SPECIAL TOPIC

DISCOMFORT
DESIGN

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Insights

→ HCI is largely designed to eliminate discomfort and reduce challenge. We are, however, wired to adapt optimally through acute bouts of discomfort, like cold, heat, hunger, and fatigue.

→ Novel inbodied challenges in particular create discomfort; these are core aspects of supporting growth, adaptation, and resilience.

→ Aligning designs to support deliberate phases of discomfort offers a novel research path for HCI for performance, well-being, and health.

Over the past 30 years, as digital technologies have become both cheaper and near ubiquitous, from computerized environmental controls in buildings, to cellular networks for no-downtime connectivity, to the pervasive smartphone, we have likewise seen the exponential increase of so-called lifestyle diseases: obesity, cardiovascular disease, type II diabetes, chronic stress, and lack of sleep—all ailments associated with certain kinds of abundance or excess. That is, we have designed our environments such that, for many of us, for many contexts, much of the time, we do not have to feel discomfort.

We stay dry in the rain; warm in the cold. We do not have to feel a visceral response of discomfort for longer than it takes us to reach for the thermostat, the fridge—or now, our phone—to have whatever urge we feel satisfied momentarily, from transportation to meal delivery.

In inbodied interaction terms, we could frame this urge fulfillment as optimizing on hedonic satisfaction. That is: We optimize designs to reduce any immediate discomfort and amplify immediate pleasure and reward. Or, if not satisfying immediate pleasure, our innovations are largely targeted at reducing the momentary discomfort of energetic cost: elevators rather than stairs, cars rather than bikes, voice controls to avoid a trip to the light switch. From an inbodied interaction perspective that strives to promote positive, holistic adaptation, one may even say that the so-called lifestyle diseases are diseases of constant
INBODIED SCIENCE UNDERPINNING DISCOMFORT DESIGN

As the science of our neurology, genetics, and microbes grows, it is increasingly clear that we are designed—perhaps ironically—to be at our best when we are taxed; we progress through discomfort.

Research on human fasting is showing that we rejuvenate in incredible ways when we actually simply stop eating for approximately 12 to 13 hours [1]. Go a little further to 16 hours, and evidence suggests that lean tissue building (muscle building) is stimulated. Occasionally go as far as three days (akin to going to the dentist for an annual checkup), and research suggests that we practically completely reboot: Our bodies seem to pick up that they are entering a potential scarcity scenario, and so clean out all the crud, not unlike pruning dead branches. When the refeed happens at the end of three days, the space is there to rebuild afresh.

This work on fasting is still in its early days, but it certainly aligns with positive adaptations in other physiological processes, such as physical effort. The Wingate test evaluates anaerobic power. In the test, a rider pedals a stationary bicycle loaded to 7.5 percent of their mass, and then pedals at full exertion for 30 seconds. This test is often perceived as physically draining and psychologically daunting.

Whether it is being chilly, hot, hungry, or fatigued, our bodies—including our brains—thrive and even rejuvenate from these acute physiological stresses.
Researchers got quite excited at the effects of athletes performing six Wingates in a row, repeated three days a week. The result improved physiological function at a tenth of the training volume in a quarter of the time, compared with a more familiar 40- to 60-minute, moderate-intensity, steady-state effort [2]. This program is an extreme instance of degree of discomfort mapped to accelerated adaptation, but it is not unique. Other examples of how we are wired to respond positively to discomfort challenges are abundant:

- Breath holding post-hyperventilation to the point of eliciting, and then managing, the panic response has been shown repeatedly to significantly improve immune response [3]. Similarly, “intermittent hypoxia training” is being used to positive effect in areas from athletic performance, to cognitive-function improvement, to increasing insulin sensitivity in type 2-diabetic men.
- Muscular hypertrophy (growth) is associated with training to muscular fatigue (uncomfortable experience) where one cannot complete that next rep [6].
- Novel eccentric contractions from such effort (like slowly lowering oneself from a pull up) often induces “delayed onset muscle soreness” [7].
- In terms of cognitive performance, chronic challenging physical activity (where one feels one is doing hard work) is strongly correlated with improved cognitive performance [8].
- The concept of “deliberate practice”—of working on something that is not easy, that is in fact difficult, whether this is a challenging piece in a musical performance, or working through a math problem—is shown to be more productive in problem solving than hours of repetition of the familiar [9].

