A FUNNY THING HAPPENED ON THE WAY TO THE FORTUNE
OR
LESSONS LEARNED DURING 25 YEARS OF TRYING TO TRANSFER A BEHAVIORAL TECHNOLOGY

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Origins of the Technology

In the fall of 1974, The American Cancer Society (ACS) and the National Cancer Institute (NCI) jointly sponsored an invitational conference entitled “Breast Cancer: The Behavioral Dimension.” Attending were a variety of behavioral scientists, including psychologists, sociologists, epidemiologists, and anthropologists. Their charge was to consider how the behavioral sciences could contribute to the problem of early detection of breast cancer. Specifically, it had been known since 1960 that mammography could document the presence of very small lesions which, if treated early, could lead to decreases in mortality (Shapiro, Strax, & Venet, 1971). Unfortunately, women were bringing in lumps averaging the size of ping pong balls, by which time the likelihood was great that metastasis had already occurred. What could the behavioral sciences do to cause women to detect breast tumors at an earlier stage?

After three days of deliberation, the group concluded that the biggest contribution the behavioral sciences could make would be to help women learn to cope with the anxiety that accompanies any consideration of breast cancer. My colleague Mark Goldstein arose and stated that as the husband of a wife and the father of three daughters, he could assure the assembly that there was more the behavioral sciences could do than just teach people to cope with anxiety. He sat down to a smattering of applause and a few boos and the conference disbanded.

Mark returned to Gainesville at the exact moment a party was being held in honor of the Department of Psychology’s colloquium speaker, A. Charles Catania. A lively discussion of the challenge that emerged from the meeting led to the observation that here was simply a problem of stimulus control, and that pigeons could probably be taught to detect small breast cancers. Others opined that here was a simple problem in signal detection and that the vast literature of

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psychophysics surely held the keys to improved early detection. By the end of the evening we decided to accept the challenge, form a team, and bring our collective talents to bear on the problem of early detection of breast cancer. We agreed that the focus should be on training lay women, rather than professionals, so that any benefits of our research could reach the widest possible population. Thus was born the Breast Self-examination Project of the University of Florida.

**The Basic Research**

Our first task, as any properly trained graduate student can attest, was to search the literature. We were amazed to discover that there was none. To be sure, there was a lush literature from social psychology on the role of attitudes in the performance of breast self-examination, but we could find nothing on the technique itself. To summarize our findings:

- It appeared that women were being taught to imitate the behavior of physicians conducting clinical breast examinations.
- There was no analysis, experimental or otherwise, of the components of the skill.
- Instruction was delivered through the eyes and the ears via pamphlets, films, and audio tapes.
- The tactile component had been completely ignored.
- If compliance was poor (and it was), the women were blamed, much as children are blamed when instruction fails in schools. Women were said to be fearful, victims of cultural prohibitions against breast touching, possessed of negative attitudes, or overcome by anxiety, as suggested by the ACS/NCI conference. Apparently, it escaped everyone’s attention that no one had bothered to teach women what to search for and what it would feel like if the search was successful.

**Research Strategy**

We decided to conduct a full-scale experimental analysis of the behavior known as manual examination of the breast. We would then synthesize the results of that analysis into a definable and measurable skill. Finally, we would attempt to develop an instructional technology to teach that skill to the largest possible number of women. Specifically, we sought to achieve the following objectives:

- Construct a high-fidelity model of the human female breast.
- Use the model to answer some basic psychophysical questions about the sensory system involved, specifically: how small a lump can fingers actually detect? How small a size difference can fingers detect? Does lump
hardness matter? What behavioral topographies are required to reach these psychophysical limits? What does proper palpation look like? How much pressure should be used? What search pattern should be used?

- Synthesize these behaviors into a functional, fluent skill.
- Design and validate a technology for teaching that skill.

**Research Accomplishments**

*Construction of the Model*

We were fortunate to have at the University of Florida a distinguished group of materials scientists in the College of Engineering. The biopolymers group taught us about silicone. They taught us that it comes in large containers marked Part A (gel) and Part B (curing agent). They taught us that if you carefully mix exact proportions of the gel and the curing agent, then heat the mixture for a specified amount of time at a controlled temperature, the result will be a semi-solid mass shaped like the mold in which it was baked (see Figure 1). The firmness of this material is a joint function of the mixture proportions and the heating parameters. After a great deal of trial and error, we found a formula that very closely matched the firmness of real breast tissue (Madden et. al., 1978).

