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Project Report

A Project Report prepared by:

Ariel Egri, Juris Doctor, MBA Candidate

Jesse Hill, BA Candidate, Industrial Design

James Hopkins, MBA Candidate

Xiaoyun Li, MBA Candidate

Jay Vaidya, MS Finance, MBA Candidate

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Executive Summary

In order to provide compassionate patient care and elevate patient experience, hospitals in the U.S. have been making unremitting efforts to ensure access to quality health services and expanding access for underserved populations within the country. However, with fundamentally different communication skills - namely written versus oral communication - and different levels of reading comprehension, medical professionals face a difficult time when it comes to treating a deaf patient. Thus this neglected segment of the population relies heavily on third party interpretation in their medical encounters. The foremost factors contributing to physician hesitancy to interact with deaf patients are as follows: difficulty of understanding each group, fear of assuming full responsibility of misinformation; lack of confidence in the efficiency of communication; and anxiety of misdiagnosis and mistreatment. These factors along with the inability to create emotional and social interactions between both groups, hinders the efforts of connecting with deaf patients without the presence of an interpreter. In addressing this particular issue, our team created a service that facilitates the interaction between deaf patients and medical professionals before an interpreter arrives, which enable hospitals to continuously provide quality, value driven health care to all they serve. Despite the possible associated risks and costs, the service generates benefits for deaf patients, medical professionals and hospital systems by facilitating interaction and increasing satisfaction and through time savings for all three groups.

Designing Interaction Service Experience

1. Problem/Hypothesis

Problem

The United States economy has seen a marked shift to a service-based economy. As services continue to grow in complexity and scope the precise, timely communication and interaction between individuals has become increasingly important in ensuring the success or failure of a given service. In this context, the opportunity to adapt services for the unique communication and interaction needs of the Deaf community has been overlooked by most service providers, offering an opportunity to improve the experiences of Deaf and hard of hearing individuals in the United States.

The fundamental tension faced when Deaf individuals communicate and interact with hearing individuals is the result of Deaf individuals' reliance on visual rather than oral communication. Consequently, many individuals from the Deaf community stray away from unfamiliar services or face impediments to using many services offered by predominately hearing individuals. The disconnect in this interaction leads to a separation of the Deaf community from the hearing community and hinders the ability of hearing individuals to create emotional and social connections with individuals from the Deaf community.

In particular, healthcare is a sector where the disconnect in the interaction between the hearing and Deaf community severely impairs the experience of the user. More specifically, for the deaf community, basic medical services rely too heavily on third party communication — such as interpreters and telecommunication interpretation services — and miss the opportunity to socially and emotionally connect with Deaf patients. Typical interactions between Deaf patients and medical professionals rely on interpreters, but offer no recourse when interpretation is not available, leaving the patient isolated with little or no attempt made to communicate in a way that is comfortable for the Deaf patient. This can leave the patient with an emotional disconnect that carries throughout the entire medical process.

Hypothesis

The deficiencies in the current process used to service Deaf patients provide an opportunity to generate a means of communication directly between medical staff and Deaf patients. By facilitating interaction through a delivery system easy to understand for both medical staff and Deaf patients we can allow both users and providers of the service to feel more comfortable working with one another, leading to a better service experience. Specifically, a graphical communication intermediary could accomplish this goal, enabling interaction even in the absence of an interpreter. In addition to providing an opportunity to interact, an intermediary would also reduce reliance on 3rd party communication, produce higher quality medical service for deaf patients and reduce total treatment time and time of the appointment process.

2. Product

Prototype Description

To facilitate an interaction between Deaf individuals and medical staff we have created a service that provides visual communication cards, (See Appendix) tailored to the processes of specific medical offices and specialties, which shape interactions between deaf individuals and medical professionals before an interpreter arrives. The cards generated by the service are 3 1/4 inches wide by 5 1/2 inches long and have images printed on one side of the card with brief descriptions on the back of the cards. The visual on each card has been created to allow both the medical staff and the patient to either pose or respond to a question related to the informational and interactional needs of both parties. The cards are broken into sections that represent the most important steps to the medical interaction and all of the cards are bound in a hardcover portfolio. The inside flaps of the hardcover portfolio also provide images, but these images are designated responses that allow the interaction to be dynamic and allow for users to respond to questions that are qualitative in nature. Specifically, the images on the hardcover portfolio flaps contain representations of time, the alphabet –for the communication of prescription names other important qualifiers – and graphic scales that use color and size to allow for the communication of the severity of a feeling or symptom. It is important that to note that this is still a prototype. The service that is being provided has the ability to customize a visual communication to the needs of the client. This provides the opportunity to change the size of the displays of the format, whether it remain an artifact or take form in a digital format such as an application.

