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Lessons Learned in Technology Transfer from Dr. Gregg Vanderheiden and the Trace Research & Development Center

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This* FOCUS Technical Brief *describes the exemplary technology transfer (TT) and knowledge translation (KT) work of the 2013 winner of the Center on KT4TT's Product Utilization Support and Help (PUSH) Award. The recipient is Dr. Gregg Vanderheiden and the Trace Research & Development Center at the University of Wisconsin-Madison.

Introduction

The Trace Research & Development Center at the University of Wisconsin-Madison was established in 1971 with the development of an early augmentative communication system, which was ultimately transferred to a well-known assistive technology manufacturer. Founded by a group of students, the Center has always focused on ***outcomes*** rather than ***outputs***. That is, the purpose of the Center was not to produce prototypes and research papers. Instead it set out to change the technology solutions available for consumers, and along with that to impact clinical practice, industry practice, and government policy so that people with disabilities could participate more fully in education, work, and community living. Advancing science and the knowledge base was a critical part of this—but that was not the goal.

An early decision in the life of the Trace Center that was to set a pattern for our later approach to research and technology transfer was to stop using our Rehabilitation

2013 PUSH AWARD

The Center on Knowledge Translation for Technology Transfer (KT4TT) is pleased to announce the recipients of the 2013 Product Utilization Support and Help (PUSH) Award, Dr. Gregg Vanderheiden and his team at the Trace Research & Development Center, University of Wisconsin-Madison. Trace is home to NIDRR's Rehabilitation Engineering Research Center (RERC) for Universal Interface and Information Technology Access and RERC on Telecommunications Access. Dr. Vanderheiden and his team exemplify knowledge translation for technology transfer through their implementation of a needs-driven approach to focusing their Center's research and development efforts on creating innovative technology solutions and transferring them to the marketplace.

Many of the product development and knowledge translation approaches Dr. Vanderheiden uses and advocates for in this issue of *FOCUS* are a confluence of product development best practices espoused in Product Development and Management Association (PDMA) publications, along with Ian Graham's Knowledge to Action concepts for KT (Graham et al., 2006). Dr. Vanderheiden's knowledge translation for technology transfer approach has modified and adapted those best practices so that they may be successfully applied to the assistive technology marketplace.

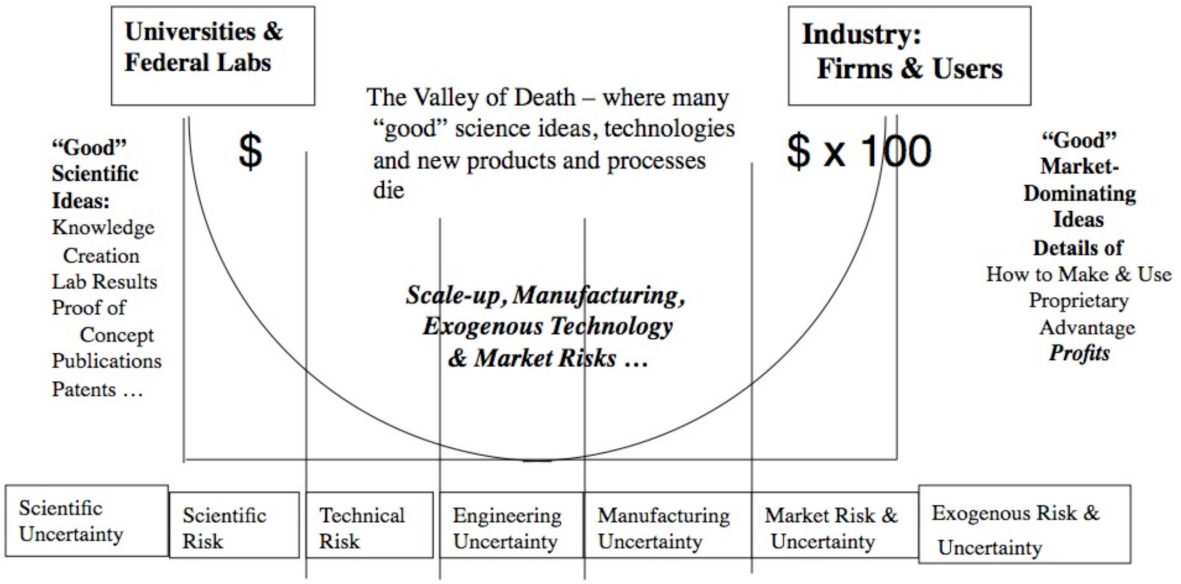
Engineering Research Center grant to provide innovative solutions directly to clients in our hospital affiliated clinic. Instead, we used our work in the clinic to identify areas where solutions did not exist and then focused our research and development (R&D) on creating those solutions and transferring them to vendors. Only when they were available from a vendor as a standard product did we prescribe them for our clients. This slowed the availability to the first client, but greatly accelerated the availability to other clients in our clinic and nationally—and ensured that there was support for the solutions, especially since our clients came from around the country.

