

Problem-Led Leadership: An MIT Style of Leading

There's a certain kind of talent that manages to put a dent in the universe – and there's no reason one school should have a monopoly on it.

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When the idea hit Elon Musk for a revolutionary means of city-to-city transportation—the system that he dubbed in 2013 the “Hyperloop”—it didn’t take his SpaceX company long to announce a student innovation competition focused on a key component. The trickiest aspect of the system, which aims to propel passengers at speeds exceeding 700 miles per hour through elevated tubes, is the design of the “pods” that will carry them. Over 160 university teams pledged to show up in Los Angeles in June 2015 to test their competing prototypes in a mile-long tube built for the purpose. One group went home with the prize. Pulled together by undergraduate engineers John Mayo and Philippe Kirschen in Cambridge, MA, it was the MIT Hyperloop Team.¹

People are capable of leadership, obviously, at MIT. The thirty-member Hyperloop team (which was made up not only of undergrads but also of graduate students in various disciplines, including from the Sloan School of Management) is just one of many superbly run projects to come out of its student ranks. Impressive leadership capability shows up even more dramatically among MIT alumni, as graduates of the school succeed as startup business founders. A 2014 study by a Sloan School team, following up on earlier findings by the Kauffman Foundation, concluded that if the active companies founded by MIT graduates formed an independent nation, their revenues would put it among the largest economies of the world. Active companies launched by MIT alumni totaled 30,200 by Kauffman’s count, employing roughly 4.6 million people and generating roughly \$1.9 trillion in annual revenues. That lands “MIT Nation” between the world’s ninth-largest GDP, Russia (\$2.097 trillion), and the tenth-largest, India (\$1.877 trillion).²

Such an outsized impact suggests that there might be something powerfully different about MIT-minted leaders. And that is also something we hear anecdotally – people observing that leaders who are products of MIT have a special quality to them. There isn’t always an agreement that this quality makes them better, but the belief is widespread that there is a pattern to be observed. They are distinctive.

We wanted to pin that distinction down – not just because it is intellectually interesting but because we want to make sure it is sustained. It may even be a style of leadership that, if we could define it, some others would want and be able to replicate, whether as individuals or in organizational settings. Over the past year, we’ve conducted dozens of interviews of people representing many constituencies at MIT and systematically analyzed the transcripts. We’ve pored over biographical accounts of how MIT-trained business leaders have operated and been perceived. We’ve studied successful projects launched and managed by MIT innovators. (See the sidebar “Finding the Patterns in MIT Leadership.”) Here, we present what we’ve learned.

SIDEBAR Finding the Patterns in MIT Leadership

The findings in this study come from a qualitative, inductive study focused primarily on the undergraduate culture and leadership patterns at MIT. The following steps were undertaken:

- Thirty-seven in-depth, semi-structured interviews were conducted between November 2015 and November 2016. Participants included fourteen faculty and administrators and twenty-six students (undergrads, grads, and alumni).
- Interviews were transcribed and coded, grouping together quotes around similar themes. This systematic analysis of patterns and relationships resulted in a set of categories that were then grouped into our key constructs. Coding was done separately by members of the research group, and then conflicts were discussed and resolved through discussion. Thus far, coding has occurred in five rounds; between each round, team members discussed findings and results. Transcripts are also recoded when new constructs arise. To date, 113 codes have been collapsed into 14 overarching categories and subcategories.
- Just over two hundred artifacts have been analyzed. These include Faculty Newsletters, articles and opinion pieces from The Tech, articles from MIT News, and local news outlets' stories about MIT. They also include internal MIT announcements and communications distributed throughout the institute (such as emails from the President), as well as material generated by MIT community members, including websites of student organizations and videos of events on campus. For comparison purposes, we also reviewed artifacts from similar outlets at Harvard.
- Various MIT events, such as the 2016 Presidential Convocation for incoming freshmen, a number of conferences and workshops, and high-profile faculty presentations, were observed and field notes coded.
- The next step is to send our analysis out to key informants and others in the MIT community to get feedback from them as to the validity of our findings.

Anti-Leader Leadership

Immediately complicating our task was the discovery that MIT people have a kind of allergy to the word “leader.” At the very least, they don’t show any eagerness to apply it to themselves. As Dava Newman (who holds the Apollo Program professorship of astronautics at the Institute and also served as Deputy Administrator of NASA) puts it, “they’re very comfortable in their skin” as technologists, mathematicians, and so forth, but “calling them leaders? I think it might be a little bit shocking to them in terms of a label.” For many, the term even has negative connotations. Those jockeying for leadership roles strike them as ambitious, self-promoting, political, power-hungry. People explicitly working to build leadership skills can seem more interested in appearing to be up-and-comers than in actually helping people make progress toward goals.

Many self-styled leaders, too, seem to MIT folks to be more interested in the spoils of high rank than in the satisfaction of accomplishing great things. More intrinsically motivated people, they note, shun the trappings of

exalted office. If you walked into a renowned MIT professor's office, for example, you might never know you did. Sam Keyser likes to tell the story of a delegation visiting from Japan, surprised to see the state of his linguistics department wing. Noam Chomsky told them: "Our motto is: Physically shabby. Intellectually first class." ³

Even the university's president does not occupy a corner office with a commanding view; it's right in the thick of things, in line with a hundred other offices along the school's famous "infinite corridor." And, as MIT Corporation vice president Kirk Kolenbrander commented to us: "If you look at the ceiling of that hallway, you will see a bunch of pipe. Exposed pipe. I would submit that this is the only president's office hallway of a premiere research university in the world where you will see exposed pipe. And the reason you see it here is not because we don't care about aesthetics or design, we just tend to place a high value on practicality and appreciate functionality."

