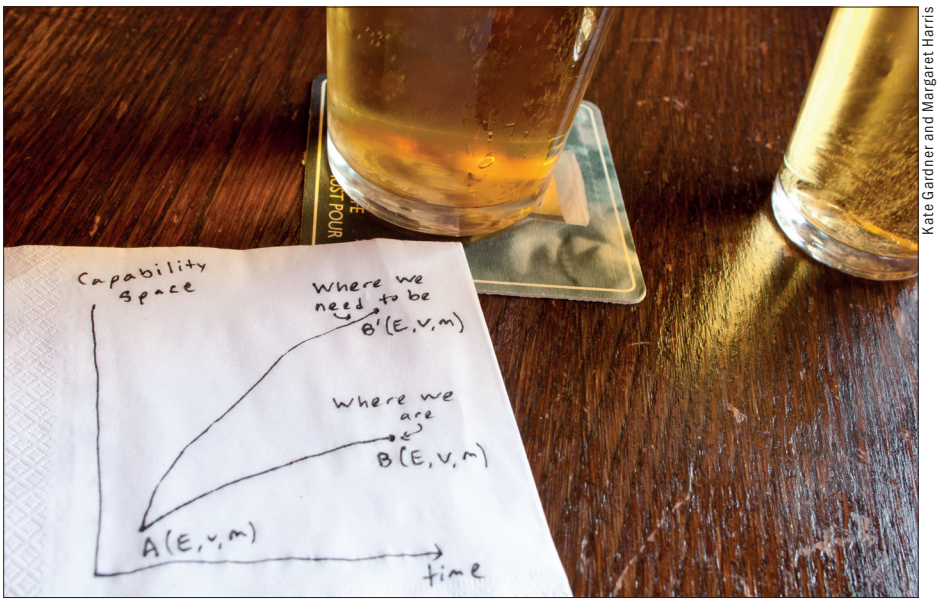
Careers

Changing the Hamiltonian

Trained to understand particles rather than people, physicists who become managers often struggle with human-resources challenges such as motivating and developing employees. Properly applied, however, a knowledge of physics can be a management boon, not a burden, as **Graham Boyd** demonstrates in this analogy



Kate Gardner and Margaret Harris

Hamiltonian management Brainstorming physics-based management ideas over a pint.

It's Friday night, and Ed Executive and Fiona Physicist are in their local pub after yet another stressful week at their hi-tech company. Ed looks glum as he sips his pint.

"I wish our staff could learn faster, Fiona," he sighs. "Right now the two of us are spending far too much time working on projects, and not nearly enough leading the company. We're surviving today at the expense of thriving tomorrow."

"I know, but I was looking through my old mechanics textbook earlier today, and I think I've figured out what we need to do." Fiona looks pleased with herself.

Ed raises his eyebrows. "Oh? And what's that?"

"Change the Hamiltonian!" She grins impishly at Ed as his blank look changes to curiosity. They have worked together ever since they started their PhDs, so they have long since become accustomed to each other's quirks. Reluctantly, he laughs. "Okay, what crazy meta-application of physics have you dreamed up this time?"

Like the fictional Ed and Fiona, I began my career in research. The years I spent working on lattice-quantum-chromodynamics theory – at the Forschungszentrum Jülich, and also at the universities of Cape Town, Bielefeld, Pisa and Tsukuba between 1987 and 1998 – shaped the way I view the world of business. Later, as a manager at the world's largest consumer-goods firm, Procter & Gamble, I saw the business as a complex system with many nonlinear and non-perturbative terms. Most managers neglect these terms (or do not even see them) because they look insignificant; in fact, they are often the levers you need to pull to effect higher performance. More recently, as a "performance transfer consultant", I have become particularly interested in how these couplings affect the way people take the step from learning new skills to applying them on the job. In many businesses, the need for rapid change in performance is well beyond the "propagation speed" for traditional people-development techniques. Hence, the key to getting ordinary people to do extraordinary things (which is the primary role of an organization) is to modify the couplings – as Fiona has already suspected.

Quickly, Fiona sketches a diagram on a paper napkin (see above). "We can think of our company as a phase space containing a people-capability sub-space." Ed nods. "Within this space, a particle – or, in our case, a person – with an initial state A will end up in a final state B when acted on by a Hamiltonian. Let's take Danielle Designer as an example."

Ed groans. "Yes, let's. I can think of several people whose final states aren't good enough right now, but she's definitely business-critical."

"Agreed – we have to figure out how to step-change her performance. Rather than ending up in final state B, she needs to be at a higher-energy state B'. But to get there – do we focus on Danielle or on the Hamiltonian?"

Models of behaviour

Early in their training, physicists learn about particle mechanics, where the relevant quantities include v, the particle's velocity, m, its inertia, and external forces. In the parallel field of "people mechanics", I like to think that the analogue of v is a person's learning speed, while m is their inertia around learning or change. The "external forces" are things such as peer attitudes and line-manager support, all of which affect the extent to which employees apply new learning to their work. These forces, and their couplings to each individual, are vital in assessing how much the performance of someone with a given m and v will improve after a certain "energy" input.

Such forces are usually built into a company's work environment and employees' perceptions of it, as well as their understanding of the business and themselves; unfortunately, they are not normally part of the performance-changing intervention itself. This means that "quick fix" interventions designed to improve performance, such as providing stand-alone training sessions – or, in more extreme cases, firing the problem employee and hiring someone else – fall short 70–90% of the time.

