A typical doctor's office pain scale chart.

On the one hand, the pain scale is an essential pain research and clinical tool, with proven value — it's the main way that we measure the effect of therapies, to see if they really work. On the other hand, the opportunities for abusing the pain scale are legion, and the pain scale is a source of perpetual confusion in health care offices throughout the land. It sounds so easy: just rate your dang pain! But people are often stumped by the question, or they overthink it, or they wildly exaggerate.

Many times I have seen pain-scale discussions nose dive into philosophy. Is #10 reserved for the worst pain we have ever experienced, or the worst pain we can *imagine*? "I don't know, I can imagine quite a bit." Can we ever really know what someone else's pain feels like? (*No.*) If pain fluctuates, do we take the average? For really horrible pain do we go off the scale? Or recalibrate?

The thing is, people *like* to go off the scale. Drama is fun. Hyperbole is fun.

"Definitely a 15. Having a baby, yikes, that was like a 19 with spikes to 38."

The irony is that the pain scale is supposed to help you think more objectively and rationally about your pain, but it often just creates another opportunity for melodrama. So use the pain scale, but use it wisely. Use it as a tool for getting a little more real about your pain.

Speaking of hyperbole, this pain scale business was hilariously lampooned by Allie Brosh of the brilliant, scribbly blog Hyperbole and a Half. Look back at #8 on the pain scale chart above. Does that look like a #8? According to Brosh, #8 seems to be thinking: "The ice cream I bought barely has any cookie dough chunks in it. This is not what I expected and I am disappointed." So she did her own. Here's *her* take on #8:



"I am experiencing a disturbing amount of pain. I might actually be dying. Please help."

Now that's more like it! No ambiguity there! Brosh's pain scale is so funny that you will spray milk out your nose. (Assuming you drink some milk first.) Read the whole thing. But get the joke!

What's the difference between "pain is an opinion" and "it's all in your head"?

I've already pointed out a couple times that *none* of this means that pain is "all in your head," but we should make it much clearer. Unfortunately, it's tricky to tell patients "sometimes pain correlates poorly with tissue damage" without them *hearing* "it's all in your head." It's a hazard baked right into modern pain science, and I think it's a serious problem. I have experienced it myself as a patient, and seen lots of other evidence of it.

For example, here's the beginning of an amazing, uplifting back pain story, told by Dr. Jerome Groopman in his book, [The Anatomy of Hope](#), about his own experience with super severe chronic low back pain:

Dr. Rainville planted the MRI scan of my spine on a lighted box on the wall and systematically inspected the film, vertebra by vertebra. Seemingly satisfied that he had reviewed all the relevant data, he turned and stood before me.

"You are worshiping the volcano god of pain," he declared. "The volcano god of pain is your master."

I had been warned that Rainville was a brash, in-your-face clinician who held contrary views. But what on earth was he talking about?

The "volcano god worship" lecture Groopman gets from Rainville is really great: an intense, dramatic version of the central idea of this article, that pain can get totally disconnected from reality. Despite the artfulness of the explanation, Groopman struggles with the implications like any patient:

And what was he really saying, in cold biological terms, not flamboyant metaphors of volcano gods? That changing my beliefs could dampen flaming circuits of pain? Was I some mystic or yogi who could walk barefoot over hot coals or lie down on a bed of nails?

Groopman's story is worth the price of the book.
Especially because it has a happy ending.

So here's the difference:

- Pain that's "all in your head" is pain *primarily driven by hypochondria*, a form of anxiety disorder, a mental illness.
- Chronic pain without obvious tissue damage is a systemic malfunction in which the nervous system produces more pain experience that is *out of proportion* to actual tissue trouble, sometimes dramatically (as in Groopman's case). But, crucially, the problem usually began with tissue trouble and *there's still usually some tissue trouble remaining*.

What if there is tissue trouble?

The ideas presented in this article are so clinically important and interesting that, in many discussions, they have begun to drown out the boring-but-basic fact that tissue trouble still *usually* leads directly to pain. Pain and tissue damage are positively and strongly correlated. Just because that correlation can get messy and break down does not mean that it doesn't exist, in spades. Pain is volatile, but it's not totally out to lunch!

Pain perception is subject to strong distortions, but these are mostly rare and *hallucinatory*. We can make pain up out of thin air, but we rarely *do*. And we can have painless trauma, but we rarely *do*. There are famous and fascinating examples of such cases (described above), but they are famous *because* they are somewhat exotic. Pain perception may be volatile, particularly with complex and chronic cases, but it's still mostly a consistent and predictable warning system about tissue danger.