And thus, when you hear MIT people talk about the bosses and colleagues they do like to work with, typical "leaderly" words, even the most positive ones, don't come up. Instead you hear appreciation for geniuses, hackers – or more colorfully, superheroes, or Jedis. The model contributors who earn their loyalty are brilliant, iconoclastic, creative. To invoke Einstein's words, they are passionately curious. They are obsessive problem-solvers.

One implication of this, for us as researchers, was that we would need to use different vocabulary in our interviews. A question like "what do you think of when you hear the phrase MIT leader?" wouldn't get us much. We had to shift to questions such as: "How do people at MIT get cool things done?" Or: "In the early stages of a potentially awesome project, what does it take to get people to contribute their efforts?"

We also saw that we should call out the widespread aversion to the term leadership as a finding in itself. If there is a special kind of leadership going on at MIT, it must be a kind of anti-leader leadership. At least, it is a kind of leadership that doesn't call attention to itself. Well-organized efforts of people working together toward big goals are constantly forming and getting things done, yet as a rule, highly capable people at MIT don't aspire to be "leaders." It's almost as though they become leaders in spite of themselves. Somehow leadership just happens. But how?

Wicked Edgy Problems

The truth is that few at MIT are interested in following another person. That's why it is generally considered absurd and obnoxious to declare oneself a leader. What people do want to follow are *problems* – that is, they are attracted to and willing to expend incredible amounts of energy and attention on puzzles they know would stump or have stumped others. There is a corollary to this, too: if the problems are not sufficiently intriguing, MIT types will not stick with projects or stay in situations for long, no matter how charismatic or powerful their leaders might be.

What kinds of problems get MIT hearts beating fastest? It will surprise no reader to hear that a big part of the MIT leadership "brand" is a dedication to advancing science and technology. In these rapidly evolving fields the questions come thick and fast, and a straight line can usually be drawn between answering them and making a positive impact in the real world. Dava Newman told us she will not even make internship connections for her students with companies she thinks won't present them with technically hard and meaningful enough problems. "That's the only advice I have to people at SpaceX, Blue Origin, etcetera: just please give them a hard problem – a problem you think they can't solve. Put them on a team that you think, 'oh, they're way too inexperienced for that.' ... I say, 'please

don't put them in an internship where they're doing run-of-the-mill work as the low engineer on the totem pole. They may never come back to industry.” It doesn't matter what their market cap is, or how great their employee benefits – to get access to her students, companies have to be willing to let interns work on intriguing problems.

This emphasis on the attractiveness of the problem means that, when people do emerge as leaders at MIT, their leadership journeys begin not with personal ambition but with problem identification. When someone spots that an intriguing, important problem might just be solvable, that recognition often turns to a sense of mission. There is an inherent sense of optimism that solutions can be found. If it's a problem of any real scale, they then have to involve others, and that imperative imposes on them the burden of leading. But the problem remains the focal point. The often-reluctant “leader” relies on it—the problem's intrinsic appeal as best they can articulate it, rather than their own stature, resources, or charm—to inspire and attract others to contribute effort. One student we talked with put it this way: “A lot of times when people ... hold leadership positions here at MIT, it's not that they necessarily want to, but ... they feel like they have to. [They're] working towards ... a bigger goal.” For him, it was a stark contrast to spend a summer interning at a company where the people he saw leading projects “were doing it for individual purposes – or, like, to impress people – and not actually personally motivated for an idea.”

Jeff Karp is a great example of using fascinating problems to engage and develop brilliant people. Head of his own bioengineering lab with several products on the market and others undergoing clinical testing, he did his post-doc work at MIT and keeps a connection to the school as faculty. He is best known as an advocate of “bioinspiration”—or looking to nature for fresh ideas about how to engineer better solutions. A recent example is an adhesive for patching holes in the heart (often in newborns with congenital defects); it replicates certain properties from snails and slugs to maintain its grip on wet tissue while also accommodating the growth of the organ. Karp's projects often have this dual appeal to them: innovation doesn't only show up in the solution; it also rethinks the method of problem-solving. Like others at MIT he crafts insight by drawing on multiple perspectives.

Drew Houston is another alumnus who knows that MIT types will gravitate to the most interesting work. Cofounder (along with fellow MIT computer science major Arash Ferdowsi) of the \$10 billion company Dropbox; he has recruited his share of software engineers. By way of advice, he shared this thought with *Technology Review*: “First, you have to keep an inventory of the best people you or your team has ever worked with.” Then it's a matter of getting them intrigued with the problems you are working on. “You have them swing by the office for drinks [and] do various things ... to sort of tastefully educate them on everything that's going on in the company. There's a bunch of reasons we are excited about what we're doing, and after we explain it to them, it's pretty easy to get other people excited, too.”⁴ Of course, not all students find great jobs and not all companies provide great problems—so some of the MIT graduates find themselves struggling with bureaucratic procedures and politics. They find themselves nostalgic for the world of MIT.