Over the past 42 years, the Trace Center moved from a focus on augmentative and alternative communication to the broader field of information and communication technology. Throughout its history, the Center's R&D has retained its focus on consumer and stakeholder needs, and adapting to the realities of industry, clinical practice, government policy and the real everyday lives of people with disabilities, in order to keep our research and outcomes relevant and realistic to all these stakeholders. The Center keeps technology transfer and system change as its number one priority. As a result, approximately 83% of all the projects undertaken have resulted in transfer to the commercial sector (devices and product enhancements) or to clinical/practitioner practice. These successes include assistive technologies, hardware designs and software implemented in mainstream products, and techniques and strategies adopted into clinical practice, industry standards and government regulations.

Technology transfer is difficult, expensive, and time-consuming

Technology transfer typically costs more (and often *much* more) than the innovation itself. Taking an idea from initial prototype through to something that is anywhere near ready to move into production or sales is a very expensive proposition. A large company in a large mass market is well equipped, and indeed prefers, to handle this process itself. In some (but not many) fields, just creating an idea is enough and industry will take it from there. However, assistive technology is not one of those fields. In the AT market, with its small vendors, the idea must usually be much closer to commercially hardened before it can be transferred. And for access features intended for mainstream products, companies usually want

Figure 1: The Valley of Death – where many "good" science ideas, technologies, and new products and processes die



Source: *Factors that Foster Industry-University Cooperation: Implications for I/UCRCs.* Paper presented by M. Jelinek at the National Science Foundation - Industry/University Cooperative Research Centers Program Evaluator Meeting, Arlington, VA, June 2006. © Mariann Jelinek, PhD, Professor of Strategy Emerita, College of William and Mary, Williamsburg VA, 23185, Copyright 2006. SEDL used with permission of the author.

fully-developed ideas, with proven track records and proven reliability in the field before they will even consider incorporating them into their mainstream products.

Typically there is little funding available to bring ideas forward, maturing them from research results toward something directly usable by companies. The gap between research and commercial viability is sometimes referred to as the "Valley of Death" and is a long-recognized problem (see Figure 1).

Whereas many funding programs exist for carrying out research, there is relatively little funding to move ideas forward to the point where they are attractive to industry. Even programs with titles like "Technology Transfer" are often on the very edge of research funding rather than being located toward the center of the valley. Figure 2 shows the National Science Foundation's funding programs in 2008 as they relate to the technology transfer "valley."

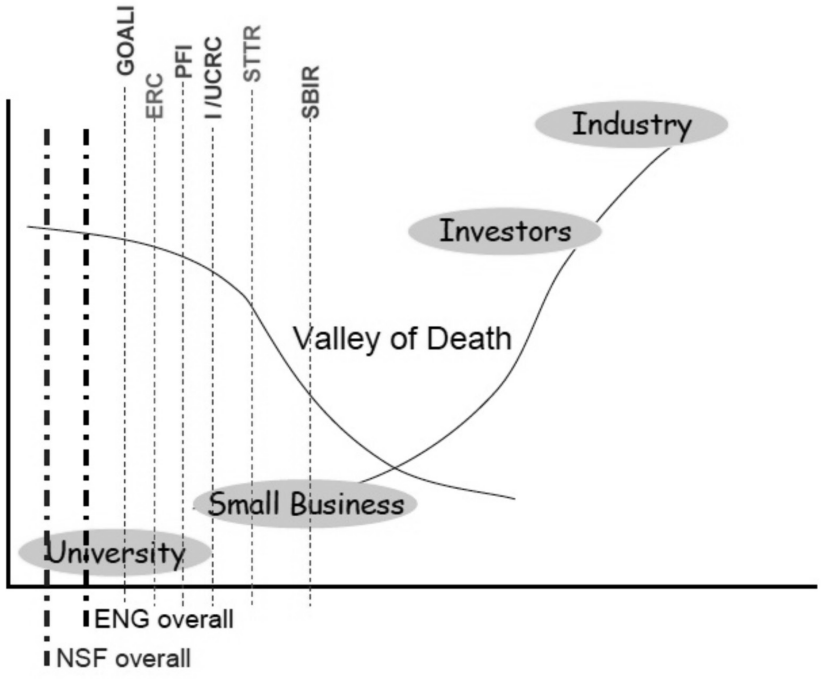
Even if the funding obtained for the research has a technology transfer component, it is usually a fraction of the budget (rather than being half or more) and technology transfer usually takes longer than the grant cycle—even for grants with longer than normal cycles. Once the initial research grant is complete, it can be very difficult or impossible to get funding for the additional documentation and dissemination, negotiating, testing, and commercial hardening needed for transfer. The result is a very low technology transfer rate for most R&D, even for highly successful projects.

