FROM FIELD TO OFFICE

TRANSLATING BRAIN-BODY BENEFITS FROM SPORT TO KNOWLEDGE WORK

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Recently, colleagues and I proposed the term *wellth* to describe a focus on health as a foundation for performance rather than as a preventative for illness [1]. Wellth foregrounds the "brain-body connection": The state of the brain is mirrored in the state of the rest of the system to which it is attached. This *in-bodied* connection is something our dominant sedentary work paradigm ignores. But sedentarism—this attempt to live from the neck up, where the body is constructed as a carrier of the brain from one place to another—is injuring us, costing us our quality of life. Illnesses such as metabolic syndrome, stress, fatigue, and other lifestyle conditions, as well as falling national averages in innovation, discovery, and creativity, are all strongly correlated with sedentary lifestyles. A wellth approach suggests that connecting the brain with the body, prioritizing the body's needs, has immediate benefits for performance and quality of life.

Sport exemplifies the brain-body connection. As such, sport is a fantastic mechanism to help redress sedentarism and support wellth in a knowledge economy. At its best, sport has many benefits: It develops motor skills (not just aerobic strength); it builds perceptual-cognitive awareness of others in a constrained, rules-based environment; it provides opportunities to create new solutions to solve dynamic problems; it creates opportunities to learn, develop, and practice social skills; and it drives physiological requirements from sleep to eating to movement, which help burn off stress and improve cognitive/creative performance.

Knowledge work, which is primarily a sedentary activity, is carried out by 40 percent of the U.K. population [2] and likely at similar levels in North America and Europe. Critiques of sedentary activity—which is undertaken an average of 9.75 hours a day [3]—refer to it as "the new smoking" in terms of its effect on cardiovascular health. Related studies show the ill effects of sedentarism on hormonal processes,

IMAGE BY MARK BONHAM

which lead to a variety of physiological problems including type 2 diabetes.

ARE WE DESIGNING OURSELVES TO DEATH?

Most people reading this article fall into the knowledge-worker camp. We may even be reading this while sitting down. According to the Whitehall Cohort study, if we are reading this sitting down, we're not getting smarter—we're getting thicker (and not just physically). Our highly digital environments have so far mostly contributed to making us less resilient and less brilliant: The more networked our information tools have become, the less we move. We don't even need to get up to grab a book; we just search online. This lack of movement also seems to affect access to the nonverbal parts of our brains that process the information that often leads to our aha moments. From Susan Goldwin-Meadow's observations that our hands are speaking from our nonverbal or pre-verbal past, to Maxine Sheets-Johnstone's assertion that movement *is* thinking, much current scholarship indicates that our increasingly disembodied knowledge work may be cutting off opportunities for insights.

In other words, just by sitting so much, we're making ourselves less swift of thought and more vulnerable to disease: The brain and the body are connected. Physiologically, sitting uninterrupted for over an hour creates fundamental changes in muscle tissue, which results in changes in normal signaling for fat processing and associated hormonal signaling that affect cognitive processes. As our bodies slump forward at our desks, that flexion tells our nervous system to be more protective of us. It's a reflexive signal: Protect the squishy bits. Add a little stress to this mix without any movement to respond to that signal, and the brain goes into an increased threat/stress response, shutting down peripheral vision and focusing more exclusively on what's immediately salient. This is no place to be creative. The longer this stress experience continues, the more debilitating the effects on the brain-body connection. For instance, chronic stress reduces our sleep—which is where a lot of learning, memory building, skills uptake, and insight processing occur, to say nothing of tissue repair. Poor sleep also impacts fat burning, which in turn has a hormonal cost, which in turn affects our ability to be creative. It's a vicious cycle. Sport as skills-based structured play actually helps address each of these states.

DESIGNING SPORT PRACTICES FOR WELLTH-BASED KNOWLEDGE WORK

When we think of sport, most of us think of activity that privileges physical over mental processes. When we think of knowledge work, we may imagine it as sport's antithesis: the epitome of cerebral practices.

And yet, this separation between sport as fundamentally physical, on the one hand, and knowledge work as exclusively cerebral, on the other, reveals a grave mischaracterization of how we excel at cognitive activity. It is an error born of a culture that desires, it seems, to ignore that the brain is part of the body, constructing the body only as an inconvenient carrier of the brain from one sedentary location to another.

However, evidence from physiology and neurology shows unequivocally that when we connect the brain and the body, our cognitive performance improves. Ratey and colleagues show that the longer one is involved in physical activity—effectively elevating heart rate over time—the better one performs at school. And introducing physical activity means better cognitive performance immediately, as well. Studies have shown that people who have just performed a bout of 20 minutes on a stationary bike at 65 percent of their maximum heart rate perform better on cognitive executive functioning tasks. What is less clear right now is which aspects of sport support these cognitive benefits. In HCI we have an opportunity to do this primary research to help more of us engage in sport as play (vs. profession) and to translate the brain-body benefits of these practices from the sporting field to the rest of life.

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TRAINING FOR COGNITIVE PERFORMANCE

There is so much more to sport than physical activity when imagining benefits for wellth creation. To make these connections, it may help to formalize some of the differences between sport and physical activity. Whereas anything that elevates one's heart and requires effortful muscular contraction at some level of intensity is physical activity, sport as a game also adds rules to this effort. Sport has an end in mind, driven by a particular target: to win the game/the contest/the competition.

