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InfoVision (A): Technology Transfer at Georgia Tech

Katie Emery sat at the coffee shop at Georgia Tech's Student Center, having coffee with her faculty advisor, Professor Julie Jacko, in February of 2004. The Student Center was alive with faculty and students, some of them Emery's Ph.D. classmates from Georgia Tech's School of Industrial & Systems Engineering. She and Jacko talked about the progress made to date on a new technology they had jointly invented, while also weighing the options for the future. In a matter of months, Emery needed to make a series of decisions that would impact her immediate research effort and future career and, at the same time, consider the societal impact their invention might make. And by the end of the week, she needed to decide whether to enter San Diego State University's Venture Challenge, a business plan contest in San Diego, California.

The seed for InfoVision had been planted more than five years earlier, while Emery was still an undergraduate at the University of Wisconsin-Madison and Jacko was on the faculty. At the time, Jacko had just begun working on a CAREER Award granted in 1996 from the National Science Foundation (NSF), investigating ways in which new technologies could be developed to help visually impaired people interact with computers and other GUI-based devices.[1]

Jacko began conversations with Emery about her interest in human-computer interaction (HCI) research and specifically Jacko's projects sponsored by the NSF and Intel. Their discussions evolved into joint research when Jacko assumed a faculty position at Georgia Tech and Emery became not only her Ph.D. student but also the lead graduate research assistant working on the NSF-funded research, which could culminate in the development of a technology suitable for commercial release.

The early stages of Emery's Ph.D. studies, collecting and analyzing data for the project, along with her rigorous coursework and dissertation planning had kept her mind firmly rooted in academia. But now that Emery's graduate studies were progressing and the bulk of the underlying research for InfoVision had been completed, her thoughts turned to the challenge of how best to transfer the new technology out of the labs of Georgia Tech and into the commercial world. Some faculty and administrators familiar with the InfoVision project felt that it had the potential to help improve the quality of life for a great many people with visual impairment, while also generating revenue for its

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[1] Graphical user interface (GUI) is the most commonly used computer interface, exemplified by Microsoft Windows and MacOS. Typical elements of a GUI are a mouse interface and a system of visual directories that look like file folders (iet.ucdavis.edu/glossary/ definition).

Professor Lee Fleming, Professor Marie Thursby of the Georgia Institute of Technology, and Research Associate James Quinn, Global Reseach Group, prepared this case. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

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inventors and Georgia Tech. And while Emery had always assumed she would pursue a traditional academic career path following graduation, the thought of linking her career more tightly to the InfoVision product—perhaps leaving academia to launch a start-up, or licensing the technology to Microsoft or Dell and joining the firms as an internal researcher—was becoming a possibility.

InfoVision

Emery and Jacko began their association when Jacko, who held a B.S., M.S., and Ph.D. from Purdue in industrial engineering, offered a course called "Usability Testing and Evaluation Techniques" in which Emery enrolled. The course drew directly from Jacko's emerging area of research. She explained:

> My research can be broadly categorized in the area of human-computer interaction. I started looking at the HCI literature, and I realized there is very little in the literature about technology and usability for people who have visual impairments. While individuals who are completely blind have access to technology through speech input and output, people who have uncorrectable vision but some degree of residual vision have very few technologies available to them. These can be productive, employed, professional people who want to make use of these technologies but can't see them the way we see them.
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> We began to ask questions about developing technologies that were adaptable: intelligent enough to adapt to the needs of somebody who cannot see as well as we do. And how do we build in multilevel components that don't just exploit someone's sense of vision but also their sense of hearing and their sense of touch?

The subject captured Emery's attention, and as the course unfolded, she and Jacko began discussions about how a new technology could be developed to help people with visual impairments interact with computers and other GUIs. Through discussion and preliminary research, the two began to investigate how a software and hardware configuration might help people with a range of visual impairments navigate a computer's operating system, operate e-mail, use a word processor, work with spreadsheets, and so on. Early fundamental research indicated that the range of visual impairment was relatively broad and diverse, and Emery and Jacko reasoned that in order for a technology to adequately serve the intended population, it would need to have the capacity to tailor its responses to the full range of users. They also felt it was important that a new technology be able to exploit a user's multiple senses, including sight, sound, and touch. Jacko explained: "We were asking questions like, is it appropriate to stratify people who have visual impairments based on visual acuity? If we wanted to look at a range of people with different functional capabilities, is it appropriate to stratify based on acuity, or should we stratify based upon color perception? Should we stratify based on visual field?"

Emery added:

> As you can imagine, the solutions you provide for one individual who has, say, diabetic retinopathy aren't necessarily well suited for someone else who has macular degeneration. We've seen that the impact of the disease on functional vision, such as visual acuity, contrast sensitivity, and visual field, as well as computer performance can vary greatly, even as a single disease progresses. In addition to this, there are several personal attributes that can interact with their visual condition, such as computer experience, age, stress, and to what extent they have learned to cope with the effects of the disease.

Very shortly after receiving the NSF CAREER Award, in February 1999, Jacko received the Presidential Early Career Award for Scientists and Engineers (PECASE), a highly prestigious grant for the nation's best young scientists and engineers. One year later she received a grant from Intel Research to further support and extend this research. Jacko observed that although the Intel grant came from a private-sector source, the funding was free of any future commercial claims by Intel. The company was merely interested in "seeing and contributing to the advancement of science," while developing relationships with students and faculty associated with the research.