And listen to how Hyperloop team leader John Mayo described the appeal of that project to a *Boston Herald* reporter. “Hyperloop has the ability to have a good impact on the environment, the speed of transportation and just advance physical transportation in general,” he said. “That's why we go to school, that's what we do, is help improve, and do challenges and solve problems.”⁵

As even Mayo's short comment suggests, a problem that inspires sustained, collective effort usually has three things going for it. First, it's “wicked edgy” (a phrase we loved hearing since it rolls together the formal mathematical

observation that some problems are “wicked” and the Massachusetts use of that word as an all-purpose intensifier). Edgy, daunting problems are appealing because they demand ingenuity. It is no accident of history that the school has become the home of the “hack.” Its students’ notorious pranks give the public a laugh but just as importantly, leave people scratching their heads and asking: “how did they do that?” Alumnus André DeHon explains why they do it: “Hacks provide an opportunity to demonstrate creativity and know-how in mastering the physical world. In that respect, they reflect the Institute’s value system. At MIT, intellect and its application are valued...MIT students eagerly anticipate the annual mechanical engineering design contest. And the next hack.”⁶ The best problem is one that represents an opportunity to show off the elegance of one’s solution, the novelty of one’s approach. Why waste your time on problems that have been solved before, or will be easy to crack?

Second, the best kind of problem is one crying out for a practical solution. The objective cannot be to work out puzzles just for the intellectual satisfaction, or to gain understanding for understanding’s sake; it has to be to take something that is broken or missing or wrong and actually fix that. Kolenbrander puts it this way: “Our students are remarkably tuned in to this question: What would people find useful? What would make a difference in their lives?” MIT’s is clearly an engineering culture. Even in the faculty ranks, professors don’t stop at publishing in prestigious journals; they start companies that deliver on their new ideas. (Bob Langer, as a standout example, has done so more than thirty-five times.) At the project level, this is the kind of problem-solving that provides a clear objective, and the chance to say “mission accomplished” when the job is done.

Third, the problems that inspire most effort are ones with big implications for human progress and well-being. Fundamental human needs for food, shelter, energy, transportation, and social harmony are never solved once and for all; every generation has the chance and necessity to rethink them anew. When we spoke with MIT alum Sterling Anderson he was directing the Autopilot Program at Tesla, and he had a definite opinion about what an MIT education prepares a person to do. Relative to other professionals, he said, MIT-trained people are “uniquely good at ... back-of-the-envelope, first principles problem-solving.” That term, *first principles*, refers to a mindset that is willing to start with a blank slate and the most fundamental articulation of the problem to be solved, rather than be constrained by the lines of prior solutions that have been designed. The world’s most pressing problems can always be distilled to the first principles that govern them, and they constantly beg to be rethought in light of current technological possibilities. Problems this important inspire passion and commitment, and these are infectious.

To sum up, if we had to single out just one, headline-level finding about the MIT style of leadership, this would be it. It is *problem-led leadership*. If the key talent of another type of leader is the ability to delegate and motivate people to do work they would not otherwise do, the mark of the MIT leader is the ability to identify and articulate a cool problem that will inspire people to contribute their best efforts. The person who exercises this kind of leadership is someone who identifies a compelling problem – often by reframing a question in a way that demands new thinking – and then gets sufficiently obsessed with it to step up to the work of getting others on board and organized to solve it. This includes improving MIT itself, where students play a major role in its governance. If this sounds like what all leadership should be, consider for a moment how completely ignored it is in typical leadership development curricula. No one is told or taught that leadership starts with seizing on a compelling problem (let alone taught to do that). But that talent gets cultivated from the start at MIT. Students get thrown into problem-solving right away, and it is not only the creative solving that distinguishes their work but their choice of the problem to focus on in the first place.

Problem-led leadership ends up having a number of advantages—for example, in drawing together diverse talents and perspectives and getting their combination to yield novel approaches. We heard this recently when a group of leaders from another renowned university visited with MIT faculty, looking for insights on how to spark the boundary-spanning innovation that seems to happen so naturally among them. The visiting school’s dean asked, “What does it take to get that magic? How much money do we have to invest, and in what? Do we need to dedicate a space...?” The MIT faculty shook their heads, but seemed unable to name the secret—until one put his finger on it. “You have to start with really hard, edgy, cool, wicked problems.”

SIDEBAR What Distinguishes an MIT-Style Leader?

There are all kinds of “leadership styles” in the world, and some places become known for molding certain kinds of leaders. In the settings we’ve examined where MIT-trained minds are in leadership roles, a pattern emerges. MIT leaders are typically marked by:

An “anti-leadership” affect. Rarely eager to apply the label “leader” to themselves or to those they respect most, they approach the traditional role with reluctance and skepticism.

Passion for hard, edgy problems. For them, leadership begins with the identification of a wicked awesome problem, and consists largely of getting others excited about it.

Deep expertise and broad working knowledge. These leaders gain their legitimacy because of their “T-shaped” knowledge, combining (often technological or scientific) expertise relating to the problems at hand with significant knowledge of the other domains across which that expertise must contribute.