![Constructing breast model](image-url)

*Figure 1. Constructing a breast model*
Figure 2 shows this match as measured with a Rex Gauge 00 durometer. We applied for and received a patent on the model in 1977. Although we could not fully anticipate the value of this event at the time, we were aware of its potential importance. As Bunch and Hellmans (1993) state, “A patent is a capitalist device that like many great ideas works on a paradoxical principle: The way to spread the benefits of an invention is to restrict the number of people who can exploit it” (p. 250). The value of the patent would be realized sooner than we thought.

Figure 2. Durometer reading on a model and real breast tissue

**Psychophysical Studies**

With the aid of a small seed grant from the University, we began a series of studies to determine the psychophysical limits of the sensory system we were attempting to understand. We found, for example, that the size threshold for detecting ball bearings placed under a hemisphere of our gel was slightly less than 0.2 mm (Adams et. al., 1976). This was exciting because in those days clinically minimal breast cancer was defined as being between 1.0 and 2.0 cm, and we had

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1 Rex Gauge Co., Glenview, IL.
shown that fingers might be capable of lowering this value by a whole order of magnitude. In 1976 we applied for, and received, a sizeable grant from the NCI. This allowed us to further perfect the model and complete the psychophysical studies. With the aid of durometer measures of breast tumors and normal surrounding tissue, we were able to match the firmness of real tumors (not well simulated by ball bearings) and to create a good simulation of the normal nodularity or lumpiness that is typical of most breasts, especially in the upper outer quadrant. We found that both depth of lump placement and lump hardness played a role in detectability. Using lifelike simulations of both lumps and surrounding tissue, we found that it was possible to detect lumps as small as 0.3 cm and as soft as a ripe strawberry (20 d; Bloom et. al., 1982). We then turned to the challenge of learning how to teach individuals to approach these limits, both on models and on real tissue.

**Training Studies**

In a detailed examination of various techniques, we found that palpating with the pads of the distal phalanxes of the middle three fingers—not the tips—was most effective. We also found that applying three discrete pressures at each point of examination was preferable to either one or two. We conducted a series of studies using pretest–posttest designs across groups in an attempt to isolate those elements of the process that would be essential in an effective training procedure. In one study we found that with respect to learning to find lumps in a model, reading a pamphlet and doing nothing were almost exactly equivalent. No wonder women had been unable to assist in early detection of breast cancer. We also found that practicing on a model alone induced a high rate of false positive detections, but that this problem was largely eliminated by concurrent practice on the woman’s own breast.

An important study in this series validated a novel search pattern (vertical strips). People in the United States were being taught to search the breast using a series of concentric circles or an Archimedes spiral, while those in Canada and Europe searched in a wedge, or hands of the clock, pattern. Our observation that people mow lawns, plant and harvest crops, and search the ground for missing objects using parallel rows led us to apply this tactic to breast examination. We found that this method produced much more thorough coverage than either of the extant methods and would therefore increase the likelihood of a detection should a lesion actually exist, especially in the upper, outer quadrant (Saunders, Pilgrim, & Pennypacker, 1986). By applying this search pattern to the entire area (bounded by the collarbone, a plumb line from the axillary pit to the fifth rib or bra line, the fifth rib, and the midline), where breast cancers can actually occur, one is assured that the educated fingers will be likely to encounter a lesion should one exist. Thus, the final training procedure consisted of two components: 1) teaching the fingers what to feel for using the models, and 2) transferring this skill to the entire volume of the actual breast tissue. Both components are necessary; neither is sufficient alone.
When the training research was completed, we integrated the components into a teachable sequence and christened it...
was now, as CEO, responsible for regular filings with the Securities and Exchange Commission (SEC) and for managing that vague enterprise known as investor relations. I quickly learned that so-called inside information is far more valuable than any earnings the company might post and that there were those who would go to any lengths to obtain it. For example, I would get calls that began “Is it true that you are going to...?” Either a yes or no answer would constitute inside information to which the rest of the investing public would not have access. My stock reply was to the effect that I could not comment on that, but I would be happy to send the caller a copy of our latest SEC filing together with copies of any recent announcements the company had issued.