It has to be reliable: that's why it exists.

Unexplained chronic pain is common, and the relationship between pain and tissue damage often gets weirder and murkier as time goes on, which can get totally confounding for patients and professionals. We need to simplify. When there's no known damage, there are two possibilities (other than hypochondria):

1. either there is tissue insult (a source of nociception) that just can't be identified (surprisingly common I think), or
2. the relationship between tissue insult and pain has broken down (*also* quite common).

And these scenarios are not mutually exclusive: you can have both tissue damage *and* a wonky, disproportionate relationship to pain.

Point one is an important source of reassurance for many people. I'm speaking both professionally and personally here, because I suffered exactly that fate in the last year: a persistent pain with no apparent cause, so much so that I was told by a few professionals that my only problem was "pain dysfunction," or experiencing pain without tissue damage. But then, rather better late than never, the source was found and removed and that was the end of my pain. Ta da!

So I suffered a year of serious chronic pain with no apparent source that absolutely *was* positively, strongly correlated with a tissue insult. Just a sneaky one!

I know similar things have happened to plenty of other people too.

So sure, technically, all pain is indeed all in your head...but so are those nectarines, bumblebees, and nebulae. That is the nature of consciousness. Most experiences have strong roots in the world. Or your body.

Everything is in the brain, but when we want to learn about the universe, we look through telescopes, not brain scanners.

*~ Dr. Rob Tarzwell of One-Minute Medical School.
(Ironically, when Dr. Rob wants to learn about people, he looks at them with a brain scanner.)*

If you want to know about nectarines, you mostly study *nectarines*, not brains. If you want to know about that nebula, you use a telescope, not a brain scanner. And if you want to know how back pain works, you are going to have to study back injuries and pathologies *and* the creative and colourful ways that brains play with pain perception. But brains are still usually playing with the perception of something that is actually going on in the "world" of your back, in your tissues.



Is a nebula out there? Or is it just a mirage between your ears? Trick question! (Running Chicken Nebula, photo by Martin Pugh)

Concluding advice for Professionals

I'll keep this simple. Physical therapists, massage therapists, chiropractors and anyone who works with hurting bodies: please consider not trying to "fix" patient's flesh. It's possible that it's impossible. **39**

Instead, address the nervous system. Be kind to it. Help patients remember what it's like to feel safe and good. Be the source of a positive sensory experience. *Educate to reassure*, and avoid giving patients any new cause for alarm or worry.



About Paul Ingraham



I am a science writer, former massage therapist, and I was the assistant editor at ScienceBasedMedicine.org for several years. I have had my share of injuries and pain challenges as a runner and ultimate player. My wife and I live in downtown Vancouver, Canada. See my [full bio and qualifications](#), or my blog, [Writerly](#). You might run into me on [Facebook](#) or [Twitter](#).

Appendix: more examples of pain weirdness

Pain weirdness example #1: Insight from eyesight, Spring of 2011

I had corrective eye surgery a month ago. Today my eyesight gave me good insight into *how pain works*. The laboratory of my own body has yielded results yet again. I swear, I should just start injuring myself and having surgeries just for the academic experience. (Hm, on second thought, *no*. But you know what I mean.)

Recovery is going swimmingly. My left eye is so good it's practically bionic now. My optometrist — an excellent one in downtown Vancouver, who *loves eye-science tangents* — basically can't find any sign that anything even *happened* to my left eye. No laser tracks. No remaining signs of recovery. It's done!

The right eye? *Total slacker*.

The right seems blind! ← subliminal political message

The left eye is so good that the right eye *actually feels bad*. It aches a bit. In reality, the right is also healing well and is either on recovery schedule or slightly ahead.

And yet my bionic left eye is so far ahead of healing schedule that the right actually *literally* suffers by comparison. It seems awfully blurry, and there has been mild pain for a couple weeks now, and this was freaking me out a little. Get a load of what my optometrist said (paraphrasing) when I told him about this:

People's eyes often hurt when they think there's something wrong with them.

Really? So ... I should probably resist this punning, but I just can't ...

Pain is in the eye of the beholder!