Stepping up and stepping out. Believing that the best person to lead the charge on any particular initiative (or phase of a project) is the one who understands the near-term objective the best or has the talent most needed at that moment, they cede control easily when it’s time to shift a group’s focus.

Low interest in trappings. MIT’s famously Spartan offices reflect a proud insistence on devoting every brain cell to the work at hand, and produce legions of problem-solvers happy to work in garages.

Distaste for office politics. Again, a point of pride for the MIT leader, but also a blind spot for many who could use more political acumen to get big things done in bureaucratic hierarchies.

Limited focus on teams’ social and emotional needs. With so much time and energy focused on problem solving, they may miss or discount the importance of leading with emotional intelligence.

High tolerance of team members’ idiosyncrasies. What matters is whether contributors have relevant strengths to contribute to solving the problem, not whether they look, act, or believe alike on other dimensions.

Boredom with status quo operations. “Execution” is a strength of MIT leaders as long as it means translating a brilliant strategy into an effective solution, but presiding over that humming operation day after day holds little appeal.

Hopelessly analytical bent. In a position to support or reject others’ proposals, their primary question is “where’s the data.” Decisions are data-driven, or delayed for lack of it.

Most likely to be leading an entrepreneurial venture. Whether it’s a skunkworks team within a large organization or a startup based on the latest tech breakthrough, these are settings where the MIT leader’s strengths matter most, and weaknesses matter least.

Is it Something in the Water?

The problem-solving form of leadership practiced at MIT starts with the kind of student the school admits – high IQ, yes, but also intrinsically motivated to keep building their skills and applying them to fix things that matter. Take Amar Bose, who both studied and taught at MIT before founding the remarkably innovative Bose Corporation. The son of an Indian immigrant, he was just a teenager when his father’s small importing business was shut down in the 1940s by a wartime ban on shipping. Already by then, however, Bose was a whiz at diagnosing and fixing broken radios. At his suggestion, radio repair became the family business that put food on the table through the war years. In a 2004 interview with *Popular Science*, he said he got into MIT “by the skin of my teeth.”⁷ He says he had to put in an enormous effort in his first year to catch up with peers who had already mastered calculus. But we suspect Bose might have been suffering a bit of the “impostor syndrome” that afflicts so many who arrive on MIT’s campus, discover the tremendous value its culture places on problem-solving, and wonder if they really have what it takes to succeed.⁸ In fact, Bose was just the kind of student MIT wanted then, as it does now. The school doesn’t want people who got their high marks by doing what they were told and checking all the boxes; it wants to see comfort with ambiguity, and pursuit of mastery as a matter of personal responsibility.

Given the intellectual firepower and problem-solving fervor that MIT people come in with, it would be tempting to say these people would go on to accomplish big things with or without MIT. They are destined to do great things, and the school only has the luxury of housing them for a while. But that would ignore a great deal of personal development and transformation that takes place in their time on campus. Across many interviews with MIT leaders, we became convinced that two major phenomena are involved in their personal evolution here. First, the very fact that so many likeminded and similarly capable people are gathered in one place has the effect of intensifying and honing certain strengths that would, in other settings, erode. Second, many very smart people who come to MIT accustomed to working as loners are compelled to join forces with others, and learn to negotiate—and appreciate—the dynamics of teams.

Finding Your People

One thing that produces joy for many on their arrival at MIT is the recognition that they are no longer outliers; in a very real sense they are part of a community. This means, first, that their idiosyncrasies are valued rather than regarded with puzzlement (or derision). Many arrive as relative introverts, the products of settings where their learning obsessions got them labeled as “nerds” by peers more interested in other pursuits. They learned to accept that others weren’t interested in the subjects and puzzles that intrigued them. Now they find their people – people who love science and technology, and who have the same curiosity to solve the mysteries of the planet. Thus, second, they experience a level of psychological safety they may never have enjoyed among peers in the past. They are comfortable venturing further out on limbs, voicing half-formed ideas and trying approaches that are likely to fail, at least in the first outing. Third, finding their people not only produces happiness – it also provides the sounding boards they need to advance their work. It’s a typical experience at MIT that, no matter what obscure topic has captured your intellectual fancy, there are twenty people nearby who would gladly engage with your thoughts on it.

Self-selection into the Institute is every bit as important as the Institute’s offer of admission. For many, the recognition that they have found their people occurs as early as MIT’s “Campus Preview Weekend.” Something of

a legend by now, this first immersion in the school's culture for admitted high-school seniors is not to everyone's taste – and that is the point. Rather than doing the solicitous handholding that most colleges do to “close the deal,” MIT gives students a feel for how their lives will be come September. They are presented with an enormous variety of activities to check out and doors open to them – and left to make sense of it all for themselves. Many get their first taste of an anxiety they will later come to know well by its acronym, FOMO – for “fear of missing out” on the even better stuff that might well be taking place down the street.⁹ Those who are energized by the random connections they make, and comfortable with the lack of structure, self-select in to the institution; those who find it all too chaotic, self-select out.

Finding your people in the world is no small thing. It means there will be constant encouragement to take the risks to push what you are even further. MIT offers you the freedom to be yourself in a place where idiosyncrasies are not just tolerated but expected. And therefore, you flourish. To put a finer point on this, you came in loving problem-solving – and that is what is celebrated at MIT. You came in with some talent for solving problems – and bigger ones are thrown at you. You came in with a high tolerance for ambiguity – and that is required. You came in valuing tech over humanities – and that is reinforced. You came in with impatience to be able to pursue your own projects rather than cutting your teeth by working for others for years – and that is expected. You came in assuming that mature people shared your values – and you weren't disabused of that.