Marketing Strategy

Our original objective was to disseminate a technology for saving lives through early detection of breast cancer. MammaCare was that technology, but how would we disseminate it? The answer lay in the curious mixture of material science and behavioral process that we had created. We knew that only through careful and deliberate training would individuals acquire the skill to detect breast cancer at the earliest palpable stage. We also knew that there was not a huge demand for training, particularly on the part of the general public. Very few people are eager to learn how to find breast cancer, especially in their own breasts.

There was, however, a substantial demand for the models. The solution to our marketing problem was immediately obvious: make access to the models contingent on undergoing the training. Only by learning MammaCare could one enjoy use of a MammaCare model. This was a nice solution for the shareholders because it ensured a flow of revenue from model (and training) sales, but it lacked the financial potential of unrestricted sale of the models. Since ours was the first behavioral technology being marketed under the auspices of a publicly owned company, and since we wanted to make the behavioral technology the centerpiece of our enterprise, we had to spend a good deal of time educating not only the public, but the financial community with respect to the nature of our undertaking. Fortunately, we were able to secure the services of an excellent public relations firm so, as we shall see, this task was not as formidable as it might first seem.

MammaCare of New York

One of the benefits of a public stock offering is that it attracts investors who are influential in other areas of life. Among our original investors was William G. Cahan, M.D., Chief of Thoracic Surgery at Memorial Sloan Kettering Hospital in New York City, his wife, Grace Mirabella, editor of Vogue, and John Kluge, head of Metromedia, Inc. These individuals persuaded us to open a MammaCare Center in downtown Manhattan at the site of the original Strang Clinic on Park Avenue and 34th Street. They used their contacts to help us accomplish this, and on August 9, 1983 we opened MammaCare of New York for business amid a barrage of publicity, including appearances on Today with Jane Pauley and CBS Morning
News with Diane Sawyer. A sampling of the print media is shown in Figures 3, 4, and 5.

Figure 3. Excerpt from *Self* Magazine
Figure 4. Excerpt from *Glamour* Magazine

**YOUR BREASTS**

**GOOD NEWS FOR THEIR GOOD HEALTH**

Good news: A better way to examine your own breasts

Breast self-examination—you know you should do it monthly, but if you’re like most women, you skip it or do it halfheartedly because you don’t feel competent. Working to counter this attitude are MammoCare Centers—so far, in New York, Gainesville, San Diego, San Francisco, with several more slated to open soon—in which trained instructors teach women breast examination. The MammoCare method is different from conventional methods. First, you examine your breasts not in circular patterns but in a series of vertical strips, covering an area that extends from clavicles to bra line, then from armpit to breastbone—the grid, left, shows the pattern. Second, you use three pressures—light, medium, heavy—on each dime-sized spot you examine. Third, fingers are taught what to feel for, using a series of breast models (see upper right). Instruction takes an hour and the $6.50 fee includes a take-home breast model and a follow-up skill check.

According to Henry F. Penney, M.D., president and underdeveloped of the MammoCare program, women trained with MammoCare know detected lumps as small as .3 cm. The average-size lump detected is 2.5 cm (about the size of a cherry). For women who occasionally practice breast exams (that’s the majority of women), “If you can teach fingers to read braille dots, you ought to be able to teach them how to find tiny lumps in the breast,” he concludes. For more information, write MammoCare Inc., 66 East 13th Street, New York, New York 10003.
Figure 5. Excerpt from Redbook Magazine

The plan was to sell MammaCare training to the public. At that time, our training was delivered on an individual basis by highly trained nurses using the procedures we had developed in the laboratory. We quickly discovered that the cost of doing this was prohibitive. We had priced the training to be the equivalent of a moderately expensive blouse, but with the cost of the staff, the building, advertising, and the fact that the training took at least an hour per customer, we quickly began to hemorrhage money. In an effort to reduce some of these costs, we developed a video version of that portion of the training involving the models, hoping thereby to increase traffic with no increase in staff costs. This was partially successful and evolved into the MammaCare Professional Learning System (Figure 6).
A little over nine months after it opened, MammaCare of New York closed its doors. Although it lost money, it accomplished three things for us:

1. It was the booster that put us in orbit. Located in a national media center, it attracted attention and gave us a presence, however small, in the consumer products and health care industries.