"Fire and hire" is difficult because many jobs are changing so rapidly (and have so many aspects unique to a specific employer's business and culture) that the set of potential recruits who are ready to start

immediately is the null set. As for training sessions, without the right pre- and post-training efforts from the employer, the only employees whose performance will improve will be those who have negative or low inertia in the face of change. These people are your innovators (perhaps 2.5% of the population) and early adopters (around 13.5%), and they are usually already doing what you wish the rest would do.

The final option is to use highly skilled employees to fill the performance gaps of everyone else. In physics terms, such a course of action is like Maxwell's demon, where an intervention by an external actor boosts a worker into a higher state by breaking the system's "thermodynamic laws".

"But that simply isn't sustainable," explains Ed, draining the last of his pint. "I've spent most of today doing with Danielle what she should be doing alone. And up to a point, it works: my intervention temporarily places her at a point in the capability space otherwise inaccessible to her –"

"– but being a demon is wasting your time – you'd be better off spending that time and effort leading the company," Fiona finishes. "We can't grow our business if we spend our time compensating for our employees' shortcomings. And I'm sure that hiring new people is seldom the answer. After all, Danielle's the third person in a row who's failed to perform in this role. And they all looked good in the interview."

"Which leaves us with Danielle's speed and inclination to apply new learning – which, according to her line manager, is only ever going to get her to B," Ed concludes. "I think I need another pint."

"But Ed, you're assuming our current company Hamiltonian is a given. We can change the environment around our people, the forces acting on them. We'll need to do it quasi-statically."

"Meaning…?"

Fiona gestures impatiently. "Slowly enough to avoid damaging shock waves, yet still fast enough to create change. But I'll tell you about corporate thermodynamics later. Right now let's focus on the Hamiltonian."

Shaping the work environment

The factors that make up a company's Hamiltonian fall into three categories: the ability of individual employees, their motivation and the work environment. Clearly, the last of these is the one most amenable to being shaped by a business's leaders. Line managers are an especially important part of the work environment, since a good manager will effectively support employees using the new ways of working that they learn during training, while a bad one will feel threatened and act to maintain the status quo. An employee's peers will also be a support or a hindrance. Finally, rewards for applying new methods – or disincentives for failing to do so – are essential.

The first step in reshaping the work environment so that it maximizes employees' ability to acquire and use new skills is to understand what your Hamiltonian is right now. Ed Holton, a human-resources expert who specializes in adult learning, has defined a tool called the Learning Transfer System Inventory (LTSI) that measures the 16 largest terms in the learning-transfer part of the Hamiltonian. The book he co-authored on the subject, *The Adult Learner* (2007 Taylor & Francis), is now in its seventh edition, and I would recommend it to anyone trying to improve how their employees learn. The LTSI asks each participant undergoing training a series of questions to evaluate how each of the 16 terms affects their ability to apply what they learn to their jobs. Their answers allow managers to understand whether a particular change is likely to improve learning transfer. For example, the LTSI for one of my firm's clients (a major financial institution) predicted that holding a "coaching" session for managers was unlikely to effect any change in employee behaviour unless changes were also made to several factors related to the work environment. However, the company could not change these other factors immediately, and a year later it confirmed that the "coaching" had yielded no useful improvement.

Once you know your LTSI, and the job-specific critical behaviours that will deliver outstanding business results, you can put the right people on the right training courses at the right time – and also change the rest of the Hamiltonian so that any terms in it that are currently making application of the training more difficult are altered, too.

We can change the work environment around our people, slowly enough to avoid damaging shock waves, yet still fast enough to create change

"Classical mechanics applied to organizations," Ed nods. "Fascinating. Except that, unlike classical mechanics, there really are demons deciding which people are where, how big the coupling coefficient is, and which sign it has."

"Yes, and I've already spoken to Danielle's usual demon – her line manager – about sending her on a week-long training course. But we've also drawn up a contract to ensure that what she learns on the course is transferred to her daily performance, and I've asked her manager to make sure it's adhered to. This will have a big impact, since we know that clarity of role, plus the actions and attitude of line managers, are the biggest terms in the Hamiltonian."

"Fiona, you're onto something. Let's meet for breakfast tomorrow – my place – and spend the day getting crystal clear on what we need to do in the next three months. It's my round, so how about a good malt to celebrate another of your game-changing ideas?"

Beyond learning transfer

I like to think that Ed and Fiona's story had a happy ending – that after a couple of years, they had released the latent capabilities of their employees, building a company twice the size with 10 times the revenue. However, there is a lot more that goes into managing a successful physics-based company than just getting the learning-transfer part of the Hamiltonian right. Other important factors include developing leaders and frontline staff, and creating a high-performance culture. Organizations are like quantum systems, where the better you know one variable, the less precisely defined another becomes. In particular, variables such as an individual's values and the overall company culture are often insufficiently quantified. However, these variables define what actually happens in a firm, regardless of what management says, and it is possible to shape them to create a bias towards the desired behaviour.

But the story of how Ed and Fiona did that will need to wait for another pub, and another time.

Graham Boyd is a former high-energy physicist and managing director of the performance and learning transfer consultancy tetraLD (www.tetrald.com), which aids companies in improving business results by helping employees to use new learning on the job, e-mail graham.boyd@tetrald.com