So, if you *think* there's something wrong with your eyes, they may well start to hurt. This demonstrates that "pain is an opinion" rather well. That is, pain intensity depends surprisingly heavily on how dangerous/scary/disturbing the situation seem to us, on our "opinion of the state of the organism." If you think the organism (you) is safe, pain will be dulled. If you think you're in danger, then pain will be more painful.

This is clearly not the same thing as being "all in the head." It's pain being *affected* — dialed up or down — by what's in the head, both consciously and unconsciously.

My optometrist described the following scenario (paraphrasing):

Someone can "discover" an eye problem they've had for twenty years and start hurting. They accidentally cover one eye while watching television, happen to notice that the vision in the free eye is a bit off. It's been off all along — almost everyone is at least a wee bit astigmatic, but the brain completely takes care of that when both eyes are open. But if they notice it with an eye covered, a week later they're in my office complaining of blurred vision and an ache.

Fascinating. And exactly like the [mind game in low back pain](#). As with back trouble, I reckon that the idea of eye trouble is just a bit more freaky, and thus usually more sensitive to psychological factors.

Not only is worry generally excessive and unnecessary, we can see here that it is actually *counter-productive and painful*. (Which is worrying!) It's really quite a thing: here I was getting anxious about my right eye when it's only problem was being *less awesome* than my left. Good grief.

Honestly, I really became a little obsessed with it in the last couple weeks. I "discovered" that it wasn't as good as the left, and started checking it constantly.

And so it started to ache.

I am impressed again by how easily I am fooled by the illusions of neurology, even when I am well aware of them. It is becoming clear to me — if I look at it with my left eye, anyway — that we need to know the basics of pain neurology quite

well indeed in order to acquire the confidence required to see through those illusions. I was able to quickly focus on the nature of the problem when it was explained to me ... but despite all my knowledge about musculoskeletal problems, I was blind to it without a bit of help.

Pain weirdness example #2: Metal rod embedded in arm painless for fifty years

Sensation and pain are nothing if not mercurial. On the one hand, we can be driven half out of our minds by a bit of beef wedged between a couple teeth. Or, stuck right in the other hand, a large piece of metal can be painless for 50 years. Like a turn signal lever.

Art Lampitt got one of those embedded in his arm in a car accident long ago. What with all the other injuries, no one noticed. It didn't give him any trouble until recently. His arm began to ache and swell and an x-ray revealed a strange, thin third arm bone.

"I was hoping it might be shiny still," he said in an interview with [CBC Radio One's "As It Happens,"](#) but it was badly corroded — perhaps the reason it finally caused some symptoms, but who knows.

I love medical marvels that challenge our preconceptions about what will hurt. It's noteworthy that it *didn't* hurt for decades — because if that's possible, just imagine how unpredictable the symptoms of a little arthritis can be — but it's also noteworthy that it did start to cause trouble *eventually*. It's a great example how pain is weird.

What's new in this article?

Nineteen updates have been logged for this article since publication (2010). *All PainScience.com* updates are logged to show a long term commitment to quality, accuracy, and currency.

August — Cited [Stanton](#), an experiment demonstrating that VR-generated illusions can kill pain effectively, adding to the list of interesting but impractical examples of modifying pain with brain "hacks."

January — Cited [Ruiz-Aranda](#), an experiment that showed that emotional coping skills improve pain tolerance.

2017 — Science update: cited [Parr et al](#) on the effect of the fear of pain on post-exercise muscle soreness; [Höfle et al](#) on the effect of context on how much needles hurt; and [Nilakantan et al](#) on romantic analgesia.

2017 — Quoted Todd Hargrove on the implications of the modular theory of mind from evolutionary psychology and added the recommendation of "positive movement" (as opposed to positive thinking).

2016 — Added sidebar: "We cannot trust our eyes (or pain)."

2016 — Major upgrade: added a new section, "Explain Pain: myths and misconceptions" ... and then edited it to within an inch of its life. I had a lot of afterthoughts. 😊

2016 — Two new sections at the end, talking about the "all in your head" problem.

2015 — Miscellaneous edits; added a new example of pain weirdness.

A few un-logged updates in 2014 and 2015.

2013 — A couple of clarifications inspired by, and quotes from a new article by Lorimer Moseley for [theConversation.com](#): [Pain really is in the mind, but not in the way you think.](#)

2013 — Added an important good-news citation, [Vibe-Fersum et al](#), and discussion.

Several updates missed! I just dropped the ball, I'm afraid. Between the summer of 2012 and spring of 2013, I did a lot of work on the sections about "Thinking pain away" and the practical implications of pain science, but it appears I neglected to log any of it.