Exacerbating the problem, the reward system for university-based researchers typically places a much lower value on technology transfer than for research and publication outputs. Academic recognition, awards, and even advancement through academic ranks and annual peer review for compensation are usually based on scientific publications and rarely even consider, much less value, commercial transfer or clinical adoption.

Universal/Inclusive Design

Technology transfer to mainstream industry is usually the objective when one is working for universal or inclusive design of products. This typically means

Figure 2: Filling Gaps in Current Portfolio



ACRONYMS	
NSF	National Science Foundation
ENG	Directorate for Engineering
GOALI	Grant Opportunities for Academic Liaison with Industry
ERC	Engineering Research Centers
PFI	Partnerships for Innovation
I/UCRC	Industry & University Cooperative Research Centers
STTR	Small Business Technology Transfer
SBIR	Small Business Innovation Research

Source: Report to the ENG AdCom, April 24, 2008, Dr. Cherri Pancake, Oregon State University (Co-Chair), ENG Advisory Subcommittee on University-Industry Partnerships. SEDL used with permission of the author.

you must transfer a feature or capability for a market segment (consumers with disabilities) that is not the market focus for the mainstream commercial product.

In this type of technology transfer, one is trying to convince the mainstream company that the universal/inclusive design feature would make their product more useful to persons on the tail of their market distribution and that they should care about this part of the market. Sometimes a business case can be made that this feature would broaden or increase the market for the product. The best case would be when the feature has appeal or utility for the core market for the product. For example, providing built-in voice control for all of a cell phone's functions enabled blind consumers to use the product, but also appeals to many other people in a variety of different situations. However, building a compelling business case for the tails of a company's market is rarely possible without some help.

Here is where regulation can play an important role—taking social values (in this case, inclusion) and turning them into normal market forces (sales and profit)—but only if the regulations are enforced and there is a real impact on profit, whether direct or indirect. For example, accessibility standards in buildings are very effective where they are incorporated into the building code and when they are enforced. When this is true new buildings cannot be occupied if they do not meet the code, and there is great incentive to implement the regulations. Those regulations that are not enforced are rapidly ignored since they have no monetary impact on profit. In cases where the enforcement or penalty is low, compliance is also low and is often treated as a cost of doing business and the penalty is paid. It has been interesting to observe the increased priority placed on accessibility by companies each time accessibility regulations were promulgated, only to see it taken off the plate, and accessibility teams reduced again when companies observe lax enforcement or find ways to circumvent the rules.

With the aging of our populations and the more flexible and powerful interface technologies now available, we are seeing a broadening of the target market of companies and a reduction in the cost to create more flexible, accessible interfaces. These are combining to create an increase in the incorporation of inclusion features into products. However, much of this benefits only the larger and milder disability populations and does not address the needs of those who are further out on the tails or those with mixed disabilities that are the tails of the tails—yet cumulatively are still are large number of people.

Success is possible: One model for technology transfer

It is important to note up front—that there is no *one way* that will work across all fields, technologies, industries, or even companies and research organizations. The Trace Center actually has evolved a number of different models for technology transfer that have been successful for commercial transfer of different types of ideas, designs, techniques, and strategies to different mainstream companies and organizations in the information technology and telecommunications industries. Sometimes different variations are needed in different parts of the same company.

The general approach described here is typical of many of our models, especially for universal design (built-in accessibility features) with larger companies. However, elements of this model and the principles that go with it may be useful to others, including those working in assistive technology.