WHY DISCOMFORT?

Novel inbodied challenges create discomfort as part of supporting an adaptation. Discomfort is often framed as part of what may be called a pain continuum, and often described as more psychological than physical, as a mechanism to keep us safe. From an inbodied adaptation perspective, we can view discomfort as part of a complex warning system in the body—mediated via the nervous system—that alerts us something unfamiliar is happening that either may be a novel threat or may be reminiscent of a past experience that was a threat and may be happening again. Discomfort-as-signal brings our conscious attention to the experience as a signal in order for us to respond to that signal and make a decision. Our response can be either to stop the activity (I don’t like the taste of vegetables; I shall not eat them) or to continue on (one more mile in this run; one more hour trying to learn this statistics method), unless that signal intensifies and we find we can no longer execute the task.

It is important to note that neither discomfort nor pain is always related to physical harm. Both discomfort and pain signaling are (as per the tuning and insourcing articles in this section) related to context, including those of our own experiences. For example, in a highly arousing situation like combat, soldiers focused on keeping their team alive have reported being shot and not realizing it until well after the current priority signal had been addressed. Similarly, when all else is calm, a minor paper cut may become the entire focus of our attention. In other words, whether we interpret something as painful or uncomfortable does not mean that other inbodied processes are not happening to address an injury: Inflammation will still set up around a wound; we will bruise even if we don’t remember feeling ourselves bump into something hard enough to cause that under-the-skin bleeding. And yet, how we perceive and interpret pain has consistently been shown to affect our experience of pain severity and associated debilitation. Migraine sufferers who have mental models for the pain experienced report being better able to manage and reduce its intensity. Cyclists who justify the discomfort of a long training ride in the rain as part of their race preparation, to familiarize the experience, respond to that discomfort differently from people for whom this is unfamiliar and thus potentially threatening, and so an undesirable experience to be avoided.

INBODIED INTERACTION OF DISCOMFORT MEANS STRATEGIC ADAPTATION AND RECOVERY

A significant attribute of effective discomfort is that it is acute, not chronic. It lasts within part of a particular focused activity, to be followed by recovery. The challenging practice session ends; the exercises of the new math concept finish.

Another key fact for design consideration is that the adaptation elicited in response to discomfort happens after the event itself—during recovery. It is in the recovery phase that our bodies build the new strength, skills, and interpretations of an uncomfortable experience. For every deliberately uncomfortable process we ask of ourselves, we need to provide
Our ability to stick through the discomfort has been shown to improve the speed and accuracy of progress in skills acquisition.
discomfort and adapt when followed by phases of recovery. Indeed, a certain degree of discomfort is simply, fundamentally part of any inbodied adaptation. These uncomfortable adaptations are essential to developing physical, social, and emotional skills.

As shown in this article, inbodied adaptation itself is part of a cycle of modulating discomfort and recovery; of supporting crafted, acute bouts of discomfort and recovery associated with growth, strength, creativity, well-being, and social harmony. In relation to tuning, we propose inbodied interaction as a focus on design for positive adaptation, complementing the medical model’s focus on prevention and the sports-science focus on performance.

The above is not to say that insight cannot be crafted without discomfort, that art must always be painful—far from it. HCI has understandably had a focus on making interactions as easy as possible to reduce frustration, if not pain and discomfort. As proposed here, discomfort design offers HCI potentially new territory: how to make deliberately exploring and using discomfort as easy and effective as possible. The inbodied interaction concepts of tuning, insourcing, and adaptation, leveraging inbodied fundamentals like the inS, offer us starting points to build deliberately into discomfort design for positive adaptation toward better quality of life for all.

Endnotes

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