The visual communication cards are intended to be used together, by both medical staff and patients. In using the cards together the patients and staff members will form a closer connection through direct communication and through a shared willingness to use the system. This type of interaction will produce more attentive staff members and more comfortable patients.

Introduction and Action Cards

The cards are divided into four sections: Introduction/Action Cards, Symptom Location cards, Symptom Qualifier cards and Diagnosis/Treatment cards. The graphics of the introduction cards provide an opportunity for the medical professional to explain the purpose and process of the cards to the patient and to allow the medical staff to begin interacting with the patient by working through simple, general questions related to the current well-being of the patient. It is important to note that the introductory cards present the Deaf individual with the option to defer the use of the cards and wait for an interpreter, or to proceed with the communication card method until the interpreter arrives. The action cards provide graphics that show the patient the preliminary medical tests that medical staff routinely perform, which include the following: checking vitals such as blood pressures, pulse, the patient's height and weight, using a stethoscope to listen to heart beats, asking a patient to breathe deeply, basic ear, nose and throat tests and reflex tests. These initiating cards also provide a graphic that asks patients if they take any medications; this graphic is used in conjunction with the alphabet on the hardcover to allow patients to first point to the type of medication being taken – i.e. a pill and its shape, liquid medication, inhalers, medication deployed through a syringe, etc. – and then use the alphabet to spell the name of the medication. These cards are extremely important in the scope of the process, as they not only provide important initial information for the medical staff, but the ease and simplicity of the graphic communication creates the initial connection between the medical professional and the Deaf individual. This connection is vital to the building of the relationship through the remainder of the process.

Symtpom Cards

The next section of graphics are the Symptom cards. The Symptom cards are divided into two types: location of symptoms and qualifying information. The location cards contain images of the human body on which the patient can indicate the general areas of discomfort. This allows for an interaction between the staff and the patient as the intention of the card is to be a way to begin a dialogue of exactly where the discomfort is and how severe. The severity of the discomfort can be ranked on the graphic scales provided on the hardcover flap that stays visible throughout the process. The desired outcome is that the medical staff member, having seen the patient's indication of the location of pain as shown in the card, would then use the cards to ask the patient to indicate the symptom location on their own body. The next section of symptom cards is classified as qualifying information. These cards provide answers to questions about the pain level, the type of pain as well as any additional symptoms such as nausea, rashes, swelling and discoloration. These cards also provide a way for the patient to communicate the duration of the symptoms felt through the use of the time graphics (shown by a calendar and a frequency graphic) located on the hardcover flap.

Diagnosis Cards

The final section of cards are the Diagnosis/Treatment cards. These cards will be disposable in nature and replaceable so medical staff can leave patients with the diagnosis rendered. In other words, the diagnosis cards will include a visual that allows medical staff to use pictorials to show patients the source of the ailment. Additionally, the diagnosis cards offer a structure for the medical staff to write brief notes that spell out the proper treatment and follow-up procedures. This is important because the cards provide the Deaf individual with the diagnosis information in a way that is easily understood and allows for a basic understanding of the cause of the symptoms. Also, by writing down the diagnosis, the doctor is enabling the patient to take home the diagnosis or take the card to subsequent visits such as referrals. The process of bringing past cards to referral appointments will more easily facilitate the beginning of an interaction between the patient and different medical personnel. This option allows for a decreased dependence on a single interpreter attending all of a patient's medical appointments, and allows each party in the process to reach a point of mutual understanding at a much quicker pace.

3. Process

The above described service was generated through a team-based new product development design process. Together, designers from the Weatherhead School of Management and the Cleveland Institute of Art focused efforts on understanding the physical, social, emotional and financial needs of the parties involved in a Deaf medical interaction. The result of this collaboration is the creation of a service that can be used to have an immediate impact on the experiences of Deaf patients and operations of medical facilities across the country. The distinct phases of this work are detailed below.

Selection Process

The first phase of our work was developing a strategy for selecting a designer from the Cleveland Institute of Art with whom to work. Our focus was on selecting a designer with a strong concept and who was willing to revisit the research behind the concept to assist in new product development. By meeting with prospective designers and evaluating their concepts based on social, economic and technological trends, we narrowed the focus of our product development to two areas of interest: educational support services and the elderly and disabled service industries within the United States. The final concept selection occurred on December 7, 2010. We

selected to focus our product development on the disabled service industries in the United States. This selection was followed by a formal proposal for product development collaboration that was extended to the designer from the Cleveland Institute of Art, Jesse Hill. Our goal as a product development team was to then assist the designer in advancing the concept through problem identification and development of solutions.