Winning requires physical movement skills as well as cognitive skills for strategy and tactics. There is often also a high demand on visual processing to coordinate physical awareness. Vision—or perceptual cognition—is highly demanding information processing that to be effective in sport requires rapid intake and an understanding of the physical and dynamic state of play—reading the field *and* being able to find and deliver the appropriate strategy and tactics (a deep knowledge of one's playbook, for instance) to map teammates' skills and positions with opportunities to advance toward the goal. The fastest or strongest players are not always the *quickest*.

There is, as we can see, tremendous mental processing along with physical exertion happening in sport. Watching a long tennis match among skilled opponents foregrounds how tactics and endurance ebb and flow between each other. When both players are in great physical condition, we see that an older, more experienced pro can defeat a stronger, younger, highly skilled but less experienced opponent: The older player may be quicker, having more experience with rapid pattern selection for dealing with known problem types. The truly great can also break their own patterns and

adapt and respond to new patterns more quickly.

Outside the match context, there is also planning and evaluation to tune skills practice. Reflection on one's performance to refine one's physical and mental preparedness for the next competition and to understand which skills must be honed requires planning, preparation, and execution. These attributes are often best supported by a coach, whose job it is to help interpret what has happened and help an athlete improve. Some sports bring more of these elements together than others, but all of them have these components.

When considering sport, so far computer science and interactive technology have predominantly focused on two factors: supporting a game or practice as a whole—one already jogs, so let's augment that—or improving physical measurements of an aspect within a particular practice—measuring how many of one thing or how far of something else to provide feedback for physical performance. Each of these approaches benefits *aspects* of sport performance. As I hope to have shown here, however, sport affords even more kinds of interactions where HCI research and design could help both the development of sporting success *and* the translation of those skills to everyday life, in particular to support creativity, innovation, and discovery in knowledge work.

COMMUNICATION QUICKNESS

One area where HCI may be able to assist is in developing perceptual-cognitive practice and skills. Rapid information processing and communication is a critical part of sports performance. Indeed, in sports training, much of excellent performance is not simply about being the fastest or the strongest but rather about being cognitively the quickest: perceiving opportunities faster than one's opponent and translating them into team success.

The beauty of sport is that these often visually perceived opportunities must be cognitively processed against possible solutions and then executed with physical skills under pressure.

This communication may include not only how one drives a play, but also how one might support the person driving the play (or blocking it). In sports performance, such skills development may be built by studying a playbook and then practicing that play over and over. American football coach Vince Lombardi was famous for running the same play over and over in practice so it could be executed flawlessly under the duress of competition.

How might interactive technologies help accelerate the development of this vision-cognition quickness for motor performance, particularly when one has a job and a family and limited practice time on a field with teammates? Is there a role for augmented reality combined with physical practice? And further, and more to the purpose of this article, can we use interactive technology to help tease out these skills in the sporting domain to transfer to problem solving in the work domain? For example, in a non-sports environment, most of us would call the kinds of pressure to come up with solutions rapidly and deliver them in real time, nonstop, over several hours, "stressful." It is! Our physiological responses on the field in a game are pretty much what they are to stress in the office: a threat response, fight or flight. The difference is our response. Depending on the sport, swinging at the ball or at the opponent is exactly the physical response we need to tell our hormones we are listening to them, that we are responding to the stressor and making the necessary changes to address the "threat." Stress signals demand a physical response. When they don't get one, they simply repeat the same message—until we respond or break.

REFINED RESEARCH OPPORTUNITIES

To my knowledge, there have not yet been deep studies that have compared, for instance, the cognitive performance of people who participate in sports vs. people who "work out" regularly, that is, outside a game/competitive context where skills are challenged. As HCI researchers and designers, we have an opportunity to engage in this kind of primary work. We may well develop even more novel opportunities to support the brain-body connection for enhanced knowledge work performance and quality of life.

As a sports/athletics coach, I have the opportunity to help athletes develop a range of skills: physical, motor, visual, cognitive, social, and emotional. As such, I have the privilege to see how exciting and empowering it can be for someone who has thought of themselves as a klutz or as slow to become more skilled in their body, move with power and grace, and translate that confidence into other areas of their life.

By looking more closely at the skills that sport requires, we have more opportunities both to engage with its performance and to augment its benefit by connecting these facets more deliberately with the rest of our lives, not the least of which is our daily mainstay, knowledge work.

We know that physical activity alone immediately improves cognitive performance. But considering the richness of the skills developed, often outside in the environment, a reasonable hypothesis is that there is more than the physical-cognitive connection at play here. It may well be that sport enacts a rich combination of skills that draw on our evolutionary biology as physical, social, thinking creatures. As such, it seems that digging into these roles, not just to measure performance, but to help build performance skills—performance in the broader brain-body connected way exemplified by sport—is a great terra incognita for HCI to explore.

Endnotes

1. Churchill, E.F., and schraefel, m.c. mHealth + Proactive Well-being = Wellth Creation. *Interactions 22*, 1 (2015), 60–63.
2. Levy, C., Sissons, A., and Holloway, C. A plan for growth in the knowledge economy. A Knowledge Economy programme paper. The Work Foundation. 2011.
3. Dunstan, D.W., Thorp, A.A., and Healy, G.N. Prolonged sitting: Is it a distinct coronary heart disease risk factor? *Current Opinion in Cardiology 26*, 5 (Sept. 2011), 412–9.

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