The Trace Center's General Technology Transfer Model consists of five phases:

1. Exploratory Research
2. Research and Development
3. Commercial Hardening
4. Support and Nurture
5. Follow Along

One cornerstone of this model is participation by industry and consumers throughout, maintaining a continuing dialogue. These dialogues are not about our projects, but instead focus on the concerns, questions, and issues of the companies and the consumers. We often work with both groups on standards efforts, serving as a free resource for information and, to the extent possible, acting as a free research body to explore and answer questions they had that they could not answer—or were unable

to get answered by those within their organization. This work is almost always done at our expense. But through these interactions we build a communication channel that leads to frank discussions and deeper understanding of real needs on both sides. It also leads to their being more comfortable in communicating with us, and more candid (critical in a friendly, but frankly honest, fashion) about our ideas. This helps to make our ideas and thinking more robust over time and more realistic and useful to both of these groups.

PHASE 1: Exploratory Research – look for solutions to problems, explore different ideas to determine what might work

The starting point is problem identification. *The key is to work with consumers and industry to ensure a complete understanding of the problem by our team***.** In the Trace Center experience, this means engaging with people who have a variety of disabilities in order to learn about the barriers they are encountering that hamper or prevent their use of mainstream technology. It is important to look beyond the technology currently in use to the emerging technologies that may improve things or bring about new barriers. In other words, we don't solve yesterday's or even today's problems—but rather focus on the problems of tomorrow. Especially in the fast moving Information Communication Technologies (ICT) area, failing to look forward will result in solutions that are obsolete before they are released.

It is absolutely critical to pay attention to the relevant industries, even at this exploratory stage. Beyond general knowledge about the major companies, their culture, and where they are strategically positioning themselves, it is important to listen to presentations or engage in conversation with people from these companies. It is helpful to listen to people who are engaged at some level in accessibility issues, as well as those who fulfill other more mainstream functions within the companies.

It is particularly important to understand what motivates a company to implement accessibility features (or add any features to their products). From 1996-2000 the Trace Center engaged in a study that included in-depth interviews with individuals in a variety of companies about what motivates and facilitates a company's practice of universal design. That study confirmed that the decision to include or exclude a particular accessibility feature is, like many other decisions in business, based almost exclusively on management's *perception* of its impact on *profitability.*[1]

Listening to consumers is also key to identifying problems and potential solutions. Especially in the ICT area, consumers may not be able to identify the issues they will have with emerging technologies they have not yet encountered, but by thoroughly understanding the types of problems they are encountering and the types of solutions they find practical and helpful—AND—by including them in your explorations of future technologies and solutions, it is possible to create solutions that are much more effective, practical, and acceptable to consumers in their everyday lives. Techniques or strategies to address the known issues may be identified through work with colleagues or other researchers. But, it is important to be rigorous in assessing whether an idea really addresses the problem and is practical for consumers. Also, care needs to be taken to stay need/barrier driven and not become technology driven. One can fall into the "to a hammer, everything looks like a nail" trap, where the goal is to apply the technology rather than to solve a problem the best way.

Documentation of information on both the problems identified and the potential solutions is essential throughout. (Note that any patents may need to be filed before sharing ideas with others. See "To Patent or Not to Patent?" sidebar on page 6.) In addition, dissemination through presentations and in written form is helpful for drawing in others who might provide useful insight. There is also a possibility that the idea could be picked up by industry at this "paper" stage, although that is unusual. (If this happens, you can skip to *Phase 4: Support and Nurture Implementation*.)

1 Vanderheiden, G., & Tobias, J. (2000). Universal design of consumer products: Current industry practice and perceptions. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting July 2000, 44*(32), 6-19 - 6-21. doi: 10.1177/154193120004403206

To Patent or Not to Patent?

One of the more interesting and difficult areas we have encountered in technology transfer is questions regarding patents. In our early years we did not patent anything because we wanted everything to be freely available to everyone. We had been told by some company representatives that they would not incorporate any accessibility features into their products if they had to license them. However two problems arose with this approach.

First, some of our ideas were later patented by someone else who then sought to prevent or restrict other companies' ability to use the ideas. In one case the patent holder did not just want royalties, they wanted a prohibition from anyone else using the ideas that we had developed (and they had later patented). This created a severe problem. Once someone has filed and secured a patent it is very difficult to break the patent. No one is interested in paying for the process of breaking the patent because in the end the ideas are free for anyone to use. Who will invest money to break up a patent where they do not have any mechanism to recoup their expenses? After using personal funds and much time to break one patent, I reconsidered this approach.

Second, we found that companies actually were unwilling to use ideas for which we did not hold a patent. Their position was basically that if we did not have a patent then they did not know who owned the idea. They were unwilling to put an idea into their product unless they had some assurance that they had the right to do so.