Research

The first stage for our product development team was to revisit the research that led our designer to develop his initial product concepts. This process involved extensive user interviews and development of detailed profiles of Deaf community members. These initial interviews focused on understanding the lives of Deaf professionals who, for the Deaf community, have adapted most seamlessly to working and using services from the hearing world. Our primary Deaf professional contact was Susan Bungard, a Deaf individual who is a manager at the Cleveland Hearing & Speech Center. Another important contact during our research process was Mike Ciero, a licensed American Sign Language interpreter for the deaf community. From our conversations with Mike and the research we had been conducting, we began to create an understanding of the deaf community and where there were opportunities to address. It became apparent that were several barriers that need to be addressed in an product designed for the Deaf community.

The first barrier was that the typical Deaf individual has only a 4th grade reading level. There are several reasons for this, the first being that there are 13 tenses in the English language, while there are only three in American Sign Language ("ASL").[1] English becomes primarily phonetic after the 4th grade which poses difficulties for a deaf individual as it becomes difficult to communicate with hearing individuals in more advanced written communication. An important observation that coincides with the previous finding is that that when our economy shifted from a manufacturing base to a service base, the deaf community lost a significant source of employment and began a process of separation from the hearing world. Specifically, many of the jobs that provided income for the deaf community evaporated as new service jobs could not be easily fulfilled by Deaf individuals who could not communicate as easily with hearing individuals in a dynamic service environment. This led to an 85-90% unemployment rate increase within the Deaf community.[2] The shift also left the Deaf community to function in a world now more heavily interaction based. In other words an important consideration in product development was the discovery of the difficulty that the Deaf community faces in brief social interactions with hearing individuals as an important issue to address in our product development process.

 The next phase of our product development was to explore the tension faced by the Deaf community when interacting with the hearing community. When analyzing the realm of brief social interactions in a service setting, it becomes apparent that much of our interactions with service providers relied heavily on our ability to accurately and efficiently express ourselves. One of the largest challenges for the development of our concept was to understand the needs of an individual and how to express those without being able to verbally interact. From the research, we found that the most intuitive form of communication between Deaf individuals and hearing individuals visual representation, whether in written form or pictorial form. One brief social exchange scenario explored to further understand the potential for visual communication was that of a Deaf individual in a store who wanted to find an item, and how that individual would go about interaction with hearing employees at the store. We also explored interactions that occurred in a retail setting and in settings where the accuracy of information is vital to the success of the process; such is the

case with medical services. Through this research, the conclusion was made that the need for timely, accurate information in a medical setting, coupled with the high cost of interpretation services, provided an opportunity to bring value to medical staff and Deaf patients through enabling communication and interaction directly between the two parties.

Identifying Opportunity Gap

Once the interaction within a medical setting was chosen, further research was required to understand the process, interaction, and emotions involved. Research was conducted in two primary areas: emergency and non-emergency settings. We determined that emergency situations are too vital, complicated and intricate to develop a prototype system of interaction. The information that must be conveyed in an emergency situation has major implications if information is not conveyed correctly. This, coupled with the unpredictability of both the event and those involved, makes an emergency situation difficult to control and dramatically complicates the interactions between Deaf patients and medical staff. Once this distinction was made, further product development work was required to both understand the non-emergency medical process as well as the interactions of a Deaf individual in such a process. We developed an understanding of the flow of a medical appointment, specifically a general practitioner. We conducted interviews with three Deaf individuals, three licensed ASL interpreters, four medical professionals and the Deaf Access coordinator at St. Vincent Charity Hospital, which narrowed the scope of the project to two areas of the process. Specifically, our field interviews, process analyses and simulation work pointed to two frictions in a non-emergency setting that had potential to increase Deaf patients' experience in a medical service.

The first area of possible impact is creating an appointment. The Deaf individuals that we interviewed shared that when they needed to schedule a doctor's appointment, they were offered little help in preparing for scheduling the appointment and then preparing to arrive at the appointment with the frustrations of organizing an appointment in conjunction with an interpreter. In one instance, an interviewee recounted an experience where he had to go over to his neighbor's residence and communicate through the neighbor to the receptionist at the doctor's offices. In addition, any subsequent phone calls would then go through the neighbor's phone. It also became apparent that the paperwork that all patients are required to fill out at their appointments would be challenging for a Deaf individual to complete – based on the previously discussed 4th grade reading level. Knowing that the average reading level of a Deaf individual is the fourth grade, it is difficult for many Deaf individuals to understand the language of the medical forms and thus they may not provide the appropriate information. We explored the possibility of developing a service that makes the appointment process easier for the Deaf individual as well as possibly providing information forms customized to a 4th grade reading level, either prior to or at the appointment. In a similar vein, an additional concept we explored was the creation of a visual checklist that would function as a guide to helping a Deaf individual with all the pre-appointment tasks such as arranging transportation, locating the facility and appropriate office and with the paperwork when they arrived and could be used as a means for communication and interaction. However, because of HIPPA laws and regulation, as well as speaking with our contacts, it was determined that the appointment process had too many restriction for us to have an immediate impact on the experience of the Deaf patients.