2012 — Added reference to [Moseley](#), about the validity of explaining why pain education is therapeutic.

2012 — Added references to and quotes from Atul Gawande's excellent article, [Scratching an itch through the scalp to the brain](#).

2011 — Added Lorimer Moseley's superb TED talk about pain, [Why Things Hurt](#)  14:33, and a couple of good quotes from it.

2011 — Added terrific story about pain without injury: the man with the nail in his boot.

2011 — Added interesting little item about how even microscopic organisms have complex pain experiences that vary with the circumstances.

2011 — Substantial new appendix, providing a great example from life: eye pain rather obviously amped up by worry. Chock full of puns. Enjoy!

2010 — More practical advice in the form of a large new section at the end, "Don't be a pain drama queen."

2010 — Added references to an excellent article by [Moseley](#).

2010 — Updated references related to mirror therapy, added some perspective about "mind over matter," and re-wrote and upgraded the practical recommendations in the final section.

2010 — Publication.

Related Reading

- ["Pain really is in the mind, but not in the way you think,"](#) a webpage on TheConversation.com. In this not-too-technical article, the endlessly quotable Lorimer Moseley summarizes the role of the mind in chronic pain, especially low back pain.
- ["Scratching an itch through the scalp to the brain,"](#) a webpage on NewYorker.com. This is a particularly wonderful article, which uses a fascinating and awful medical story — about a woman who *scratched through her skull* (seriously) — to explain how pain works, just as this article does. It's a point that a lot of experts are making in a lot of different ways, and more all the time, but this is the best I've seen yet: great storytelling and superb reasoning, from Atul Gawande, one of the best medical writers alive today.
-  [Why Things Hurt](#) on YouTube.com.. A genuinely funny and entertaining TED talk about a snake bite and pain neurology. No, really, you will actually laugh — it's like stand-up comedy. A must-watch for anyone with chronic pain, and the professionals who care for them.
-  [Understanding Pain and what to do about it in less than five minutes](#) on YouTube.com.. Beautifully produced short video that neatly summarizes most of the key points in this article. I do have a few quibbles with the treatment advice provided, discussed above.
- [Pain Relief from Personal Growth](#) — Treating tough pain problems with the pursuit of emotional intelligence, life balance, and peacefulness
- [Does Acupuncture Work for Pain?](#) — A review of modern acupuncture evidence and myths, focused on treatment of back pain & other common chronic pains
- [Anxiety & Chronic Pain](#) — A self-help guide for people who worry and hurt

- [Therapeutic Options for Pain Problems](#) — A guide to therapies and medical professionals for injuries, chronic pain and other musculoskeletal problems
- [Pain: The science and culture of why we hurt](#), a book by Marni Jackson. [amazon.com](#) ☐ Marni Jackson's book is the perfect book for thoughtful, liberal, middle-aged women in pain who will probably thoroughly enjoy Jackson's style. Others may find it frustrating, overtly poetical and coquettish, neither rigorous enough for the science-minded, nor explanatory enough for the layperson seeking real understanding of either "the science or the culture of why we hurt." Nevertheless, it is one of the most accessible and modern surveys of pain science available to readers.
- [All in My Head: An epic quest to cure an unrelenting, totally unreasonable, and only slightly enlightening headache](#), a book by Paula Kamen ([book review](#)). [amazon.com](#) ☐ Like PainScience.com, this book offers an unusual combination of both humour and information about pain. Kamen is a completely engaging writer, and tells her story with both journalist rigour and personality.
- [The Pain Chronicles: Cures, myths, mysteries, prayers, diaries, brain scan, healing & the science of suffering](#), a book by Melanie Thernstrom. [amazon.com](#) ☐ Nicely summarized by Dr. Harriet Hall for ScienceBasedMedicine.org: "Melanie Thernstrom has written a superb book based on a historical, philosophical, and scientific review of pain. Herself a victim of chronic pain, she brings a personal perspective to the subject and also includes informative vignettes of doctors and patients she encountered at the many pain clinics she visited in her investigations. She shows that medical treatment of pain is suboptimal because most doctors have not yet incorporated recent scientific discoveries into their thinking, discoveries indicating that chronic pain is a disease in its own right, a state of pathological pain sensitivity."
- A particularly excellent scientific paper by Lorimer Moseley: "[Reconceptualising pain according to modern pain science](#)"
- "[Central sensitization: Implications for the diagnosis and treatment of pain](#)," an article in *Pain*, 2010. Pain itself often modifies the way the central nervous system works, so that a patient actually becomes more sensitive and gets more pain with less provocation. That sensitization is called "central sensitization" because it involves changes in the central nervous system (CNS) in particular — the brain and the spinal cord. Victims are not only more sensitive to things that should hurt, but also to ordinary touch and pressure as well. Their pain also "echoes," fading more slowly than in other people. For a much more detailed summary of this paper, see [Central Sensitization in Chronic Pain](#).
- [Sensitive nervous system](#), a book by David Butler. [amazon.com](#) ☐
- [Explain Pain](#), a book by David Butler and Lorimer Moseley. [amazon.com](#) ☐
- [Painful yarns](#), a book by Lorimer Moseley. [amazon.com](#) ☐
- [The Challenge of Pain](#), a book by Ronald Melzack and Patrick Wall. [amazon.com](#) ☐