By the late 1990s, Microsoft and others had released products aimed at improving screen readability and application usability for people with visual impairment. But Emery and Jacko viewed most of the available options as unsatisfactory, "one-size-fits-all" models that typically relied on only one of the user's senses. (See **Exhibit 1** for description of existing products and their potential limitations.)

Jacko explained why the existing solutions were lacking and how they identified the problems:

> We needed to understand, from a contrast sensitivity perspective, some of the solutions that Microsoft was offering at the time. Why were those failing some users? Why were some people unable to make use of the technologies, despite the fact that Microsoft at that time was providing them with some very basic screen manipulations, most of which were magnification-based manipulations? We found that there were people with certain ocular pathologies for whom magnification was extremely problematic. They would lose track of visual images due to blind spots in their visual field because the enlarged images on the screen would overlap with the blind spots. This resulted in a partial view of the screen.

Emery described how the product would be used:

> So let's say somebody has age-related macular degeneration [AMD] that results in central visual-field loss, distortion, and blurred vision. They would take this CD containing the InfoVision software and put it in their computer. The program would automatically guide them through a series of diagnostic tests to assess a host of interactions that we've identified, through our research, as critical to working within a GUI environment. The software then compares their performance profile, generated from the diagnostic tests, with the identified performance threshold that we hold within a database. This database is essentially an aggregation of the data we've collected from thousands of experimental trials in the field with individuals who have a variety of visual impairments. Based on that comparison, the software makes prescribed changes automatically to their interface, for that specific user's profile. For one person it may reorganize the layout of icons on their desktop, increase the icons to an optimal size, and provide sounds to the user indicating their location on the screen relative to those icons. For another individual, the software may provide a few visual enhancements, increasing contrast and sizes, as well as strategic auditory feedback and haptic feedback—or vibrations through the mouse. Our solutions enable them to see this interface under more optimal conditions but also hear and feel their way through the interface, a truly multimodal solution. As a person's vision or coping skills change over time, they can always return to the diagnostic tests and adjust their profile accordingly. In addition, all the changes made to the computer settings are associated with a single log-in name. This is key, because it doesn't impose any inconvenience for other family members or coworkers wishing to use the same machine. When the individual with visual impairments returns to the machine after someone else has used it, they do not have to mess around with any system settings. They can sit down immediately and get to work.

> The potential impact of our technology is personified with the story of a woman I met during our field testing. She was younger than age 30 and had diabetic retinopathy with visual acuity worse than 20/150. Recently, she had left her job because her visual impairment inhibited her productivity with the computer. She told me that she had been awarded a computer with some assistive software through a low-vision program. They sent her the unassembled computer and software in the boxes, where it remained. She couldn't set the computer up, and her parents were also unsuccessful. She had this potentially beneficial technology and the desire to improve her ability but could not use it to her advantage. She was finally given assistance to set up the computer but was clearly frustrated with the whole scenario. She also pointed out that she had to rely on someone else to adjust the accessibility options for her before she even began to try to work with the machine. Her story alone suggests the great value a product like InfoVision provides, as it automatically makes these necessary adaptations for individuals striving to maintain their productivity, in spite of their impairment.
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> Our field work is very eye opening, because we see firsthand how people who have visual impairments can struggle with basic computer interactions and how even the smallest modifications to the way their interface looks, or strategically providing them with sound or vibrations through the mouse, can result in quantifiable improvements in their efficiency and accuracy. Oftentimes it is encouraging just to observe their reactions to our interface and how excited they are that somebody's working on their problem.

During the 1999–2000 academic year, Jacko was offered a tenure-track position at Georgia Tech, a leading science and technology institution in Atlanta. At Georgia Tech she intended to continue her research in the area of human-computer interaction, along with her new teaching, administrative, and advising capacities. At the time, Emery was approaching graduation and deciding on a career path. Jacko encouraged her to pursue study toward a Ph.D. on the basis of Emery's undergraduate work and what she recognized as long-term potential in the field of teaching and academic research. This choice to pursue a Ph.D. in industrial engineering squared with Emery's view of "working hard at what you study so you can do what you love." As it turned out, she was admitted to Georgia Tech's program—the very department in which Jacko taught—and made plans to matriculate there in the spring of 2001.

Jacko viewed the relocation to Georgia Tech for herself and Emery as something of a transition point for the research on InfoVision, pointing out that while the initial NFS funding had been provided to support fundamental research, the Intel Corporation "was very much interested in the developmental efforts." Once the Intel funding completed its interuniversity transfer, she set aside a portion of the funds to hire a project developer to help "manage the coordination between the fundamental science and the actual tools and diagnostics that would be needed for development." She also prepared to begin the all-important empirical research and data-collection phase of the project.

The Lab

Integral to Emery's work in her Ph.D. studies at Georgia Tech was her involvement in the Laboratory for Human Computer Interaction and Health Care Informatics, which Jacko directed. Comprising seven Ph.D. students from the School of Industrial & Systems Engineering, the lab maintained a portfolio of projects on a range of topics, many of which were rooted in making modern technology more widely assessable. Students of the lab gathered and analyzed field data over the course of multiple semesters, with their findings leading to academic publications and sometimes forming the basis for doctoral dissertations. Individuals were responsible for managing their own projects, but as colleagues in the lab, they were also expected to exchange ideas and, when appropriate, lend their time and expertise to support other projects. In Jacko's words: "I'm very, very careful to cultivate a culture that is positive and emphasizes accomplishment, but not at the cost of others."