Discovering the Value of Collaboration

The other important change people typically undergo at MIT is the broad realization that they “can't do it alone.” Note that these are people who generally did a lot of that before they arrived in Kendall Square. Now, however, they are among others who get what they want to do and have the skills to help. MIT reinforces that basis for connection by immediately making it impossible for students to succeed solo. Study groups form immediately and spontaneously in the face of its infamous “p-sets” (or problem sets). By putting students through an extraordinarily hard process when they're freshman and sophomores it forces humility and compels them to rely on the strengths of other people. Think of it as the intellectual equivalent of Marine boot camp—the individual finds his or her limits, and viscerally discovers the value of the team.

At the same time, the school doesn't hand anyone a preassembled cohort – so, linking up with others is an ongoing imperative. That might sound like a sink-or-swim situation, bordering on neglect. But it has to work this way, because solving those hard, edgy problems won't get done with people who most resemble you. They will be people who complement you. Speaking in particular about the School of Engineering, Dava Newman claims the emphases on “problem-solving and teamworking are imprinted in our DNA... From undergraduates to graduates, we're always having students working in teams, constantly telling them: ‘Three heads is better than one,’ and ‘Cite your collaborators.’”

Think back, for example, to the Hyperloop team. For a pod to be functional, it had to have adequate speed, braking, stability, and levitation. That demanded students in aeronautics, mechanical engineering, electrical engineering, and computer science – all stepping up with their own unique skills to tackle the problem together. All challenging each other to be at the top of their game.

The habits cultivated on projects like this endure and scale up as MIT people find themselves leading enterprises in commercial “ecosystems” full of complementary and interdependent players. When Dropbox’s Drew Houston was asked recently (by *Technology Review*) about why his company hadn’t focused more on fighting malware, he seemed surprised at the question. “We’re big believers in, like, ‘Do your thing really well,’” he said. Dropbox’s thing is providing people with access to their files in the cloud. As for the malware-syncing risk that might accompany that, “There are a lot of good companies that solve that problem well.”¹⁰

At MIT, students build their capacity for teaming, and their appreciation for the diversity of perspectives and strengths it takes to accomplish something awesome – and all the while, they are homing in on and sharpening specific areas of expertise. To do this, they typically do many trial runs: taking classes within their majors but beyond as well, sampling new realms of research just as they try out musical instruments or dance, athletics, trips abroad, and green or blue hair. By the end of four years, undergraduates have typically accumulated several deep areas of expertise anchored to a very broad, solid base of science and technology. This is what makes the combinations so powerful when they happen. Pull a team together for a project that requires a combination of disciplines and you can be reasonably assured that everyone on it brings A-game energy and competence in their particular field and beyond. Like *The Avengers*, each focuses on a superpower different from the others. Yet all share enough common knowledge to understand what each brings to the table. This often leads to an innovative twist whereby someone steeped in one field sees the problem from a new angle. It also means that, at different points in the action, different people must step up and lead the group on the basis of their special skill, only to step out and let other experts take the lead at other points.

Jedis in Training

The best way to earn the respect of a community is to be a model of what it most values in itself, and at MIT this means always being seen taking on next-level challenges and becoming more capable. People at the school seem to live with the expectation that the world will throw an immense challenge at them, so they must prepare themselves for the day they will take it on.

One person we interviewed used the phrase “Jedis in training” to describe MIT undergraduates. The reference is of course to the *Star Wars* film franchise, which depicts generations of epic, intergalactic battle between good and evil. Jedi knights are the good guys, and aficionados of the films – and they are legion at MIT – can tell you about the many skills that must be mastered to become one. Understand the importance MIT folks attach to working toward mastery and you begin to see “hackathons” and other Brainiac competitions in a new light. These events are not full of arrogant eggheads, though the occasional egotistical student or faculty member is not unknown. Rather than trying to trounce their peers, their real opponent in the room is the challenge. The problem itself is the worthy adversary that provides a great sparring match, as preparation for bigger ones to come. What they are hoping to beat is the level of capability they brought to their last attempt.

To do this, they must keep learning as much as they can, and putting themselves in testing situations, not only to hone their practiced moves but to become adept at putting them together against foes they have never encountered before. MIT reinforces this by structuring exams not only to test the recall of material presented but to challenge the

ability to apply it. Pushing into new territory is the point. Familiarity with concepts and tools covered in class and readings is assumed; many exams demand that students use what they have learned to solve a problem they have not thought about before – and couldn't possibly have crammed for. When we asked one student about an upcoming test, he said, "I can't really study. I will know how to deal with it or I won't."

How does the contribution to a team of many talents translate to leadership at some point? Those who emerge as leaders are specialists in their own right, but also have the broad understanding of other specialists' domains to make the connections. These MIT leaders can understand what each person brings to the table and let their own thinking stretch to accommodate new perspectives. In great teams, there is a high level of knowledge that is shared, sitting above and spanning across members' distinct areas of expertise. Teams play with multiple perspectives and play with different approaches. Leadership happens because the same inclination to do what it takes to master a field also provides the motivation, when a problem presents itself, to gain the skills to inspire and orchestrate the necessary teamwork.