So we shifted our strategy and began securing patents on ideas but, with the cooperation of the university, licensing and royalties were set low enough (a quarter of a percent or less) that the cost could not have any significant impact on the price of any product incorporating them. Note, however, that not all universities operate in this fashion. We have heard stories from other universities where, once the patent was secured, the university wanted to get as much royalty income as it could, inhibiting or preventing commercial transfer efforts. Because of the Bayh-Dole Act, researchers on federally funded projects do not have any choice in this. Researchers must disclose all inventions and universities have the first rights to patent any results of federally-funded research.

Bayh-Dole Act: P.L. 96-517, Patent and Trademark Act Amendments of 1980.
http://www.gpo.gov/fdsys/pkg/STATUTE-94/pdf/STATUTE-94-Pg3015.pdf

Example: While most of our development projects caused us to have to go beyond this phase, one example of an idea that went from research (and evangelism) to implementation was our work on the standard for simple switch interfaces. Our second National Science Foundation (NSF) grant was focused on creating a connector standard for simple one to five switch interfaces. At that time in the 1970s there were about 15 companies that created most of the communication and control assistive technologies. And it turned out that not even by accident did any of the 15 use the same connector and pin assignments for their switches, even for their single-switch interfaces. After much work and lobbying we got one, and then another, company to switch to using the simple 3.5mm phone plug that is in use by everyone today. By the end of the project, all but one company had switched to the 3.5mm phone plug, and that company gave up using the ¼ inch phone plug several years later and switched to 3.5mm. While this seems trivial today, it was a major concession for a company to change connectors and make all of their new products incompatible with their old products or accessories. This was also an example of finding and convincing a key company (Prentke Romich) to be a leader, which then helped tip the decision balance for the others.

PHASE 2: Research and Development – experiments, develop proof-of-concept, mature the concept enough to attract industry

Throughout this second phase, it is critical to continue working with both consumers and industry to update and sharpen understanding of the issues and possible solutions. Especially in rapidly changing areas of technology, new problems and opportunities emerge (sometimes seemingly out of nowhere).

For example, in a recent development project we had

proposed a new crowd-sourced real-time caption correction system based on a new technology announced by Google (WAVE). We had coordinated with their engineers to use the underlying engine to build the new capability. One year into our program, however, Google cancelled the project, requiring us to fall back and build our own engine—a considerable undertaking. However, in the end, through collaborating with other companies and working with consumers we will have a leaner, faster, and more useful solution. We had to recover, re-plan, re-scope and move fast to do this within the grant duration. Existing good relations with companies and consumers, and our history of meeting their needs in the past, was key to our ability to do this.

The core activity of this phase is constructing proof-of-concept prototypes, but not to keep them in the lab. The key is to *share* them with consumer groups and companies, and to *ask for and listen carefully to their feedback*. This allows everyone to explore the idea further, testing it with consumers (end users) and also assessing the reactions of the companies who are most likely to adopt the idea.

This is an important opportunity for selling the idea within a company, often with the help of one or more consumer groups. A prototype, much more than a paper design, can build confidence in the idea's viability, practicality, and effectiveness with people with disabilities. It can also be used to explore possible appeal for (or lack of negative impact on) a company's mainstream users.

> *Example:* EZ Access® (a simple set of interface enhancements which can be applied to electronic products and devices). Although EZ Access is now in use through the United States in post offices, Amtrak ticket machines, national monuments, and airports, before EZ Access was first accepted we worked with both industry and consumer groups by building prototypes and carrying out hands-on testing of concepts. During this phase we revised assumptions we had made about what industry would support and what would work well with consumers (moving from a more complicated one-switch design to a simpler 3+1 switch, then 4-switch design). The result was an approach that was somewhat more expensive but infinitely easier to understand and use without instruction—and that led to its widespread implementation. (Learn more: http://trace.wisc.edu/ez/)

It may be critical in some cases to use this prototype process to deal with interoperability or other standardization issues. If the idea can be picked up as a new standard, or as a solution to a standardization problem, it opens the door to being adopted by many companies.

> *Example:* The Trace Center created a series of web accessibility guidelines, the "Unified Web Accessibility Guidelines." They brought together guidelines from around the world. Their impact, however, was limited until they were picked up by the World Wide Web Consortium (W3C) and used as the basis for building the first Web Content Accessibility Guidelines (WCAG 1.0). Once it was evolved into a standard, its impact was several orders of magnitude greater.

The bottom line, both now and in the next phase, is not to bypass any opportunity to *evangelize, evangelize, evangelize* the idea with industry, and to try to get it adopted. This is not a question of getting the word out about your solution. Evangelizing is *two-way* communication, with as much or more time spent *listening* as presenting or demonstrating.