Notes

1. The complexity of pain makes it much harder to beat overall, but it also means that some factors are more treatable or manageable than others — but only *if* you have a modern understanding of how pain works. You cannot hack a system you don't understand. I can hardly imagine a better argument that we need a more biologically literate society! [BACK TO TEXT](#)

2. Modern pain research was kicked off in the late sixties by the work of [Dr. Ronald Melzack](#) and Dr. Patrick Wall. [BACK TO TEXT](#)
3. All the dumbed-down pain science in this article is presented in a more scholarly form by the erudite Lorimer Moseley, an Australian pain scientist, in his excellent article "[Reconceptualising pain according to modern pain science](#)". Dr. Moseley's article is a perfect companion to this one: it is both much more detailed and scientific and yet still fairly accessible compared to, say, a neurology textbook. [BACK TO TEXT](#)
4. The *most* common kind of presumed cause of musculoskeletal pain — a "structural" or biomechanical problem, like a slipped disc, or a short leg — is one of *least* likely actual explanations. The failure of such explanations for pain to pan out over the last 20-30 years is also evidence that there's more to pain than just screwed up tissue. See [Your Back Is Not Out of Alignment](#). [BACK TO TEXT](#)
5. Brodie EE, Whyte A, Niven CA. [Analgesia through the looking-glass? A randomized controlled trial investigating the effect of viewing a 'virtual' limb upon phantom limb pain, sensation and movement](#). *Eur J Pain*. 2007 May;11(4):428-36. [PubMed #16857400](#). [BACK TO TEXT](#)
6. Moseley L, Gallace A, Spence C. [Is mirror therapy all it is cracked up to be? Current evidence and future directions](#). *Pain*. 2008 Aug;138(1):7-10. [PubMed #18621484](#).

ABSTRACT

Despite widespread support of mirror therapy for pain relief in the peer-reviewed, clinical and popular literature, the overwhelming majority of positive data comes from anecdotal reports, which constitute weak evidence at best. Only two well described and robust trials of mirror therapy in isolation exist, on the basis of which we conclude that mirror therapy per se, is probably no better than motor imagery for immediate pain relief, although it is arguably more interesting and might be helpful if used regularly over an extended period. Three high quality trials indicate positive results for a motor imagery program that incorporates mirror therapy, but the role of mirror therapy in the overall effects is not known. Obviously, more robust clinical trials and experimental investigations are still required. In the meantime, the relative dominance of visual input over somatosensory input suggests that mirrors might have utility in pain management and rehabilitation via multisensory interactions. Indeed, mirrors may still have their place in pain practice, but we should be open-minded as to exactly how.

[BACK TO TEXT](#)

7. Fisher JP, Hassan DT, O'Connor N. [Minerva](#). *BMJ*. 1995 Jan 7;310(70).

This source is tough for readers to confirm. It's widely cited, downright popular, because it's a great anecdote, but of course that doesn't mean much. Is it for real? It is indeed. If you are determined, you can verify the citation with a free trial membership for [BMJ.com](#): the story is just one item in the full text of the "Minerva" column, which is a compilation of snippets of interest.