Professor François Sainfort, associate dean for interdisciplinary programs and research at Georgia Tech and also codirector of the lab, commented on the nature of the research within the lab:

> We approach research with an emphasis on basic laboratory research all the way through to applications of those research outcomes to applied challenges. It's becoming more and more common to use this approach, which makes us less narrow, because the actual funding in basic sciences and technology is becoming more and more interdisciplinary.
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> There also needs to be short-term tangible impact on society, and of course an emphasis on economic issues and commercialization. Demonstrating that we understand industry and can actually develop products that are useful is a big advantage. We can convince practitioners and executives in the industrial sector that the research we do does not exist in a vacuum but can be applied to real-world problems. That gives us a competitive edge in terms of getting more grant money from both industrial and government sources for quality research that is aimed at solving their problems.

Under the advice and mentorship of Jacko, Emery began carrying out field research in the spring of 2001. The original funding from the National Science Foundation was entirely focused on answering fundamental scientific questions. And at that time the idea had not evolved to the point of developing tools and diagnostics. Armed with a basic understanding of the implications of visual impairments and the challenges these impairments posed to potential computer users, Emery began the meticulous process of data collection and analysis. She visited hospitals with patients with visual impairment, gained access to patient files, and began assembling raw data in a database. Even at the early stages of the project, Emery and Jacko saw potential for a product design that could one day become commercial; indeed, the Intel grant was predicated on such commercial potential. But their focus was principally on the underlying science of the work. In Jacko's words: "I see the work as just part of a much larger cycle. For us, it was really important to advance the state of the science before developing the technology. Being able to commercialize it and accomplish the things we still needed to do from a scientific perspective would be ideal."

Jacko continued:

> One of the challenges that presented itself very early in that process was the push to get technology out the door without the underlying science. And so when we would talk to people about our ideas, they would say that's great, let's look at a prototype. Or talking to developers who would say, great, let me start coding. And we would say, but wait a minute, we have got to make sure the underlying science is in place, because when you talk about visual impairment, you're talking about this whole range of capabilities and possibilities, and you're talking about a whole host of different ocular pathologies, all of them exhibiting different behaviors and different strategies on the part of the people who are actually trying to make use of these technologies.

As the research progressed, Emery and Jacko published their findings in a variety of academic outlets. When looking at the work from an "ophthalmology or visual science perspective," they considered the *American Journal of Ophthalmology*. Papers dealing more directly with human-computer interaction earned publication in *International Journal of Human-Computer Interaction,* *Behavior and Information Technology, Applied Ergonomics, Universal Accessibility and Information Science,* and *CHI Letters*, a publication of the Association for Computing Machinery (ACM). Jacko commented on how publication outlets greatly influence a career trajectory:

> It's an interesting question about publishing. Katie's going to be trying to get tenure within a discipline, whatever discipline it ends up being: management, information systems, industrial engineering. And so she's got to make sure the places that she's publishing are valued by her colleagues, her senior colleagues, in that particular discipline. So I think it will very much influence the outlets that she chooses, at least in the first six or seven years. And I have to admit, from my perspective, that my interest is in seeing her go to an academic position, to an institution that would support this type of work. I think that she's overtrained to just go out and start up a company and do this thing. I think that my preference would be to see her go into academics and pursue it from that platform, if that's what she wants to do.

Jacko and Emery both acknowledged that the success of the work relied deeply on the support of the entire seven-person lab, and Jacko believed all projects in the lab's portfolio depended upon the infrastructure of the lab, with an informal system of "picking up the slack" emerging. The lab worked together and shared coauthorships. Most of the students graduated with at least eight publications, and it was not unusual in the field to gain tenure with only 12. Emery relied upon students at an earlier stage of their careers to do more data collection and, in turn, helped those students in learning how to analyze the data. Sainfort described the motivations that kept the lab working:

> It's also a matter of the organizational identity of the students. They all see themselves as part of the lab. And anything that contributes to making the lab better or more visible to the outside is directly benefiting all the students, and I think they understand that. So when Katie is out there winning competitions or competing, the lab, Georgia Tech, and the overall program all benefit, as well as the students.

Still, within the lab there was a tacit acknowledgement that Emery's project was something of a leading light. Because of its potential to walk the boundary between university science and commercial viability while improving the quality of life for people with visual impairment, there was a "heightened feeling that Katie had been tagged for something special."

The TI:GER Program

In the spring of 2002, Emery became interested in applying to Georgia Tech's TI:GER program, short for "Technological Innovation: Generating Economic Results."[2] Taught and overseen by Professor Marie Thursby, the TI:GER program was "a unique educational collaborative between Georgia Tech and Emory University that prepares students for the challenges of commercializing new technologies and delivering innovative products to the marketplace."[3] Students interested in applying to the program were required to complete a thorough application process that included faculty recommendations. Admission to the two-year program was competitive. Each year it drew a host of applications from MBA students, law students, and Ph.D. candidates from the two participating universities, and each year Thursby enrolled seven Ph.D. students, seven MBA

[2] TI:GER was funded by a National Science Foundation Integrative Graduate Education in Research Training (NSF IGERT) grant, the National Collegiate Inventors and Innovators Alliance (NCIIA), the Alan and Mildred Peterson Foundation, and the Hal and John Smith Chair in Entrepreneurship.

[3] TI:GER program brochure, produced by the Business School at Georgia Tech.

students, and 14 law students. Explaining the higher proportion of J.D. students, she noted: "Half of them are people who want to be patent attorneys, and half are people who want to be consultants. And so they have very different interests."