2. As mentioned, it forced us to abandon the laboratory model of training. This was the first instance in which a product was developed to help meet financial rather than scientific exigencies. Others would follow.

3. It allowed MammaCare to be discovered by Suzanne Fletcher, M.D. (Figure 7).
Dr. Fletcher was the Co-chief of Internal Medicine at the Medical School of the University of North Carolina, Chapel Hill. She came to MammaCare of New York as a customer, otherwise unannounced. So impressed was she with the training that she later called me and arranged for us to meet in Chapel Hill.

**Broadening Our Focus**

I spent two days in Chapel Hill. We discussed Dr. Fletcher’s commitment to women’s breast health and what she perceived to be the woeful state of clinical breast examination as practiced by American physicians. She outlined a research program the she envisioned and enlisted our collaboration, to which I eagerly agreed. The reader will recall that we were committed to improving breast self-examination, so this constituted a departure from our stated mission; however, we had earlier conducted a study demonstrating that practice by untrained examiners at finding ball bearings under our models essentially doubled their detection skill of real lumps in a carefully chosen group of women with known benign lesions (Hall et. al., 1980). We therefore believed that our participation in Dr. Fletcher’s program would ultimately benefit women to the extent that it would lead to improvement in another mode of breast cancer detection.

Dr. Fletcher and I spent the rest of my visit designing a series of models which would become the standard instrument for measuring proficiency in manual
breast examination. Christened the UNC Series, the set consisted of six models containing an aggregate of 18 lumps and all six with a medium level of background nodularity. The lump’s properties filled a $3 \times 3 \times 2$ matrix: three sizes (3, 5, and 10 mm), three degrees of hardness (20, 40 and 60 d), and two depths (superficial and deep). All of these lump characteristics had been observed in pathology samples taken during surgical mastectomies.

In 1985 Dr. Fletcher and two colleagues published a groundbreaking article in the *Journal of the American Medical Association* (Fletcher, O’Malley, & Bunce, 1985; see Figure 8) in which they showed that practicing physicians could only find 44% of the lumps in our models. This launched a major research program by Fletcher and her associates and ignited widespread interest in improving clinical breast examination practices. It also stimulated us to enter the clinical training market with a product of our own (Figure 9).

![Figure 8. Abstract of Fletcher et. al., 1985](image)
Dr. Fletcher’s article caught the attention of a German physician named Gerhart Hilt (see Figure 10). He contacted me in 1987 and ordered MammaCare models and materials for the women in his clinic in Bayerwald. Dr. Hilt conducted a study and showed that MammaCare training enhanced compliance with frequent practice of self-examination and periodic mammography (Hilt, 1990). Dr. Hilt published a series of reports on this study in various German medical periodicals. The reports caught the eye of Dr. Dorothea Brethold, medical director of Profamilia, a German organization much like Planned Parenthood. Dr. Brethold asked Mr. Martin Kessel, their Director of Marketing, to explore the utility of MammaCare for their organization. In 1991, while en route to Greece for a vacation with my wife, I met with Mr. Kessel in the Frankfurt airport. Thus began discussions which eventually led to Mr. Kessel becoming our European distributor (see Figure 11). He had, by then, left Profamilia, but he retained a close tie to Dr. Brethold.
25 YEARS OF TRYING TO TRANSFER A BEHAVIORAL TECHNOLOGY