[BACK TO TEXT](#)

8. "Nocebo" is Latin for "I shall harm" (which I think would make a great supervillain slogan). It refers to the harmful effect of ... nothing but the belief in or fear of a harmful effect. Give someone a sugar pill and then convince them you actually just fed them a deadly poison, and you will probably witness a robust nocebo effect. A common funny-if-it's-not-you nocebo in general medicine is the terror of "beets in the toilet": people eat beets, and then think there's blood in the toilet, and call 911. Nocebo is a real thing, and not to be messed with. It is one of the chief hazards of excessive X-raying and MRI scanning, for instance: showing people hard evidence of problems that often aren't actually a problem. Which is one of the main reasons it can valuable to learn about all this. [BACK TO TEXT](#)
9. Parr JJ, Borsa PA, Fillingim RB, *et al.* [Pain-related fear and catastrophizing predict pain intensity and disability independently, using an induced muscle injury model](#). *J Pain*. 2012 Apr;13(4):370-8. [PubMed #22424914](#). [PainSci #54315](#).

The fear of pain was assessed in 126 brave volunteers with a questionnaire before — yikes — “inducing muscle injury to the shoulder.” (Don’t worry, nothing too awful for the subjects: they just did a workout with a lot of eccentric contraction that made them super sore.) The results were not what the researchers expected. This study is interesting because it found evidence that fear of pain *before* injury can predict *recovery time*. In other words: how well you respond to injury and recover is affected enough by fear that it can actually be predicted by measuring fear before hand. That’s profound.

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10. See Gawande: “New scientific understanding of perception has emerged in the past few decades, and it has overturned classical, centuries-long beliefs about how our brains work—though it has apparently not penetrated the medical world yet. The old understanding of perception is what neuroscientists call “the naïve view,” and it is the view that most people, in or out of medicine, still have. We’re inclined to think that people normally perceive things in the world directly. We believe that the hardness of a rock, the coldness of an ice cube, the itchiness of a sweater are picked up by our nerve endings, transmitted through the spinal cord like a message through a wire, and decoded by the brain.” [BACK TO TEXT](#)
11. See Sensation on a Small Scale. [BACK TO TEXT](#)
12. Beecher HK. Relationship of significance of wound to pain experienced. *JAMA*. 1956 Aug;161(17):1609–1613. [PubMed #13345630](#). [BACK TO TEXT](#)
13. Jackson M. Pain: The science and culture of why we hurt. Trade paperback ed. Random House; 2003. [BACK TO TEXT](#)
14. Moseley GL, Butler DS. Fifteen Years of Explaining Pain: The Past, Present, and Future. *J Pain*. 2015 Jun. [PubMed #26051220](#).
A cogent formal summary and update on how this “explain pain” thing is going so far (pretty well). Moseley and Butler are always quite readable, even when writing for journals (imagine), but see also their [blogging about the same thing](#).
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15. This misconception comes straight from some overzealous advocates of Explain Pain, who too aggressively promote the idea that pain is unrelated to tissue damage. It’s true and very important that the correlation between tissue damage and pain is often quite poor, but it is still quite strong for most people most of the time. [BACK TO TEXT](#)
16. The central message of explaining pain is that pain often exaggerates the danger that tissue is in. In central sensitization, the exaggeration is pathological and entrenched: danger signalling is consistently and severely exaggerated. But that’s an extraordinary situation. Pain is also routinely out of proportion to the danger even when there is absolutely no sensitization going on at all. [BACK TO TEXT](#)
17. It’s *not* academic hair-splitting. It doesn’t mean that pain isn’t real, or that tissues can’t genuinely be in trouble. What it means is that *all* pain, always, no matter what, is a seriously unreliable and weird interpretation of information coming to your brain from your body. Just like your brain “constructs” what you see, it builds pain. [BACK TO TEXT](#)
18. TheConversation.com [Internet]. Moseley L. Pain really is in the mind, but not in the way you think; 2013 Jul 20 [cited 14 Jan 6].
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19. [www.bettermovement.org](#) [Internet]. Hargrove T. Why Your Body is a Hypocrite; 2017 September 7 [cited 17 Sep 7].

As usual, Todd goes deep to find insight into pain science, this time mining evolutionary psychology and the modular theory of mind. (I am glad he did this reading and thinking so that I didn't have to. Dense source material! But neat.) The article is about how different parts of your brain don't necessarily cooperate much.