In his role as associate dean for interdisciplinary programs and research, Sainfort was familiar with both the objectives of the TI:GER program and the portfolio of projects ongoing in the HCI lab. It was he who first introduced Emery to the TI:GER program. Sainfort explained: "In talking with Marie [Thursby], I immediately thought about [Emery's] project as a very good candidate for the concepts she was pursuing through TI:GER. I encouraged Katie to apply to be one of the Ph.D. students in engineering to participate." Sainfort believed that connections like these could often be "serendipitous," adding: "And that's something we are pretty good at doing at Georgia Tech. We continuously seek connections and try to find the right people—not just people with the right expertise, but people who possess the expertise, passion, and drive to collaborate so that big things can happen. Of course, providing the right environment that fosters this approach is critical."

For Emery, the TI:GER coursework provided her first real exposure to the legal and business issues one needed to consider when developing a new commercial technology. Discussions of intellectual property (IP), entrepreneurial finance, commercialization planning, and so on became part of her daily work. And because Thursby's course design placed the research interests of the Ph.D. students at the center of all teamwork, Emery had an opportunity to see the legal and commercialization issues as they applied to InfoVision. Thursby explained:

> All of the projects are done around the Ph.D. students' research. So when you do patent searches, it's on what this student thinks she's going to disclose if she ever invents it. When you do valuation exercises, it's in the context of this. When you look at potential markets, you do the analysis in relation to potential products that could grow out of the research interests of the Ph.D.s in the class.

Emery was assigned to a four-person team at the beginning of the course. The team included one MBA, two J.D.s, and herself. Thursby observed that the cross-disciplinary relationships that developed over the two-year program sometimes created issues relating to personal and preferred learning styles. In Thursby's words:

> My favorite way to describe this is any Ph.D., no matter what their field is, wants to know how you got from A to B to C. MBAs only care about C and what it's worth. And J.D.s only care about the precedent for C. And so you've got these guys having to talk to each other. And they use the same words, and they mean very different things. So for example, when Emery says research, she means experimental research. When a business student says research, it's probably looking up on a Web page and trying to guess the size of a potential market. And for the J.D., it's finding the appropriate cases.
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> And they're very different types of people who self-select into each degree program. Completion of the program accentuates the characteristics as well, like law and aversion to risk, science and focusing on details, and business and concern with the bottom line.
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> When I first started the program at Purdue, my thought, which was totally erroneous, was that the MBAs and I would resonate more toward each other than these people in these very different science fields.[4] I discovered, however, that the Ph.D.s, regardless of their field, thought just alike. We were all curious. And we cared about why something is the way it is. And we all want to optimize. We are much more likely to become completely engrossed in the

[4] Thursby held a Ph.D. in economics from the University of North Carolina at Chapel Hill.

> details, to the exclusion of all else—the psychologists call it perseveration. And it helps in becoming a really successful academic, because you need to be able to keep thinking about a problem until you solve it. And that's a very different perspective from an MBA, who is less patient, more concerned about missing a transient market opportunity, and worried about the bigger picture.

Emery concurred with Thursby's description but outlined more pragmatic and immediate pressures that gave each student group a different perspective:

> When we began the program, the MBAs were in four or more other classes while the Ph.D.s' coursework was winding down. I passed my comprehensive exam shortly after beginning the TI:GER program, so it was soon my only classroom work. The MBAs were tasked with a much greater variety of work than the Ph.D.s, with a different group project for just about every class; they were always working hard to juggle everything. It's the same for the law students, too, but not to the extreme of the MBAs. So in addition to our contrasting backgrounds and perspectives, it was also challenging due to our differing priorities and conflicting schedules.

The Ph.D.s faced workload balance issues as well, however. Emery's enrollment in the TI:GER program, which entitled her to a stipend of $30,000 per year, in no way diminished her responsibilities in the departmental lab or in her Ph.D. coursework. She was subject to her own standards of achievement, as well as the external standards observed by the lab and the department. Jacko noted:

> I think one of the challenges that Katie faced is that she really was straddling two different, but closely related, jobs. She had Marie [Thursby] and the TI:GER program, and there were very clear expectations about what she needed to accomplish with respect to her team. But then she was also a member of our lab. So she was getting a tremendous amount of pressure on our side to be out in the field collecting data, to be doing all the research and development work, and so on. There was a tremendous tension there in terms of being able to juggle all of this and keep everybody happy.

While TI:GER had good support from the Ph.D. faculty advisors, the support was conditional on the program's not distracting the student from his or her research. The opportunity costs of working on commercialization, as opposed to publishable research, were not lost on advisors (despite the attraction of funding). One student's advisor asked him to leave the program but changed his request after Thursby talked with the student and identified personal problems, not the program, as the root cause of the falling productivity. Engineering professor James Meindl, director of the Joseph M. Pettit Microelectronics Research Center at Georgia Tech, saw great value in the program but worried about his students losing focus on their research. He indicated, "Doing good research is hard enough for a doctoral student, even without the added stress of commercialization."

Tech-Transfer Office

By February of 2004, Emery and Jacko had not officially disclosed their invention to the university's Office of Technology Licensing (OTL), informally known as the "tech-transfer office." As Emery had solicited advice from OTL from time to time, the director of the office, George G. Harker III, Ph.D., was well aware of InfoVision's development. Emery realized she needed to file a disclosure, particularly since that disclosure would formally document the date of her invention. While Emery enjoyed some latitude in deciding when to disclose (according to Georgia Tech rules), the disclosure itself was required by university policy and her Employment Agreement, for intellectual property developed under the auspices of the university was the legal property of the university.