Working the Problem

If any film ranks up with *Star Wars* in terms of its resonance with the MIT community, it might be *Apollo 13*, and particularly its focus on the problem-solving prowess of NASA engineers during the near-meltdown of the mission. In the film's most iconic scene, the ground control director calls the room to order. They have just learned that the craft's air filtering system has suffered a catastrophic failure, and the astronauts will die in space if a solution can't be found. "Let's work the problem, people," he tells the rattled group. "Let's not make things worse by guessing." Soon after, he's in a room with the corporate team that built the craft under contract, who are ducking potential liability by pointing out that the system he is proposing to alter was not designed to perform as modified. His response – "I don't care what anything was *designed* to do. I care about what it can do" – is as pure an expression of a hacker's ethos as could be written.

This is what MIT teams do: they work the problem. Indeed, even when no one is asking them to, MIT types go at problems in a logical and methodical way. Many people we interviewed referred to their "hopelessly analytical" bent – more than once using exactly that phrase. The problem-solving style of leadership practiced at MIT, therefore, is largely about enabling teams to dive into that problem-working. This starts with ensuring a strong foundation of data gathering and analysis. A phrase we hear constantly at MIT is: "where's the data?" No one listening to someone else's provocative new declaration of truth is willing to take it on faith (and if it isn't provocative and new, they probably aren't listening at all). Tom Kochan, a professor in the Sloan School of Management and co-director of its Institute for Work and Employment Research, put it this way: "they ask for a lot more evidence before listening to you tell them what you think you should do, or what they should do, or what the answer to the question is. ... It's a data-driven kind of place." More important, the emphasis on data is part of the general embrace of the scientific method. Getting it is essential to doing the experiments and iterations that will push discovery further. Starting with data, a baseline can be established so that adjustments can be made, feedback can be interpreted, and solutions can be refined. "Fail fast and iterate" is more than a catchphrase. It's an everyday habit of mind.

There is another aspect to working the problem that is actively cultivated at MIT, and it has to do with cycling between abstract theory and practical engineering. In a recent blog post on the school's website, student Jessie Lowell explained that undergraduates tend to arrive at MIT with one of those tendencies or the other:

At the science extreme, you get brilliant people who live in the theoretical worlds in their heads, and love to know why things work the way they do, but couldn't build anything if their life depended on it. They don't really know how to apply knowledge. At the engineering extreme, you get the kids who have been writing code or machining parts or building circuits in their spare time since they were in middle school. They don't really care about the theory behind anything; they want to know how things work. They get frustrated in theoretical classes because they feel like the material is "not useful."¹¹

But Lowell goes on to say that this "frosh dichotomy" doesn't endure for long. Instead, she reports, "as these students go through MIT, most of the scientists become more like engineers, and the engineers like scientists." Seeing this happen to herself and her peers convinced her that MIT's motto, *mens et manus* ("mind and hand") is not just a Latin phrase that someone liked the sound of, but an authentic statement of how innovation gets done at MIT.

Working the problem – and the more technically challenging, the better – is so central to MIT's identity that, even in the most heartfelt project we have ever seen at the school, it came to the fore. Many readers will recall that in the aftermath of the Boston Marathon bombing, the terrorists responsible for that act also took the life of an MIT police officer, Sean Collier. The grief of the community that knew and loved him soon turned to resolve to honor his memory. J. Meejin Yoon, head of MIT's Department of Architecture, designed a memorial to honor Collier's love of the outdoors and spirit of service – but it also deeply reflected and involved the community he chose to serve. Making its massive interlocking granite pieces stand would require a technical feat that would push the envelope of engineering. The multidisciplinary group required to complete the project included faculty, students, and staff with expertise in architecture, construction, engineering, and masonry – and consulting experts in structural and civil engineering, landscape architecture, and lighting design.

Yet combining all those minds and hands didn't bog the project down. To the contrary, an effort that should by rights have taken three years was accomplished in just one. Throughout 2015, people engaged fluidly in the "stepping up and stepping out" process we described earlier, and effectively dealt with sticking points that called for their various forms of expertise. As Yoon commented, developing and constructing the Collier Memorial was "a very 'MIT' endeavor."¹²

No one needed her to elaborate; they recognized the nod to solving wicked hard problems by working across boundaries and pushing to the outer edge of the technology envelope. It runs deep. Again, most of these people had it before they got to MIT. But at MIT, they get their problem solving and teaming tools sharpened to the nth degree. Their curiosity is heightened, respect for data and the scientific method reinforced, and the iterative learning process practiced over and over again.

Architecting the System

Solve enough problems and you start to appreciate that the tough ones are complex. Not only are they interrelated; they are dynamically evolving. Solutions to problems considered in isolation create unintended consequences in other realms, sometimes creating new and worse problems there. If you're at MIT, you're in a culture that appreciates this. It is no exaggeration to call MIT a birthplace of system dynamics theory, given Jay Forrester's foundational work in the field. Many students take related courses. And they learn to appreciate it themselves as their attempts to do something innovative involve that constant cycling between theory and observable reality. One Sloan School faculty member related a comment made by a senior executive in a firm that hires many MBAs. "We can tell who the alumni of your program are," this executive said. As the professor paraphrased what he'd heard, the difference "shows up in their attitude, and in the frameworks and ways that they're approaching problem solving ... [including their tendency to] use some of the tools in systems thinking in their jobs."