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20. Nilakantan A, Younger J, Aron A, Mackey S. [Preoccupation in an early-romantic relationship predicts experimental pain relief](#). *Pain Med.* 2014 Jun;15(6):947-53. [PubMed #24716721](#). [PainSci #52835](#). [BACK TO TEXT](#)
21. Goldstein P, Weissman-Fogel I, Shamay-Tsoory SG. [The role of touch in regulating inter-partner physiological coupling during empathy for pain](#). *Sci Rep.* 2017 Jun;7(1):3252. [PubMed #28607375](#). [PainSci #53159](#). [BACK TO TEXT](#)
22. Moseley GL, Parsons TJ, Spence C. [Visual distortion of a limb modulates the pain and swelling evoked by movement](#). *Curr Biol.* 2008 Nov;18(22):R1047-8. [PubMed #19036329](#).

ABSTRACT

The feeling that our body is ours, and is constantly there, is a fundamental aspect of self-awareness. Although it is often taken for granted, our physical self-awareness, or body image, is disrupted in many clinical conditions. One common disturbance of body image, in which one limb feels bigger than it really is, can also be induced in healthy volunteers by using local anaesthesia or cutaneous stimulation. Here we report that, in patients with chronic hand pain, magnifying their view of their own limb during movement significantly increases the pain and swelling evoked by movement. By contrast, minifying their view of the limb significantly decreases the pain and swelling evoked by movement. These results show a top-down effect of body image on body tissues, thus demonstrating that the link between body image and the tissues is bi-directional.

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23. That's creative problem solving, but I think it only makes the impracticality point stronger: the very narrow field of view of binocs probably undermines the illusion significantly. Seeing an exaggeratedly remote looking arm through a peephole may not have the same effect. Not that it isn't worth trying, but for this to work the brain must actually be fooled. [BACK TO TEXT](#)
24. Stanton TR, Gilpin HR, Edwards L, Moseley GL, Newport R. [Illusory resizing of the painful knee is analgesic in symptomatic knee osteoarthritis](#). *PeerJ.* 2018;6:e5206. [PubMed #30038863](#). [PainSci #53038](#). [BACK TO TEXT](#)
25. Höfle M, Hauck M, Engel AK, Senkowski D. [Viewing a needle pricking a hand that you perceive as yours enhances unpleasantness of pain](#). *Pain.* 2012 May;153(5):1074-81. [PubMed #22520059](#). [BACK TO TEXT](#)
26. Toye F, Seers K, Allcock N, et al. [Patients' experiences of chronic non-malignant musculoskeletal pain: a qualitative systematic review](#). *The British Journal of General Practice.* 2013 Dec;63(617):829-41. [PubMed #24351499](#).

This paper reviewed qualitative research on musculoskeletal pain to shed light on what it's like to have chronic pain. Several worrisome themes were clear. Chronic musculoskeletal pain often forces patients into the awkward position of having to prove the legitimacy of their condition: "if I appear 'too sick' or 'not sick enough' then no one will believe me." Many end up doubting themselves and questioning their own identity and wondering who is "the real me." Many lose hope and feel lost (or lost by) the health care system.

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27. For instance, it is next to impossible for impoverished single mothers of children with serious health problems and inadequate social services to support them to meaningfully "reduce stress," and advising them to do so borders on insultingly naive paternalism. [BACK TO TEXT](#)

28. Vibe-Fersum K, O'Sullivan P, Skouen JS, Smith A, Kvåle A. Efficacy of classification-based cognitive functional therapy in patients with non-specific chronic low back pain: A randomized controlled trial. *Eur J Pain.* 2013 Jul;17(6):916–28.

[PubMed #23208945](#). [BACK TO TEXT](#)

29. CFT patients got a 13-point boost on a 100-point disability scale, and 3 points on a 10-point pain scale. Those are not amazing results, but enough to be considered clinically significant, and they beat manual therapy and exercise handily (those patients improved by only 5.5 and 1.5 points on the same scales). [BACK TO TEXT](#)

30. Schultz IZ, Crook J, Meloche GR, Berkowitz J, et al. Psychosocial factors predictive of occupational low back disability: towards development of a return-to-work model. *Pain.* 2004 Jan;77–85. [PubMed #14715392](#).

This study identified factors affecting return-to-work time after an episode of low-back pain. From the abstract: “The key psychosocial predictors identified were expectations of recovery and perception of health change.”

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31. Brison RJ, Hartling L, Dostaler S. A randomized controlled trial of an educational intervention to prevent the chronic pain of whiplash associated disorders following rear-end motor vehicle collisions. *Spine.* 2005 Aug 15;30(16):1799–807. [PubMed #16103847](#).