Georgia Tech's OTL got its start in the early 1990s, when it was just becoming acceptable for universities to establish offices to transfer technologies to the commercial world. Harker, who became the director of OTL in 2001, joked that universities attempting to create a dedicated office prior to the late 1980s risked "being burned at the stake," so deep was the concern that such practice might derail universities from their fundamental missions. Since start-up, however, Georgia Tech had amassed 1,532 invention disclosures, 324 issued patents, and 201 invention licenses from 1992 to 2004. In fiscal-year 2004 alone, OTL processed 277 invention disclosures and generated $2.32 million in income. (See **Exhibit 2** for technology licensing statistics.)

Harker observed that generating income was only one of OTL's goals. "Our main mission is to provide service—economic development and income will follow. If we provide service to the faculty, service to the community, income not only from licensing but also sponsored research will follow." He added: "On a given day, 70% of our work is on the service end, not on money making." (See **Exhibit 3** for more details on the OTL mission.)

The OTL, which interacted with a wide variety of constituents within the Georgia Tech community, maintained a professional staff of seven to eight people, including two associate directors, an administrative coordinator, a patent/licensing administrator, and two to three technology and licensing associates. The staff's day-to-day responsibilities included assisting members of the Georgia Tech community at every stage of the technology transfer process—from defining and protecting intellectual property, to marketing, to forming a business partnership, to disbursing financial resources to inventors. (See **Exhibit 4** for outline of tech transfer process). Harker felt it was important for his group to "set a new model" relative to tech transfer offices in other universities. He explained:

> In many universities, the tech-transfer office has to first negotiate the deal and then has to go to others for approval - like the legal affairs group, or associate VP for research, for example. This can make negotiating difficult and increases the time to get a deal done. Any such delays can lead to a company missing a market or funding opportunity or just losing interest in the deal. Many companies, due to problems they have had with some universities, have developed the opinion, and rightfully so in some cases, that tech-transfer offices are difficult to work with: They're slow, risk averse, and often understaffed. Our office has worked hard to be more user-friendly and responsive, employing a streamlined approval process for deals.

He continued:

> So what I want to do and I think most people who work in our offices want to do is have impact. They want to get this technology, they want to work with the faculty, they want to work with companies, they want to work with the VCs and they want to get it out there for the benefit of the public and all those involved with the process.

Harker[5] pointed out that the university's commitment to technology transfer took a step forward in 2001 with the founding of VentureLab, a support unit for the university's incubator. "A unit within the Office of Economic Development and Technology Ventures, Venture Labs helped faculty

[5] Harker served in a dual role of director of OTL and assistant vice president of the Office of Economic Development and Technology Ventures.

and students create high-growth companies from innovations developed through Tech's $375 million research program."[6] Members of the VentureLab devoted time to "scouting the campus for promising technologies that might otherwise remain in the lab because researchers are too busy to tackle commercialization or don't know how to begin the tech-transfer process."[7] While Harker acknowledged that the venture capital community in Atlanta was not "Boston, Austin, or San Francisco," he pointed out that the "southeast as a group, as a brand" was marketing itself and becoming more and more attractive to venture capitalists from around the country.

Harker indicated that "most companies now, they want to see a prototype, they want to see something tangible, and not just a couple of lab experiments at the bench." Without prototypes, technology could only be licensed. The technology often languished with licensing, however, with the result that universities were forced to start firms, because no firm would take the risk. Thursby added that most university inventions wouldn't make it without inventor involvement. But she also stressed the opportunity cost of the inventor's time.

Harker acknowledged some of the problems with the student project groups:

> Some of these become so real that the participants, even though they're told up front by the business school that this is not your technology, you will not be a part of any startup, you will not do that, even so we found people going off and getting SBIRs [Small Business Innovation Research].[8] It was so real to them when they finished, we had to say no, no, that technology's tied up. The graduates come back, having set up the company, and the faculty member's not even in the company. We've had that actual case. It becomes so real we've got to corral them a little bit. But we don't want to stifle enthusiasm. I'd rather be over-enthusiastic than having to push everybody to come forward.

Georgia Tech has also been discussing whether patents and commercial success should influence tenure decisions. Opinions were guarded and mixed. For example, Meindl thought that research was by far the most important criterion but that patents and successful commercialization indicated the ability to pick important research problems.

Commercialization and Business Plan Competitions

In the fall of 2003, the University of Texas at Austin invited Georgia Tech and five other institutions to compete in its Idea to Product (I2P) International Competition. Competing teams would present a commercialization plan to a panel of judges, and the top finishers would receive cash awards. Sometimes misunderstood, a commercialization plan was used to show "whether there is any merit in developing a business plan."[9] Plans submitted for the University of Texas competition

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[6] T.J. Becker, "Commercial Innovations," *Georgia Tech Magazine*, Fall 2004.

[7] T.J. Becker, "Commercial Innovations," *Georgia Tech Magazine*, Fall 2004.

[8] A program under which a portion of a federal agency's research and development effort is reserved for award to small business concerns through a uniform process having a first phase for determining the scientific and technical merit and feasibility of ideas that appear to have commercial potential, a second phase to further develop proposals which meet particular program needs, and when appropriate, a third phase in which commercial applications of R&D are funded by non-federal sources of capital. Each federal agency with an extramural budget for R&D in excess of $100M each fiscal year is required to have an SBIR program. (15 U.S. C. 638) (From https://radius.rand.org/radius/demo/glossary.html).

