

Web Performance Today

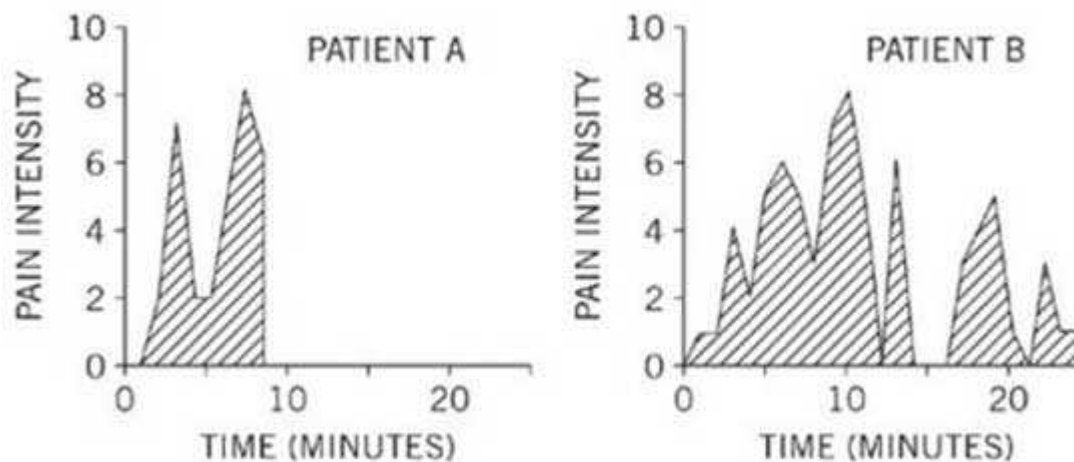
Colonoscopies, cold water and pain: How our memory works and how this relates to web performance

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Interesting fact: Back in the 1990s, colonoscopies were routinely conducted without anaesthetic or amnesiac drugs. (Note: I've never undergone this procedure myself, but I can only imagine that it's more than a bit uncomfortable.)

In the 1990s, researchers at the University of Toronto conducted a study [<http://www.ncbi.nlm.nih.gov/pubmed/8857625>] in which patients undergoing a colonoscopy were prompted every 60 seconds to indicate the level of pain they were experiencing. Patients rated pain on a scale of zero to 10, in which zero was no pain and 10 was intolerable pain. A total of 154 patients participated in the experiment; the shortest procedure lasted 4 minutes, and the longest was 69 minutes.

In the graphs below, you can see the experience of two representative patients. As you can see, the experience of each patient varied considerably during the procedure, which lasted 8 minutes for patient A and 24 minutes for patient B.



An interesting question emerges from this: Assuming that both patients used the scale of pain similarly, who actually experienced more pain? Based on these graphs, most of us would assume that Patient B suffered significantly more than Patient A.

Surprise finding: Duration of pain doesn't correlate with perceived intensity

After the procedure, patients were asked to rate the “total amount of pain” they had experienced during the procedure. Surprisingly, **Patient A retained a much worse memory of the experience than Patient B — in fact it was twice as bad.**

What emerges from this are two very interesting patterns in the human brain, which have been repeated and noted in many subsequent studies:

- **Peak-end rule:** The total amount of pain was well predicted by the *average* of the level of pain reported *at the worst moment of the experience* and at its *end*.
- **Duration neglect:** The duration of the procedure had no effect whatsoever on the rating of overall pain.

The fact that duration has no real impact on the overall experience intrigued me, so I dug deeper into this area of research.

I found another study [<http://pss.sagepub.com/content/4/6/401.abstract>] that shed more light on this (a study whose name I really like: the Cold Pressor). In this study, participants were asked to hold their hands in painfully cold water until they are invited to remove it and are offered a warm towel. During immersion, participants were asked to provide a continuous record of the pain they experience.

Each participant endured two cold-hand episodes, with some starting with the short episode and some starting with the long one:

- The *short episode* consisted of immersion for 60 seconds at 14 degrees Celsius followed by a warm cloth and a 7-minute break.
- The *long episode* (conducted on the other hand) consisted of the short episode + 30 additional seconds in which the water was made 1 degree warmer without the knowledge of the participant (1 degree Celsius is barely perceptible), followed by a warm cloth and a 7-minute break.

After completing both episodes, participants were told they needed to perform a third trial and were given the choice to repeat either the first or the second experience. The participants had no explicit knowledge that the duration of each episode was different, or that the water temperature had changed.

The peak-end rule theory predicted a worse memory of the short episode, and duration neglect predicted that the difference between 60 and 90 seconds will be ignored. This is exactly what they found: **80% of the participants chose to repeat the long episode and endure 30 seconds of slightly reduced, but totally needless, pain.**

If participants had been asked “Would you prefer a 60-second or 90-second immersion?” I’m certain everyone would have selected the short episode. When asked, people knew which episode was longer, but they did not use this information to make their decision.

How do the ‘peak-end rule’ and ‘duration neglect’ apply to web performance?

Interestingly, the peak-end rule would tell us that the last page in a flow (i.e. the end of the experience) would have a large impact on a user's experience and perception. In an e-commerce scenario, the last experience is often the slowest, caused by a long credit card authentication process. For example, I just booked an airline ticket and tracked the page load time across the flow:

Country selector page	1.3 seconds
Home page	3.2 seconds
Search results page	6.4 seconds
Review flight details page	3.3 seconds
Upsell me on stuff I don't want page	4.2 seconds
Credit card input page	2.1 seconds
Confirmation page	11.3 seconds

Conclusion: We need more studies

In the past, I've shared a case study showing how we tracked abandonment throughout a mobile transaction, and how slowing down different pages in the flow affected bounce rate. As a follow-up to that (which I hope to get to soon), **I'm very interested in seeing, on a predetermined flow, the relationship between the performance of the last page and overall user satisfaction** (measured by repeat site usage and/or cross referenced with the customer survey data that many of our customers religiously gather).

The duration neglect phenomenon is even more interesting. If human memory neglects to take duration into consideration as a key factor in determining the pain or gain of an experience, why is page performance so closely correlated to overall user satisfaction and key metrics like bounce rate, page views and conversion. **I think we need to perform more controlled studies on real participants to really understand how duration neglect relates to our world.**

I've been thinking about designing a few studies to mimic the controlled psychology studies above. If you have an experiment design you'd like to share — or better yet, if you run a psychology department and want to collaborate — let me know.

By: Joshua Bixby