Again, it is possible for a company to adopt the idea at this point. (If that happens, skip to *Phase 4: Support and Nurture Implementation*.)

PHASE 3: Commercial Hardening – work with a company to strengthen implementation of the idea; build up tools and support materials needed for first commercial implementation

This is a costly phase, and we try to achieve adoption before this point. If you reach this step, it may be because the idea is bad or its benefits are not yet compelling enough.

Repeat Phases 1 and 2 – Careful Listening and Re-evaluation

Before proceeding with commercial hardening,

repeat Phase 1 to re-examine the problem and the idea. Listen carefully to input from industry and consumers. The importance of *careful listening* cannot be overstated. Over time we have found that our failure cycles were decreased when we spent less time talking and more time listening. Again, opportunities to sell your idea or product are best spent when you are listening more than talking. Listen to their questions and concerns. Listen for what they really feel they need, rather than what you are offering. If you are a university-based researcher, resist any temptation to *enlighten* or *educate* an industry representative as if he or she were a student.

Timing and the need for perseverance

After repeating Phase 1 and if necessary, Phase 2, you may again fail to get the idea adopted. It may be a problem of *timing*. The idea may be ahead of its time. In one instance at the Trace Center, we predicted where the field would be and launched a development effort, only to find that the technology and costs were not in line when we completed the research. We shelved the work and worked on other things until the time was right, when we were able to bring it forward and move it into adoption.

Another important lesson we have learned is the need for *perseverance*. Moving products out to industry is often preceded by a series of failed attempts. We use the information gained by each failure, as well as the continuing communication with companies and consumers, to refine the idea. For example, we revised the set of operating system accessibility features three or four times over the course of almost ten years, making it work with three different generations of the software, before we were able to get them adopted into Windows. And even then the features were in and out of the planned release three times before ending up in the final version at the last minute. The good news is that these features have survived over six generations and are in millions of homes and businesses throughout the world today, and are also included in international accessibility standards.

Example of both timing and perseverance: We originally developed the Access Pack for Windows 2.0, then rewrote it for Windows 3.0 and updated it for 3.2. Although we were able to get many of the features built into the Mac operating system (OS) years earlier, we were unable to get them into Windows. Instead we kept re-implementing them for each new release of Windows and let Microsoft distribute them free of charge on their supplemental drivers disk. Then, when pressure mounted for Microsoft to build in access to Windows 95, we were in position to achieve full integration into Windows "out of the box" for all users. Microsoft had been distributing access features for years to their customers and had some experience. Even then, however, those features wouldn't have made it into the product if they hadn't already been in the Mac OS for over 6 years. It was the fact that they had been in the Mac OS and not caused any trouble that gave Microsoft's team the confidence to put the features into Windows 95 where they comprised 8 of the first 10 access features in Windows.

Partner with a company

If your judgment is that the idea has value and you want to try Phase 3, you will need to find a company willing to partner with you. Work with the company, listening carefully to their particular needs and constraints, and provide as much assistance and support as possible. With the company's input, develop support materials, prototype code, reference designs, application materials, business case data, and anything else that can reduce the risk and the cost to implement the feature.

In universal design, the goal in this phase is to get your technique or strategy built directly into their existing product, or a prototype of their product. Ideally, the company will fund this development, but if that is not possible you may be able to use grant funding. Success criteria are:

- Proving commercial practicality,
- Establishing that the technique or strategy is achievable, and
- Setting a model and benchmark for other companies.

Your best chance of attracting a partner company and

achieving ultimate adoption by this company is for them to see it as a good fit with their strategic plan and priorities, their culture and values. Therefore it is important to find out what these are and approach them from that point of view. It is not wise to approach a company by starting out with your own priorities and views about what they should do!

It is also a mistake to think of, much less talk about, the technology to be transferred as *your* technology or development. The technology transfer process is essentially one of asking someone else to take on your "child" and raise it. For this to be successful, it has to stop being *your* child and start being *their* child. We have watched many a technology transfer process fail when the inventor did not want to let go of their invention but expected a company to put up the funding and effort to develop the project while the inventor retained control.

> *Example:* We have been glad to see Microsoft's engineers take great pride in showing off the access features developed starting in 1995, many/most of them not realizing that the features had been licensed from the Trace Center. Our reaction is always to praise them for their work then and for all of the new features they have added since then. There is much to be gained when the "adoptive parent" (Microsoft, in this case) takes full ownership and pride in the transferred technology. It is this full ownership that motivates Microsoft to care for and advance not only those features but also all the other features they have added since (features that have gone way beyond the basic set of features in the original Access Pack). And we have not had to re-implement the features for any of the Windows operating systems since Windows 95, when they adopted the features as their own.