This is one of a few studies showing a benefit to education for neck pain specifically. Researchers showed a reassuring educational video to more than 200 patients with “whiplash associated disorders” (i.e. whiplash injuries that become chronic neck cricks), and found that they had less severe symptoms than patients who received no educational intervention. The effectiveness of education probably depends a lot on the type of neck pain and the type of education, making it very hard to study. A recent review of the scientific literature found that most such studies are negative (see [Haines](#) or [Ainpradub](#)), but I believe that there are still reasons to be optimistic about education for pain problems. Above all, it depends on the type and quality of the education! The right education may be effective, and the wrong could even be harmful. The fact that *some* education has been shown to be beneficial is promising.

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32. BodyInMind.org [Internet]. Moseley L. The therapy might work, but does it work in the manner you think it does?; 2012 Jun 18 [cited 15 Jul 15].

We know that “explaining pain” seems to reduce it, but how? Do we really know what's going on? “The theory behind explaining pain is that it decreases pain by changing the underlying schema about what pain actually is.” Dr. Moseley methodically applies a validity test to that theory, which it passes with flying colours, meaning that it is a reasonable, working theory about how pain education works (not proof that it *does* work — a technical but important difference).

For contrast, note that in [a follow-up article](#), he concludes that graded motor imagery does *not* satisfy the burns test — a nice demonstration of the integrity of his reasoning.

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33. Why would they do that? Unfortunately, it's pretty common for health professionals to unwittingly reinforce nerve-wracking ideas about what might be wrong with you. One of the not-so-harmless aspects of alternative medicine is that it tends to generate a lot of this. [BACK TO TEXT](#)

34. Mense S, Simons DG, Russell IJ. Muscle pain: understanding its nature, diagnosis and treatment. 1st hardcover ed. Lippincott Williams & Wilkins; 2000. [BACK TO TEXT](#)

35. Often we see inexplicable and “weird” changes in painful conditions, good and bad, and often in response to an attempt at treatment — and yet at the same time it’s incredibly rare to find good evidence that any *particular* treatment works better than placebo. What could account for this? Using a wide paintbrush: it may be that *input changes output*, that nearly anything that happens to the body has the potential to affect how the body feels and works. Pain is an “output,” and so is a lot of wet, messy biology. Tissue state is just chemistry, and the chemistry of everything is constantly micromanaged and hyper-regulated. Dysregulation and uncomfortable trade-offs and compromises in these processes are routine, but it’s still full speed ahead, all the time, damn the torpedoes, a chemical balancing act that doesn’t quit until we die. *Any* input may change the equation — the problem is that it’s incredibly difficult and maybe even impossible in principle to predict *what* inputs will help, or make any difference at all. [BACK TO TEXT](#)
36. Obviously bracing a knee with a ruptured ligament is a different case, and straightforward. Similarly, you can certainly tape up a sprained ankle for pure stability — not a sensory effect. But bracing is often prescribed for much less clear reasons, and taping gets even weirder, like the absurd colourful tape that was so faddish in the 2011 Summer Olympics. These approaches to rehab often have wildly speculative rationales, when most likely they are all just creative ways of changing sensation. [BACK TO TEXT](#)
37. [Hargrove 2017, op. cit.](#) I’m paraphrasing and riffing off of Todd’s thinking here — almost just a synopsis of his idea, really. [BACK TO TEXT](#)
38. Ruiz-Aranda D, Salguero JM, Fernández-Berrocal P. [Emotional Regulation and Acute Pain Perception in Women](#). *J Pain*. 2010 Jun;11(6):564–569. [PubMed #20015703](#). Two groups of women were tested for pain tolerance with the traditional, unpleasant method (immersion of the hands in ice water). One group was rated with better emotional coping skills, and (predictably) they were more tolerant of pain than women with poorer coping skills. [BACK TO TEXT](#)
39. I’m understating that, because I don’t want to blow too many minds. The idea that there might be little or nothing that anyone can do to “repair” tissue in any meaningful sense is a radical concept for a lot of professionals. I suspect there are a handful of possible examples, but the point is that almost all forms of manual and physical therapy, most of the time (whether we know it or not) are almost *exclusively inputs to the nervous system*. And “results” are the CNS responding with a new story. The tissue state remains the same, or only trivially changed. Flesh is remarkably good at staying just the way it is. (With a gradual, inexorable drift back towards homeostasis after injury.) [BACK TO TEXT](#)