Figure 10. Dr. Dorothea Brethold and Dr. Gerhart Hilt, December 2007

Figure 11. Martin Kessel with Gerhart Hilt at the opening of the European MammaCare Center
In 1992 Mr. Kessel dispatched three highly qualified individuals, Dr. Brethold, Dr. Christine Solbach (a surgeon), and Thea Mertens (a nurse) to Gainesville to become trained as MammaCare Specialists. They returned to Germany and began teaching MammaCare to German women: Dr. Brethold in Munich, Dr. Solbach at Wolfgang Goethe University in Frankfurt, and Ms. Mertens in Hamburg. This activity led to the creation of a MammaCare Center at the University in 2002, enabling Mr. Kessel and his crew to offer the same level of MammaCare training in Germany that was available in the United States only in Gainesville. For the first time, a portion of the technology was successfully transferred to an independent entity without sacrificing the quality essential for its effectiveness. Incidentally, this center was created under the auspices of Prof. Manfred Kaufman, Head of the Department of Gynecology at Wolfgang Goethe University, who was formerly acquainted with MammaCare from his days at Memorial Sloane Kettering Hospital, when MammaCare of New York was still in existence. It is indeed a small world.

**Reaching More Women**

It might appear from the foregoing that we had abandoned our original objective of delivering MammaCare directly to women. In fact, we had earlier developed a home version known as the MammaCare Personal Learning System (Figure 12) which we attempted to sell on our newly created website www.mammacare.com. This met with only moderate success, but it gave us a product that Mr. Kessel could adapt for the German-speaking population of Europe. His marketing expertise, coupled with Germany’s lesser reliance on mammography for initial detection of breast cancer, made the Personal Learning System very successful in Germany, and Kessel Marketing remains our single largest customer.
Also stimulating sales of the Personal Learning System was the appearance in 1990 of another article by Suzanne Fletcher and her colleagues (Fletcher et. al., 1990). Entitled “How Best to Teach Women Breast Self-Examination” and published in *Annals of Internal Medicine*, this article states:

“Mammacare (sic) instruction resulted in more long-term improved lump detection use than did traditional instruction or physician encouragement. Breast self-examination instruction should emphasize lump detection skills.” (p. 772)

**The Johnson & Johnson Study**

In the late summer of 1994, representatives of a Johnson & Johnson (J&J) subsidiary visited us to discuss a collaborative marketing study of the Personal Learning System. They proposed to fund market research to determine the possibility of distributing the Personal Learning System through retail pharmacies. We agreed to sell them systems for this purpose provided we could have copies of all data, regardless of any subsequent business decisions. They agreed and began distributing the material shown in Figure 13 to women in the areas shown in Figure 14.
Introducing
MammaCare from Johnson & Johnson
a complete system for comprehensive breast self-examination

Every year, 180,000 women develop breast cancer. 46,000 per year will die. Many of the women who die of breast cancer could have survived, had they found the cancer earlier. Early detection of tumors is your best defense against breast cancer.

MammaCare from Johnson & Johnson will give you the training and confidence you need to find lumps in your breast as small as a 1/4 inch. (The average size of lumps found by women practicing conventional breast examination occasionally is 1 inch).

The MammaCare system will teach you: (1) what normal breast tissue feels like, (2) what lumps in your breast tissue can feel like, (3) where and how to feel for lumps in all layers of your breast tissue, and (4) how to perform a thorough visual and physical examination.

MammaCare comes with a scientifically designed breast model to help you learn the difference between what normal "lumpy" tissue feels like, and what a tumor feels like. A 45-minute videotape will guide you through a systematic breast exam on the MammaCare model so you become comfortable with how to perform a breast exam. The video also explains the characteristics of lumps found in the breasts, and then walks you through an examination of your own breast tissue. An informative 34-page booklet written by a leading physician provides an in-depth discussion of breast tissue, cancer, and treatments.

The MammaCare system is:
Effective: MammaCare has been shown to help women detect lumps as small as one-tenth the size usually discovered by accident.
Easy to Use: The patented breast model helps you master the skills you need to perform a thorough, systematic exam.
Used by Doctors: Doctors have used MammaCare for years to teach breast self-examination to their patients.

Breast cancer will strike one out of every nine women in America. But early detection plays a critical role in the treated early. more than nine out of ten patients were alive and well five years later. Regular self-exams are vital to early detection. MammaCare will give you the confidence and skills you need to perform a thorough, systematic breast exam every month.

MammaCare Breast Examination System .......... $29.99
Includes breast model, instructional video, and educational booklet.