Throughout this process, *evangelize* and also—very important—***support those who evangelize inside the company.*** The insiders will become the most potent advocates if you support them well.

Finally, it is often tempting to feel that the company should pay you for this phase of the process. After all, they have much more money than you. If they want to pay, that's great. But that is unusual in our experience. So be prepared to pay all the costs for developing the idea to fit their product if they are not in a position to do this. And whatever you do, don't beat up on the person you are working with if the company is not being responsive. They are your people inside the company and you need to support their efforts to get your idea into the company's systems and priorities, and not criticize their failures.

PHASE 4: Support and Nurture the Concept and Implementation – continue through maturation and broader adoption

It is important to continue to provide support so that the idea makes it through its infancy in industry, and as it matures and spreads from the initial adopter to other companies. We have learned that adoption of a universal design feature by one company is not sufficient and can indeed be fleeting.

Start with the initial adopter. Support that company in their implementation, praise the company, and evangelize it with all of the other companies in that industry. Make sure that consumer advocacy organizations are aware of what has been achieved and are publicly supportive. One instance of "no good deed goes unpunished" can cause a company to turn away from further progress. This goes for your ideas—and the ideas of others. Sharp criticism of initial efforts that are not perfect can drive companies and industries away from doing anything again.

Document the ideas and enhancements through application notes, guidelines, and/or working papers. Contribute to getting the concept accepted in product profiles created by major industry consortia in order to increase opportunities for take-up and interoperability with different implementations.

If companies in general do not adopt the idea, identify all of the reasons that they were unable (or unwilling) to adopt it. Go back to research mode to determine whether there is a better way of solving the original issues. Since this overall multi-phase process involves communication with consumers and industry throughout, using research to address any needs or barriers identified, we have usually been successful by the time we get to this point in the process.

PHASE 5: Follow Along – make sure that concepts stay up-to-date and are revised as necessary to meet new technologies and changes in the technical environment

Even after the concept is transferred to industry, the work is seldom finished. Unless the feature gives a competitive advantage and makes the company lots of money, it usually requires updates that companies will rarely provide. If the product line is switched to whole new technology bases, the features may have to be significantly revised to work. Without that continued investment of effort, they can, and often will disappear.

Conclusion

We close by emphasizing again that there is no one approach or model that works for all industries. In fact, a technique that can work for some products and some industries may be completely ineffectual in another. Even within the same industry, approaches vary widely. For example, we have had software and techniques adopted and distributed commercially by Apple, IBM, and Microsoft. In each case the culture of the company as well as the methods that proved effective in achieving adoption were very different—and changed over time—even within the same company or the same division.

Each group in each different area of research, and each effort with a different company, will require different techniques and strategies. And each research group or inventor will have different strengths and weaknesses that they can draw upon, or need to accommodate. It is hoped that this brief and its shared experiences can help to shed light on some of the factors that may need to be considered and that were important in our work and affected our ability to succeed.

Good luck!

PRODUCT UTILIZATION SUPPORT AND HELP (PUSH) AWARD

The Center on Knowledge Translation for Technology Transfer (KT4TT) **Product Utilization Support and Help (PUSH) Award** is a peer-to-peer dissemination activity based on the identification and distribution of 'best practice' approaches to development, transfer and/or production processes by researchers and technology grantees. The goal is to provide the broader research and NIDRR community with exemplars of research utilization that have been proven effective.

The PUSH program is modeled after some elements of SEDL's highly successful Research Utilization Support & Help (RUSH) program. RUSH supported NIDRR grantees in their efforts to get their NIDRR-funded research findings used in targeted, measurable ways. PUSH candidates are university researchers or NIDRR technology grantees identified by KT4TT staff as conducting meritorious activity in Technology Transfer (TT) or Knowledge Translation (KT) for TT. The KT4TT, in conjunction with the selected candidate, generates a brief evidence-based description of a carrier used to successfully overcome a barrier within the technology transfer process. The supporting evidence may include research and/or practice knowledge.