Systems thinking is a perspective that, once it is learned, informs decisions in every part of life. Thus a hallmark of MIT-style leaders (and to be sure, it is not a type that emerges only from MIT but is one that MIT takes special care to cultivate) is that they approach organizations as self-organizing systems. This means, for example, that they expect many good ideas and innovations to have their genesis down in the ranks of the organization, and to evolve and propagate from there – rather than insisting they be planned and imposed by managers at the top. As students, that is how they saw MIT itself operating. Even in the work of faculty and administrative committees—the stuff of bureaucratic drudgery in many academic settings—MIT engages in the same "work the problem, find the data, use multiple perspectives and iterative problem solving approach" that it teaches to students.

Thus, people in the system can do their own thing, with a fundamental confidence that they can use the tools they've acquired – their Jedi skills – to figure out something that hasn't been figured out before. In every corner of the school, there is someone who has found a problem interesting, seen the potential to apply some powerful set of analytical tools, and started to work it—and work it, and work it. And periodically, someone high in the MIT administration determines that the time has come to highlight and accelerate progress in a particular realm and pulls the disparate efforts together under the aegis of, say, the MIT Energy Initiative, or Innovation Initiative, or Public Service Center. Then it distributes resources to enable the students and faculty to take the innovation to the next level. From the outside it might appear that these investments were strategically directed from the top. But in fact, the high-level sponsorship followed the innovative spadework of individuals pursuing something out of passion. While certainly the school relies on high-ranking decision makers with seasoned judgment in many areas, and its administrators hold real power, the system is more often self-organizing than top-down controlled.

Seeing how well such a self-organizing system can work, it's all the more easy to be disdainful of leaders and leadership training. And yet, the system relies on many individual leaders, as well as leaving a vital role for highly placed people who recognize and know how to sustain the healthy dynamics of a productive system. A big part of tending the system is making sure that resources are available to support novel ideas. Take Rebecca Saxe's work to learn more about brain function and resilience. It involves capturing MRI images of babies' developing brains. But MRI machines make a lot of noise and subjects have to stay still—not a great environment for babies. So Saxe and her colleagues have worked hard on multiple fronts: redesigning machines, creating new protocols and coils, and figuring out how to project movies of smiling faces to hold the babies' attention. Discussing all the resources

necessary for this work, Saxe commented, “one of the privileges of working at MIT is that they don’t say ‘you’re crazy,’ they say ‘okay, when do we start?’” Creating the system means not only enabling others to seize on cool problems, but building the meta structure where people combine “superpowers” to solve cool problems – and making all this business as usual. That takes real leadership.

Does the World Need More MIT Leadership?

To say that a leadership style is distinctive is essentially to say it isn’t for everyone. In this report, we have not emphasized the downsides of the MIT style of leadership, but they are there. We recall the reaction we got when we asked Kirk Kolenbrander the question inspired by the Sloan professor’s story: If we presented him with a set of leaders from different institutions, would he be able to pick out the MIT-developed one? “Oh yeah,” he laughed. “Not always in the most wonderful way ...” For the most part, the less wonderful traits are clear corollaries to an MIT leader’s strengths. Problem-led leadership means a style less tolerant of bureaucratic structures and rules, for example. Alternately stepping up and stepping out of leadership modes, and expecting vital change to emanate from an organization’s ranks, can create stressful ambiguity for a workforce that hasn’t previously been responsible for that.

Some managers, and we would venture to say most in large hierarchical enterprises, are products of cultures where they have been given clear marching orders and have learned to value them. So problems can easily arise when MIT leaders find themselves in organizations where straightforward delegation is the norm – or when they hire people without knowing this could be a key point of difference. Indeed, this mismatch can show up very early, as we heard in Interviews with freshmen whose summer internships gave them dissatisfying levels of autonomy and challenge.

Even high IQ is not necessarily a quality to be sought in leaders in every situation. Ed Schein noted that one characteristic of MIT leaders is “very high raw intelligence ... I don’t think anybody can get into MIT and get through it without having a lot of academic skills.” But he quickly observed that this might limit the situations in which they could lead. “You might not get the street-smart types ... the type who will succeed as, say, big-city real estate brokers. ... They’re more likely to come out of other types of schools altogether.”

Different kinds of leadership suit different types of situations. Based on what we have learned about the distinguishing marks of the MIT leader, however, and judging from the evidence of where they are leading effectively in the real world, it would seem that MIT-style leaders are best suited to settings where there is a premium on innovation; where advanced science and/or technology is core to success; and where hierarchical management structures have become less effective or have given way to more collaborative enterprises.