[9] Sager, Fernandez, and Thursby, "Implications of a Multi-Disciplinary Educational and Research Environment," http://mgt.gatech.edu/tiger/files/gt_tiger_implications.pdf, accessed January 22, 2005.

would need to include a description of the product/technology, as well as "possible applications and/or potential markets for that technology."[10]

At the time of the invitation, Thursby decided to ask Emery's team if it would make the trip to compete in Austin. She explained:

> Our dean wanted us to submit a team, and so we were trying to figure out who should go. We asked Katie—and since they were doing commercialization plans for the class, and this was not a huge cost for them—oh, and there was the potential of winning $10,000. So there were two students that wanted to go potentially, and we selected Katie because we thought she had the best chance of winning.

Emery saw the competition as a good opportunity to begin speaking publicly about the work. Her team, which called itself InfoVision based on the proposed name for the developing product, earned the Faculty Adviser's Award along with $3,000 in cash. But there was very little time to reflect on the competition in the days immediately following: She had booked herself on a flight from Austin to Vancouver to participate in an academic conference on universal usability. Such "switching of gears" from a commercial mind-set to a purely academic mind-set was becoming more and more common for Emery. However, the effort required to navigate the two contexts was not easy, as there was a fundamental need to "switch even how you word your research in those two environments."

Having completed the commercialization plan in Austin, the InfoVision team set its sights on two business plan competitions scheduled for the spring semester. On February 20, 2004, Georgia Tech would host its fourth annual business plan competition, to be sponsored by AT&T. Then in March there would be an opportunity to compete in a business plan competition in San Diego. Emery initially thought it would be worthwhile to compete in both events, assuming that her research from the lab and her work in the TI:GER program could feed naturally into the competitions. She also felt it would be a helpful exercise to go through in the event that she decided to commercialize InfoVision in the future.

Preparation for the Georgia Tech competition began in earnest, with Emery and her team working long hours to put together a comprehensive business plan. The final version, they hoped, would accurately convey not only the need for the proposed technology but also the fitness of their design and the soundness of their business approach. (See **Exhibit 5** for executive summary on InfoVision product, team, and intellectual property.) In preparing the plan, Emery gravitated toward the science and technology sections, the law students naturally focused on intellectual property and licensing issues, and the MBA handled most of the financials. As the competition approached, Emery found herself relying more and more on the help of her lab mates to carry on with research in the lab. Jacko explained:

> Well, I think one of the things that really does need to be emphasized is that Katie was able to be successful in this work because there was this whole infrastructure behind her. So she's a member of a lab with six other Ph.D. students—and all of us were instructing her and teaching her and supporting her, side-by-side collecting data, and all of those kinds of things.

During the slide show section of the presentation, she profiled one of the volunteers with whom she and Jacko had worked in the summer of 2002 as part of their empirical data collection. Showing a

[10] Ibid.

picture of an older woman wearing a specially designed headset and operating a computer via a haptic mouse,[11] Emery explained to the audience:

> Bess was such a unique individual because she was a former concert pianist who still liked to play whenever she could. But she has AMD, making it difficult for her to read the notes on sheet music. So, wouldn't it be great if we could put Bess's sheet music onto the computer and automatically make changes to the way it looked so that she could again read the notes? It could improve her quality of life, allowing her to continue an activity that she loves and is passionate about.

On the day of the competition, the InfoVision team and five other finalists made their presentations to a panel of venture capitalists, all of whom were professionals in the field of identifying and funding early-stage ventures. Thursby observed that most of the presentation went well, with the judges particularly engaged by the adaptability of the InfoVision technology to different users. When it came time to defend the financials, however, the InfoVision team discovered some of its assumptions were not well founded. The team finished in a tie for third, a result Emery found disappointing. She explained:

> I think that as an inventor, you should not distance yourself from the creation of those financials. It was all too easy to overlook if somebody else was inputting numbers into the business plan software that we used to generate those financials. I did get a question every now and then about what I thought about the numbers used, but, in hindsight, I really didn't get involved enough in that side of things.
>
> As a scientist, you had better know your assumptions, because that is what dictates the applicability of your results and what you have to stand on. I felt that I would have approached those numbers differently and played with the financials a little more comprehensively than what was done. I assumed that that process had been thoroughly checked and all of the "what ifs" explored. I only realized that they hadn't been exhaustively validated when it was too late, when we were too deep into the competitions to make significant changes to the plan.

With the San Diego business plan competition just one month away, the one MBA student in Emery's group parted company with the InfoVision team, an arrangement that was driven largely by the student's need to find a job for post-graduation. Fortunately, a first-year TI:GER student named David Beck was available to join the team to help prepare for San Diego. With aspirations of becoming an entrepreneur following graduation, Beck exhibited a great deal of interest in the project:

> The competition is very close, and I really have to get up to speed on InfoVision and what Katie is doing. But it is pretty interesting, so it is something I want to do. And [a program administrator] presented it to me as OK, hey, this is probably the best project that we have going on right here. It has the most commercialization potential. It's far along. I know you want to do something entrepreneurial. This is a good person for you to work with. It'd be a great experience if you can jump on board.

One of the biggest issues with going to San Diego, however, was that OTL insisted upon a disclosure before the team shared the technology. It was still very unique. The closest product was from IBM research in Japan that simulated what a person saw when he or she used a Web page. The team was having difficulty, however, in defining their IP exactly. They understood OTL's concern, because everyone agreed that if Microsoft wanted to pursue the idea that its superior resources

[11] A haptic mouse worked like a conventional computer mouse, with the added feature of providing tactile feedback.

would overwhelm the TI:GER effort. With changing rules at the U.S. Patent Office, the group could attempt to patent the software, but its novelty was unclear. Emery also felt that the code could probably be reverse-engineered. When she thought about it, she had to admit that most of the hard work had gone into the development of the database and threshold metrics that drove each person's customization. The creativity came with how the software made adaptations for the user, based on the user's input and database. That was not in the publication. Beck argued that the "multimodal nature of it is really the secret sauce, because, I mean, what's out there right now completely gets rid of the other senses."