TRACE RESEARCH & DEVELOPMENT CENTER

The Trace Research & Development Center is a part of the College of Engineering, University of Wisconsin-Madison. Founded in 1971, Trace has been a pioneer in the field of technology and disability. As technology has become more pervasive in the workplace, education, entertainment, and daily living, Trace's research and development focuses on universal design of information and communication technologies, so that they are more accessible and usable by elders and people with disabilities. **Website: http://trace.wisc.edu/**

Key accomplishments include:

- Trace developed the first set of accessibility guidelines for Web content, as well as the Unified Web Access Guidelines, which became the basis for the World Wide Web Consortium's Web Content Accessibility Guidelines 1.0.
- The Trace Center's EZ Access® techniques have been implemented directly in public information systems and have influenced the development of more accessible ATMs, electronic voting systems, and phones.
- The Trace Center has been a significant contributor to the development of numerous industry and government standards and guidelines related to accessibility.

Trace's 10 Laws of Technology Transfer

In our experience with the transfer of ideas from a university-based research center to the marketplace, we have learned some important principles that can be of use to new inventors/developers. These laws can be bent in specific situations, but we have found that they can't be ignored.

1. **An idea or device is of little value to anyone (except its creator) if a manufacturer is not willing and able to make it.**
   - Do not proceed too far with development of a product until one or more manufacturer(s) are identified who are willing and able to produce it.
   - Find one (or more) manufacturer(s) early in the R&D process and work with them.
2. **Remember that people will care for their own child, and invest in their child's future, more than they will their neighbor's child. This holds true even if they have been given charge of the neighbor's child.**
   - Be willing to give up control of your product and its development to the manufacturer if you want them to nurture it. They need to feel it is their child now.
3. **People prefer to adopt young children (sometimes at birth—sometimes just out of diapers).**
   - Don't hang on to your idea too long. Transfer your idea as early as possible—as soon as they are willing to take over developing it. Let the manufacturer shape the product to fit their needs/product line.
4. **What is most important to transfer is the idea—the soul of the product—and not the actual "inventor rendition."**
   - Spend your time developing, testing, and researching the idea rather than doing production design (unless you have to in order for the manufacturer to take it on).
5. **An extension of an existing product or product line is sometimes easier to sell to a manufacturer.**
   - Be willing to see your idea incorporated as an extension of an existing product rather than insisting that it be a product itself.
6. **Listen to and believe manufacturers concerning their own capabilities and limitations; offer your ideas and opinions, but listen.**
   - Businesspeople have a better understanding of their own companies' affairs than university researchers. There are few academicians who could successfully run a business—even businesses to which they are very valuable consultants.
   - Your credibility increases as you demonstrate your willingness to listen and gain an understanding of the manufacturer's issues.
   - Listen and learn even if you disagree. You can't change their minds if you don't understand their point of view completely.
   - Understand that, in the end, manufacturers must and will act according to their best understanding and judgment—not yours.
7. **Work with the manufacturer to design a product that will fit into that company's product line and be manufacturable, supportable, and marketable.**
   - Remember that some new ideas may lead (or require) a manufacturer to totally re-scope, reorganize or redirect their product line or other basic business strategies. Thus they need time and warning to examine, plan and implement such drastic change. The key again is to get them involved early in the process.
8. **Keep the design as simple as possible.**
   - Remember that simple designs are easier to manufacture and support.
   - Features are nice, but too many can be confusing and scare people (including manufacturers) away.
   - Complex products result in longer user training periods and more questions and support from dealers and manufacturers and higher customer-support costs to the vendor.
   - Trained sales forces are very hard to maintain. Complex products aggravate the problem (and increase the cost or even jeopardize their acceptance in the market).
9. **Once burned; twice cautious.**
   - Don't oversell your idea or its market. You may convince a manufacturer to take on your idea, but you will have a very hard time in the future if the idea doesn't live up to your hype.
10. **Provide all possible (requested) assistance to the manufacturer's efforts in developing, marketing and supporting the product—even if you feel their requests are unfair.**

CENTER ON KT4TT

The 5-year **Center on Knowledge Translation for Technology Transfer (KT4TT)** project (**http://kt4tt.buffalo.edu**) was awarded to the University at Buffalo (SUNY), Center for Assistive Technology (CAT) on October 1, 2008. SEDL and Western New York Independent Living, Inc., are partners in the project. SEDL's role focuses on utilization-oriented methods of dissemination, training, and technical assistance to effectively communicate with knowledge producers and knowledge users. This *FOCUS Technical Brief* is a product of the SEDL-KT4TT partnership.

The project focuses on three key outcomes:

- *Improved understanding* of the barriers preventing successful knowledge translation for technology transfer and ways to overcome these barriers
- *Advanced knowledge* of best models, methods, and measures of knowledge translation and technology transfer for achieving outcomes
- *Increased utilization* of these validated best practices by NIDRR's technology-oriented grantees

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