Does time slow in crisis?

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In The Matrix, hero Neo wins his battles when time slows in the simulated world. In the real world, accident victims often report a similar slowing as they slide unavoidably into disaster. But can humans really experience events in slow motion?

Apparently not, said researchers at Baylor College of Medicine in Houston, who studied how volunteers experience time when they free-fall 100 feet into a net below. Even though participants remembered their own falls as having taken one-third longer than those of the other study participants, they were not able to see more events in time. Instead, the longer duration was a trick of their memory, not an actual slow-motion experience. The study appears online today in the journal *Public Library of Science One*.

“People commonly report that time seemed to move in slow motion during a car accident,” said Dr. David Eagleman, assistant professor of neuroscience and psychiatry and behavioral sciences at BCM. “Does the experience of slow motion really happen, or does it only seem to have happened in retrospect? The answer is critical for understanding how time is represented in the brain.”

When roller coasters and other scary amusement park rides did not cause enough fear to make “time slow down,” Eagleman and his graduate students Chess Stetson and Matthew Fiesta sought out something even more frightening. They hit upon Suspended Catch Air Device diving, a controlled free-fall system in which “divers” are dropped backwards off a platform 150 feet up and land safely in a net. Divers are not attached to

ropes and reach 70 miles per hour during the three-second fall.

“It’s the scariest thing I have ever done,” said Eagleman. “I knew it was perfectly safe, and I also knew that it would be the perfect way to make people feel as though an event took much longer than it actually did.”

The experiment consisted of two parts. In one, the researchers asked participants to reproduce with a stopwatch how long it took someone else to fall, and then how long their own fall seemed to have lasted. In general, people estimated that their own fall appeared 36 percent longer than that of their compatriots.

However, to determine whether that distortion meant they could actually see more events happening in time – like a camera in slow motion – Eagleman and his students developed a special device called the perceptual chronometer that was strapped to the volunteers’ wrists. Numbers flickered on the screen of the watch-like unit. The scientists adjusted the speed at which the numbers flickered until it was too fast for the divers to see.

They theorized that if time perception really slowed, the flickering numbers would appear slow enough for the divers to easily read while in free-fall.

They found that while the subjects were able to read numbers presented at normal speeds during the free-fall, they could not read them at faster-than-normal speeds.

“We discovered that people are not like Neo in The Matrix, dodging bullets in slow-mo. The paradox is that it seemed to participants as though their fall took a long time. The answer to the paradox is that time estimation and memory are intertwined: the volunteers merely thought the fall took a longer time in retrospect,” he said.

During a frightening event, a brain area called the amygdala becomes more active, laying down a secondary set of memories that go along with those normally taken care of by other parts of the brain.

“In this way, frightening events are associated with richer and denser memories. And the more memory you have of an event, the longer you believe it took,” Eagleman explained.

The study allowed them to deduce that a person’s perception of time is not a single phenomenon that speeds or slows. “Your brain is not like a video camera,” said Eagleman.

Eagleman and his team have been able to verify this conclusion in the laboratory. In an experiment that appeared in a recent issue of PLoS One, Eagleman and graduate student Vani Pariyadath used ‘oddballs’ in a sequence to bring about a similar duration distortion. For example, when they flashed on the computer screen a shoe, a shoe, a shoe, a flower and a shoe, viewers believed the flower stayed on the screen longer, even though it remained there the same amount of time as the shoes.

Pariyadath and Eagleman showed that even though durations are distorted during the oddball, other aspects of time – such as flickering lights or accompanying sounds – do not change.

The conclusion from both studies was the same.

“It can seem as though an event has taken an unusually long time, but it doesn’t mean your immediate experience of time actually expands. It simply means that when you look back on it, you believe it to have taken longer,” Eagleman said.

“This is related to the phenomenon that time seems to speed up as you grow older. When you’re a child, you lay down rich memories for all

your experiences; when your older, you've seen it all before and lay down fewer memories. Therefore, when a child looks back at the end of a summer, it seems to have lasted forever; adults think it zoomed by."

Source: Baylor College of Medicine