Figure 13. Johnson & Johnson flyer.
They placed products with 167 women who agreed to use the system and thereafter be interviewed. Data obtained from 103 respondents indicated a very favorable reaction to the concept and a high probability of purchase, especially if recommended by a physician. The respondents particularly liked the breast model and felt that MammaCare would instill confidence in the user’s ability to conduct a thorough breast examination.
These data led to a proposal to test market MammaCare on a national scale as outlined in Figure 15.

The proposed retail price would be $29.95. For the test marketing phase, J&J would pay us our usual wholesale price for the systems, but if the test was successful, that price would drop to approximately $9.00. With the cost of silicone at nearly $6.00 per model and the costs of the video, booklet, packaging, and manufacturing well over the remaining $3.00, we projected that we would lose more than $1.00 per kit.

We thanked J&J for their interest and assured them that if a drastic reduction in the price of medical-grade silicone ever occurred, we would be in touch.
A New Strategy

Meanwhile, Fletcher and her colleagues conducted a series of studies of clinical breast examination (CBE) using MammaCare models and procedures. These culminated in a study entitled “Does This Patient Have Breast Cancer? The Screening Clinical Breast Examination: Should It Be Done? How?” (Barton, Harris, & Fletcher, 1999). In it, they state:

“Our recommendation incorporates practices from the MammaCare method because its components have been validated in independent investigations of CBE technique.” (p. 1276)

This study gave MammaCare added credibility in the academic medical community. It occurred to us that we should attempt to solidify a permanent presence in that community and attempt to expand our influence in the consumer market from there. Accordingly, we designed a program to establish MammaCare Training Centers at established medical personnel training sites including medical schools, nursing colleges, and residency training programs. The first of these was established in the University of Florida College of Nursing (Figure 16) and serves as our laboratory for analyzing the details of working relationships with such entities. The second center was established at Wolfgang Goethe University in Frankfurt (Figure 17), the third center was established at Oregon Health Sciences University in Portland Oregon, and a fourth center was established at Alexian Brothers Hospital in Deer Park, Illinois.

Figure 16. MammaCare team at the University of Florida College of Nursing
Figure 17. The author at the opening of the MammaCare European Training Center

The model employed in all of these facilities involved joint certification by Mammatech and the host institution of graduates based on demonstrated proficiency in manual breast examination. Proficiency is defined in terms of sensitivity and specificity in examination of a series of breast models as well as thoroughness of coverage and use of correct technique in the examination of an actual breast. Thoroughness is assessed by a trained observer using a lamp that projects a grid on the examinee’s torso, allowing an area examined calculation to be obtained rapidly (Figure 18).
There are several important aspects of this process. First is the measurement procedure. By using a standard series of models and reasonably precise quantification of the results of the examination in terms readily recognized by members of the medical community (sensitivity and specificity), we bring—for the first time—to clinical breast examination a procedure that elevates it from ancient art to reproducible technology. Second, certification may have economic value to the holders. Insurance companies are beginning to recognize the value of proficient clinical breast examination in avoiding malpractice actions resulting from missed breast cancers, and they may be willing to reduce malpractice premiums for those practitioners able to document their skill. We are also hoping to see more widespread reimbursement for MammaCare Clinical Breast Examination in the near future.
**Recent Developments**

*Adaptive MammaCare*

With the aid of Small Business Innovative Research (SBIR) funding from the NCI, we have adapted MammaCare to the needs of visually impaired, hard of hearing, or physically disabled women (Figure 19).

![Image of Adaptive MammaCare Products](image)

**Figure 19. Adaptive MammaCare Products**

Although these products have added little to the bottom line, they have greatly enhanced our credibility with the health care establishment and various funding agencies. In particular, Mammatech received the 2002 Tibbetts Award for innovative research from the U.S. Small Business Administration (Figures 20 and 21).
Figure 20. The Tibbetts Award
Mammatech was also a 2003 winner in the National Health Information Awards program, which recognizes the nation’s best health information programs and materials.