The InfoVision team hoped that a presentation and business plan in San Diego would be well received, with Beck observing: "We have exceptionally strong technology. I think we probably can win the whole thing if we have the business side of things ironed out a little bit better." Emery was torn, however, between returning to her research and entering the San Diego competition. She was pleased with the possibility of adding Beck, saying, "The level of enthusiasm of your teammates when you're developing these business plans really makes a difference in the quality of the final product." The new team would need to work extremely hard in the weeks before the competition to shore up some of the financial assumptions. Emery felt severe pressures to return to her research, however, and knew that OTL was expecting a disclosure as well. If she decided to enter San Diego, it would be yet more time away from her lab colleagues and the research.

Emery's Decision

In addition to deciding about the San Diego competition, Emery needed to decide about a direction for her career. With much of the developmental research for InfoVision behind her, Emery's vision for the new technology was clear. In her estimation, her team "could have something on the shelf within a year if we had three or four good developers doing 40-plus hours a week," although she acknowledged the product was still in "rough beta version" and would become more "intelligent" as the entries in the database increased over time.

While enjoying their morning coffee, she and Jacko considered the options.[12]

At the most basic level, Emery would need to decide whether she was going to pursue a career within academia or whether she would choose to try her luck in the commercial sector. If she chose a career outside academia, her most likely career path would be either to assemble a team and launch a start-up or license the intellectual property to a major player such as Dell or Microsoft, with the intention of working within the company in a lead researcher role to continue to refine the product and build the database supporting it. As a third option, she could become a full-time academic—and begin a walk down the path of research, teaching, and publication toward tenure—but her options for InfoVision would be less clear. In this option she could license it to a Dell or a Microsoft and observe its progress, more or less, from afar. Or she could find another way to stay involved in the project "on the side" of her academic appointment, provided she could arrange the right situation within a more lenient academic institution. While the financial risk and upside varied across the options, she suspected that the pecuniary incentives would be modest. She said:

> I am very fortunate that once I graduate there will be several attractive options available to me. I could aggressively pursue the entrepreneurial venture with InfoVision and leverage the new company to engage in low-vision research—and my true love is the research. I'm not going to be shy about saying that. I could manage three or four researchers in work that is an

[12] The two researchers had agreed to a 50-50 share of inventorship rights.

> extension of what I'm investigating now and work closely with a team of developers in getting InfoVision to market. Although there are many "unknowns" down that path, I feel confident that I could handle the challenges it presents. Another, more hands-off, approach would be to license the InfoVision technology to another company. However, if we were to license this technology, there's no guarantee what would become of it. It could potentially sit on the shelf forever without anyone to champion it through product development!
>
> Alternatively, I could pursue an academic career at an institution similar to Georgia Tech, which is supportive of its faculty's commercialization of university technology. This way, the pursuit of the commercialization of InfoVision could be a sort of side venture for me. I am uncertain as to how different it would be, coordinating a team of researchers in an academic versus a corporate setting. However, in universities I don't expect to have the development resources as readily available and would most likely outsource the development work to independent contractors. I would anticipate a great deal of freedom in my research, being able to conduct research beyond the fields of low-vision and accessible technology; the diversity of my work, in a university career, is up to me. Also, the advantages of a tenure-track position are not to be understated. Independent of the academic institution, this option allows me to follow what I am passionate about and have much control over the future paths my career takes.

For Emery, the competition coincided with the end of her two-year term in TI:GER. She reflected: "From now on, for any research I undertake, I'm going to be thinking about the commercial side of things." Beyond the general frames of reference gained in the program, however, Emery believed the experience had helped her see the wider impact of her research. She explained:

> The true strength of this technology and what can drive the company in the future is the proliferation of graphical user interfaces throughout our society. So one of our thoughts was to use Bluetooth technology on your driver's license, for example, or on your ATM card or credit card. You could then carry your profile with you. We could then work with these vendors, those who design ATM machines, people who make the point-of-sale kiosk, work with them to figure out what the prescribed changes are based on those profiles. This really demonstrates the unrestricted potential of the technology and how my research can make an impact.

Exhibit 1 Existing Assistive Technologies and Their Key Limitations

Competitor	**Product Overview**	**Key Limitations**	**Price**
Microsoft Windows Accessibility Options	Accessed through the control panel, user can turn on several different accessibility features to different levels.	• Difficult to access (especially if the user has an impairment) • Difficult to know optimal combination accessibility settings • Limited number of changes directed toward visual impairments	(Not Applicable) Integrated within the Microsoft Windows platform since 1998
Screen Reader	Software program reads to the user elements that appear on an interface via synthesized voice. The program reads left to right, starting at the very top of the screen. When an image is encountered the program reads the associated alt text.	• Solution abandons any remaining vision the user has, using only their auditory ability • Efficacy depends on the organization of the interface (e.g., anything not modeled in a left-to-right organization is not compatible) • Cannot be transferred between systems • A “one-size-fits-all” solution	$700–$1,000
Braille Display	Similar to the screen readers but gives the reader the information via tactile cues (Braille characters)	• Same limitations as a screen reader, plus the user has to learn Braille, which is not likely if they have residual vision and are losing vision later in their life	$4,000–$10,000
Screen Magnifiers	Physical device or software program that enlarges the entire screen image	• A “one-size-fits-all” solution that is not adaptable between users • Cumbersome, cannot be transferred between systems • For people with visual impairments magnification is not always the most effective strategy (especially with obstructed visual fields).	$100–$600

Source: InfoVision business plan.