It could be argued that these characteristics describe a rapidly growing number of work settings. For example, when we asked Ed Schein what particularly stands out about MIT-educated leaders, he said: “I would have to think that it’s their technical knowledge, on top of whatever else they have. And, I would think, in today’s world, that’s going to become more important, as everything is getting more technical.” For example, he noted, “If you’re going into finance today, it’s a very technical field. If you’re going into marketing, it’s a very technical field.” He was hard pressed to think of a field outside the humanities that wouldn’t benefit from leaders with more technological acumen. Similarly, there is a broad trend away from command-and-control bureaucracies to “distributed leadership” organizations, as enterprises seek more constant and collaborative innovation. Thus there may be more organizations

in which someone prepared to step up and step out as the situation demands – at any level in an organization - will thrive. Indeed, we live in a world getting more uncertain by the day, where leaders who excel in ambiguity and craft clarity out of chaos will gather increasing influence.

In sum, MIT seems to embody a kind of leadership especially well-suited to initiatives and enterprises trying make headway against seriously hard, big, and previously intractable problems. It isn't the only style suitable for guiding an organization, or the best in every situation. If the goal of the enterprise is mainly to scale up an already well-designed solution, for example, or if the imperative is to meet quarterly financial goals with no surprises, other leadership types might be a better fit.

Having studied it so thoroughly, however, we're inclined to believe the MIT style of leadership is a style the world could use more of. Leadership may not be a big word on campus at MIT. But what gets cultivated at MIT really is leadership with a capital L. The school produces people who may not be content to climb to the helm of incumbent corporations and declare themselves winners. Many imagine and build enterprises that take whole sectors into new territory, and in that way get others to follow.

So call it anti-leader leadership if you want. It's the kind of leadership that emerges when someone is intrigued by a difficult problem, develops the determination to see it solved, and recognizes that will never happen by his or her efforts alone. Leadership is a choice that at some point they are forced to make, and a necessity they finally step up to, with a team that pushes boundaries—technical, scientific, organizational, artistic. And thus we are able to look around one day and see that the problem has been solved; something actually just got built. A cancer therapy that challenged conventional wisdom is saving lives. A commercial venture has been launched on the latest advance in artificial intelligence. A memorial to an MIT police officer now stands where none stood before. We are forced to recognize that leadership happened somewhere in there, but it didn't announce itself as such. It was in that way that leadership happens at MIT.

- ¹ Subsequent to this writing, the team advanced further in competition. On January 30, 2017, its prototype was one of only three to advance to testing in a 0.75 mile depressurized tube built at SpaceX headquarters—and the only one created by an American university team. While pods built by Munich and Delft teams beat it on speed, the MIT design was judged best on safety and reliability – and the team will be back in California competing again with a further refined design in the summer of 2017.
- ² Edward B. Roberts, Fiona Murray, and J. Daniel Kim, *Entrepreneurship and Innovation at MIT: Continuing Global Growth and Impact*, MIT Innovation Initiative, December 2015. Accessed at <http://web.mit.edu/innovate/entrepreneurship2015.pdf>
- ³ Samuel Jay Keyser, *Mens et Mania: The MIT Nobody Knows* (Cambridge, MA: MIT Press, 2011), 8.
- ⁴ Jason Pontin, “Q&A: Dropbox CEO Drew Houston,” *Technology Review*, January 30, 2014. Accessed at <https://www.technologyreview.com/s/523976/qa-dropbox-ceo-drew-houston/>
- ⁵ Jordan Graham, MIT Team’s Hyper over Travel Pods, *Boston Herald*, Sunday, December 27, 2015. Accessed at: http://www.bostonherald.com/business/technology/2015/12/mit_teams_hyper_over_travel_pods
- ⁶ André DeHon, “Mastery Over the Physical World,” an essay in T. F. Peterson, *Nightwork: A History of Hacks and Pranks at MIT* (Cambridge, MA: MIT Press, 2011), 196.
- ⁷ Tom Clynes, “The Curious Genius of Amar Bose,” *Popular Science*, July 15, 2013. Accessed at <http://www.popsci.com/science/article/2013-07/curious-genius-amar-bose>
- ⁸ Since the term “impostor syndrome” was first coined in 1978 by Pauline Clance and Suzanne Imes to describe an insecurity undermining women managers’ effectiveness, it has been applied and studied in the context of other groups, including students in elite universities. See Pauline R. Clance and Suzanne A. Imes, “The imposter Phenomenon in High Achieving Women: Dynamics and Therapeutic Intervention,” *Psychotherapy: Theory, Research and Practice*, 15 (3): 241–247.
- ⁹ Fear of missing out is a form of anxiety that has attracted scholarly attention particularly in the age of social media tools. See for example Andrew K. Przybylski et al., “Motivational, Emotional, and Behavioral Correlates of Fear of Missing Out,” *Computers in Human Behavior*, Volume 29, Issue 4, July 2013: 1841–1848.
- ¹⁰ Jason Pontin, “Q&A: Dropbox CEO Drew Houston.” *Technology Review*, January 30, 2014. Accessed at <https://www.technologyreview.com/s/523976/qa-dropbox-ceo-drew-houston/>
- ¹¹ Jessie Lowell, “Mind and Hand,” MIT Admissions Blog, February 3, 2006. Accessed at http://mitadmissions.org/blogs/entry/mind_and_hand
- ¹² Kristin Lund, “Collier Memorial Dedication and Community Picnic to Honor Fallen MIT Officer,” *MIT News*, April 14, 2015 Accessed at <http://news.mit.edu/2015/sean-collier-memorial-dedication-and-community-picnic-honor-fallen-mit-officer-0414>

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