**Palpation Assessment Device (PAD)**

For several years we have been working on a computer-assisted training device that would reduce the manpower requirements of training for proficient breast examination. The problem has been obtaining a pressure-sensing device that would allow a learner to interact with a computer to acquire the skills involved in detecting lumps in a MammaCare model. Three technologies have been explored and one has been found that both meets the sensitivity requirements and can be mated to an interactive computer program. Specifically, the computer shapes the palpation technique, differential pressure application, and search pattern using contact with the lumps as reinforcement. In a recent demonstration experiment, ten out of ten naive participants acquired sufficient skill to place them above the physicians’ mean reported by Fletcher, O’Malley, and Bunce in 1985.

With additional practice and some further training, these individuals should reach the performance levels required for certification. This will enable institutions hosting MammaCare Training Centers to engage in CBE training that is both effective and cost efficient. The result should be many smaller breast cancers
detected during routine physical examination rather than as a result of expensive radiographic screening.

**Things We Have Learned**

**Lesson 1. Protect Intellectual Property**

The lynchpin of technology transfer is the opportunity to convert an intangible asset into capital. Even the greatest of ideas will languish on library shelves if there is no way to make money by disseminating some tangible consequence of the idea on a large scale. Securing a patent, or at least protecting a process by a trademark or service mark, allows the holder to assure potential investors that rights to the eventual product are theirs and theirs alone. This makes tolerable the risks investors are being asked to bear.

Today, most instances of technology transfer involve licensing rights to an invention or discovery to a third party. In our case, we conferred the rights to ourselves, at least initially, and only later allowed others to participate through the mechanisms of licensing the MammaCare Centers. Of particular importance to us was the ability we enjoyed to insist upon measurable standards of performance on the part of anyone using our trademarks, logos, etc. Since ours is among the first behavioral technologies to be disseminated in this fashion, we sought to avoid what we perceived to be the usual fate befalling effective behavioral technologies that are released without protection: they rapidly dilute under pressure from financial or cultural exigencies and are soon indistinguishable from the conditions they were designed to replace. The reader can surely recall many behavioral innovations in education that have suffered this fate.

**Lesson 2. Beware the Transition from Principal Investigator to Chief Executive Officer**

In the years immediately prior to the formation of The Mammatech Corporation I was Principal Investigator on the grant from the NCI. As such, my role, besides leading the research effort, was to ensure that all the money got spent each year and that each budget contained the maximum amount originally proposed. In other words, I became adept at top-line thinking. That history established certain habits of management and cost control that had to be quickly unlearned when I became CEO of Mammatech.

Once the funds from the public offering were deposited in our accounts, it became my responsibility to protect those funds diligently as there would not be an annual renewal to replenish the treasury. In other words, I had to shift my orientation to bottom-line thinking in a hurry. This was not always easy as many people attempted to extract funds from us on the promise of greater rewards in the future. This was a new experience; as a University researcher I did not have to cope with daily attempts by strangers to expropriate direct costs for other projects. I was fortunate to have on our management team individuals with business
experience and good detectors of the less than scrupulous players in the business world. Without their counsel I probably would not be writing this article.

Lesson 3. PR ≠ Marketing ≠ Advertising ≠ Sales

Our successful public offering and the opening of MammaCare of New York generated massive amounts of PR, as we previously noted. This was a truly exhilarating experience; appearances on national television and getting one’s name in print in national media are not common events in the life of an academic behavior analyst. We quickly discovered, however, that these exposures do not translate into sales. We had expected to be inundated with inquiries regarding MammaCare franchises, but few were forthcoming. Television and radio appearances generated numerous phone calls to our 800 number, but very few of these converted to sales, even after we introduced the MammaCare Personal Learning System.

In hindsight, we would have been better advised to allocate some early resources into marketing, advertising, and sales. These are separate activities, and each contributes to the eventual success of a product or service in the marketplace. The success of Mr. Kessel in Europe has confirmed the merit of this strategy, and we are indebted to him for showing us the way.

Lesson 4. Requirements for Technology Transfer

We learned from our colleagues in the more mature disciplines that successful technology transfer depends on three factors (Pennypacker & Hench, 1997):

1. **Quantification.** There must be agreement on standard units and measurement procedures. Behavior analysis has an advantage here because of its measurement traditions rooted in natural scientific practices. The failure of the social sciences to produce technologies that transfer effectively can be traced to the lack of standard and absolute units of measurement in their basic approach to their subject matter.