Exhibit 2 Technology Licensing Statistics

	FY2004	FY2003	FY2002	FY2001
Invention Disclosures	277	226	188	141
Patent Applications				
• Provisional	205	178	143	168
• Utility	61	53	44	52
Patents Issued	35	41	40	35
Licenses				
• Inventions	35	28	25	13
• Software	22	37	39	16
Start-ups Formed	15	10	7	8
Income (million $)	2.32	2.40	2.24	4.6[a]

Source: Georgia Tech Office of Technology and Licensing materials.

[a]Equity sale.

Exhibit 3 Mission—Office of Technology Licensing

- Provide service to GIT community in all areas of IP
- Evaluate and protect the intellectual property (IP) rights of GIT, its faculty and students
- Commercialize GIT IP through licensing and start-ups
- Generate income for future research and education
- Contribute to local, state, regional and national business competitiveness and economic development
- Encourage innovation and invention at GIT

Source: Georgia Tech Office of Technology and Licensing materials.

Exhibit 4 Technology-Transfer Process Outline

Research →	Intellectual Property →	Disclosure →	Evaluation
• Document • Date and Sign • Witness	• Invention—Device, Process, Method, Design, Composition • Copyright—Original, tangible expression of an idea • Trademark	• Disclosure Form • Patent Search Results • (www.uspto.gov)	• New • Useful • Not Obvious • Commercial Potential • Competition

↓

Protection →	Marketing →	Business Partnership
• Patent • Copyright • Trade or Service Mark • Know-how (confidentiality—nondisclosure agreement)	• Additional Research and Development • Contact Companies • Start-up Possibility	• License • Option to License • Equity • Cooperative Research and Development

↓

Commercialization →	GTRC Income →	Net Income Split
• Existing Company • Start-up	• Royalty • Contract Research and Development • Dividends (Equity) • Share Sale	• 33% Inventor(s) • 17%–33% Research Unit • 50%–34% Research Corp.

Source: Georgia Tech Office of Technology and Licensing materials.

Exhibit 5 InfoVision Product, Team, and Intellectual Property

The Product

Our initial product offering, InfoVision-PC, is software that will enable those with visual impairments to use personal computers (laptops and desktops). Running in the background of Microsoft Windows, InfoVision-PC uses diagnostic tests to assess a person's ability to interact with their computer to generate a unique profile of their functional abilities and performance thresholds. A database of thousands of performance metrics identifies the key inhibitors of the individual's performance and automatically initiates changes to optimize their computer interactions.

Key features of InfoVision-PC include:

- *Customizable solutions:* for those with visual impairments.
- *Integrated intelligence:* using a database of thousands of performance thresholds collected from a sampling of people with visual impairments.
- *Multimodal adaptive interface:* integrating visual, auditory, and tactile cues.
- *Portable accessibility:* allowing users to apply their profile to any machine that runs the software, and multiple users with different profiles to use one computer (making changes only in association with their user ID).
- *Expandability:* extending the underlying concepts of InfoVision-PC to other technologies with GUI displays (e.g., kiosks, cell phones, ATMs) compels the sustainable growth of the company.

Possible competing solutions, such as screen readers and screen magnifiers, are not multimodal or portable and are typically "one size fits all." InfoVision-PC will set new standards for these competitors.

The Team

The inventors and cofounders of InfoVision, Inc. are Dr. Julie Jacko, associate professor of industrial engineering at Georgia Tech (GT), and V. Kathleen Emery, a Ph.D. candidate working under Dr. Jacko's advisement. Dr. Jacko is a lead researcher in the field of human-computer interaction (HCI). She works extensively in the areas of accessibility and universal design, specifically for individuals with visual impairments. The underlying concepts of InfoVision, Inc. emerged from empirical research conducted with individuals with age-related macular degeneration and diabetic retinopathy.

Dave Beck (GT MBA, 2004) and Adam Severt (Emory University J.D., 2004) contributed to the development of this plan and are serving in interim chief marketing officer and chief administrative officer roles, respectively. This plan is a result of a two-year commercialization activity under the guidance of the Technological Innovation: Generating Economic Results program at GT. This plan will outline the timeline for hiring key personnel to take InfoVision-PC and future products to market. A board of directors is currently in place to advise the cofounders in this process. These individuals come from academic research, health systems, strategic management, rehabilitation, hospital administration, and the software industry.

Intellectual Property

InfoVision, Inc. will soon be filing a provisional patent application seeking to protect the method by which vision profiles are translated into specific adaptive functions. Copyright and trademark protection will also be sought where appropriate. In addition to these measures, InfoVision, Inc. will study and implement antipiracy measures and trade secrecy.

Although this technology is owned by the Georgia Institute of Technology, the Office of Technology Licensing (OTL) has expressed interest in licensing it to InfoVision, Inc. for commercialization. It is GT OTL policy to encourage the commercialization of technologies produced through university research, especially companies incorporating faculty advisors like Dr. Jacko. We expect to secure these rights to the intellectual property in exchange for royalties in the range of 2% to 4% of gross sales. The university will also consider accepting equity in lieu of royalties; however, we believe royalty payments will provide the best return for our shareholders.

Source: Preliminary InfoVision business plan.