2. **Repetition.** One must be able to produce the desired item, process, or outcome a large number of times to desired specifications.

3. **Verification.** In reducing the technology to practice, one must specify and protect the processes and procedures that can be transferred. In so doing, one must establish limits of tolerance. To the extent that we have successfully transferred MammaCare, we have relied on established measures of specificity and sensitivity of breast examination to ensure adherence to quality standards. Failure to do this would almost certainly have led to the kind of deterioration in performance that characterizes most attempts to export procedures from the laboratory to the outside world.

Lesson 5. Make Your Needs the Customer’s Needs

The old adage “The customer is always right” must be amended slightly when working with novel behavioral technologies such as MammaCare. Many of our
early customers resisted the standards of performance we imposed as a condition of their opportunity to use MammaCare. They argued that such standards were unheard of, not customary, or impossible to achieve. We learned to address this problem through education and found ways to make our standards the customer’s standards. Now, MammaCare Centers take pride in their measurable proficiency, and it is becoming a symbol of enhanced care.

**Lesson 6. Multidisciplinary and Global Thinking is Essential**

The original research that led to MammaCare was clearly multidisciplinary. The team consisted of material science engineers, physicians, and behavior analysts. Each of these disciplines was necessary to the success of the venture. Once the research was completed, however, the team disbanded and the transfer process was left to the behavior analysts. Soon after the company was formed and the public financing secured, we realized that we would have to find a way to maximize the frequency of opportunities for collaboration. It was clear that ours was a medically-related product, however vigorously we insisted on its behavioral pedigree. We would therefore be forced to look for collaborative arrangements with entities such as hospitals, clinics, and breast centers, and we initially designed a franchise program to make this possible. When this became too cumbersome to manage (legal requirements across states make franchising difficult for all but the largest concerns), we simplified the arrangement to licensing, which accomplished our ends just as well.

The opportunity presented by the collaboration with Dr. Fletcher was salutary, although it required us to abandon our strategy of going directly to consumers. This collaboration also required that we learn the terminology of epidemiology and adapt our measurement strategies to the realities of that world. The relationship has been enormously beneficial for us, although we could not have foreseen that in 1981.

Similarly, the introduction of Dr. Hilt, which led eventually to our expansion into Europe in association with Mr. Kessel, would not have occurred had we retained the characteristic xenophobia of many academic researchers. Lack of familiarity with the language, the culture, and even the currency was initially daunting, but we pressed ahead to great eventual advantage. We continue to seek and remain open to novel arrangements with other elements of the health care universe.

**Lesson 7. Saving Lives is Noble, but Saving and/or Making Money Drives the Contingencies of the Medical Marketplace**

One of the great satisfactions of MammaCare is that we can document that its use has prolonged many women’s lives. While many applaud this, it generates practically no business by itself. Without business, technology languishes and eventually disappears. Ways must therefore be found to turn these laudable outcomes into opportunities for enhanced revenue for those willing to participate in the process. One example is malpractice insurance premium reduction. Missed
breast cancers are among the most frequent and expensive causes of medical malpractice actions. Some insurers are beginning to consider making reductions in premiums contingent upon obtaining MammaCare Certification in CBE. This would, of course, constitute a major incentive for practitioners to obtain the training.

Another is third-party reimbursement. At present, CBE is not, by itself, a procedure for which providers can be reimbursed. We are seeking to change that in collaboration with one of our MammaCare Training Centers that is already training and certifying substantial numbers of clinicians. Creating a unique billing code for CBE will allow those providers to be reimbursed for this service, creating another incentive for individuals to obtain our training and certification.

The Future

The MammaCare story continues. We accepted the challenge issued by the 1974 ACS/NCI conference and brought the power of behavior analysis to bear on the problem of earlier detection of breast cancer. This has given us a unique opportunity to learn how to transfer a behavioral technology into the larger world without compromising its effectiveness. We have learned a few things that we hope will be helpful to others who will follow. They will teach us even more. Together, we will create the technologies that will eventually give our science its rightful place in the panoply of human endeavor.

References