The problems faced by the Deaf patients in a medical setting are compounded by the current shortage of medically certified ASL Interpreter's. There are currently 13,000 professional Interpreters servicing the deaf community,[3] but of these 13,000 interpreters, only 13% work within the Healthcare field,[4] leaving just under 1700

Interpreters servicing nearly 5,800 hospitals in the United States.[5] This figure only includes medical centers and office practices within these facilities but does not include private practices operating outside of a medical center.   This shortage forces Deaf patients to wait for same day care and at times forces them to plan ahead when dealing with a medical issue.

This is the point that were turned our focus to developing a service that develops visual communication to help aid in the interaction, communication and emotional connection during the examination phase of a medical appointment. Pulling from our own experiences as well as those of our contacts, we began developing the questions we believed necessary to ask to develop a connection initially in the absence of an interpreter.

4. Next Steps

Moving forward will involve several significant steps. The first step is to form an organization and protect the intellectual property. The next major action is to begin user testing of the product in an uncontrolled diagnostic setting. One of the group's contacts has offered the use of an observation room with a one way mirror to test our product. We will wait until we have a full-color mock-up of the prototype which should occur within the next few weeks to a month. With this research, we will be able to further refine the product and actually observe its full use.

One major consideration for the product is that the market size is limited but it is important to provide emotional connections and independence in a medical setting. However, because of the limited potential market, it is important to consider the broader impact of the product. There is the potential that this product can be adapted for multiple medical settings, such as cardiology, orthopedics, pediatrics, as examples. This is the essence of the service that has been created to develop the visual communication cards for numerous outputs. When given the opportunity, we will research the process of a specific medical interaction, develop an understanding of what is lacking, and develop an action plan to address it. This ability expands the potential user base slightly, but does not necessarily make the service financially viable.

By developing a product that creates a universal graphic representation to aid in communication in a medical setting while using few written words, the service provides numerous opportunities for expansion. The simplicity of the images makes it adaptable for use with non-English speaking US residents, allowing for the ability to expand the product line to include communication services for multiple languages used in the United States. This increases the potential users from an estimated 6-7 million residents to 24 million residents but could be as high as 30 million residents based on an increasing population trend amongst Non-English speaking citizens.[6] This opens the possibilities of the service up to a much larger number of users and coupled with the ability to adapt to numerous specialties in medicine make the prospects of the service much more financially viable.

Additional steps for development include further product costing in order to develop a cost model that accurately depicts the cost to produce, distribute and train users to use the product. An additional refinement to the visual communication cards is the development of a way of displaying and communicating pain. The emotions and feelings surrounding pain are very difficult to convey through a visual communication and are important to communicate properly. Because of this complexity, the

group chose to leave it out of the present product in order to not under represent its importance. However, the group would like to revisit the area and begin to investigate a proper way to represent and convey the degree as well as the type of pain.

5. Business Case

The Service offers a competitive advantage over existing services and products, as it is the only service to facilitate interaction between deaf individual and medical professional. Detailed below are the costs, benefits, and risks of the Service.

Costs

The main costs to the venture to note are labor and productions costs. Medical professionals will have to be hired in an advisory role for each specialty developed for the Service. For example, a medical consultant will likely have to be hired in order to ensure that the most important parts of the interaction are covered by the Service in a general practitioner setting, as well as other specialties such as oncology or radiology. Medical consultants will range from $5000 to $10,000 for initial consultations and can rise depending on the complexity of the work.[7] This includes medical professional consulting as well as HIPPA compliance.

Experts in deaf communication such as ASL interpreters will have to be hired to ensure that deaf patients will be able to understand and interact effectively with the medical professional. The top 10% average annual salary of an interpreter is $70,000. Therefore, one month of interpreter services and consulting can be up to $9,000 a month.[8]

A graphic designer will likely have to be employed, at least initially, and perhaps fulltime to design the Service. The cost of a graphic designer may be up to $10,000/month. [9]

As the Service is further developed, the need to hire other professionals where needed may arise. For example, medical professionals or interpreters will need to be trained on how to use the Service properly to ensure an effective interaction between patient and medical professional. Therefore, trainers may need to be employed. Also, a lawyer will either have to be employed or retained as the venture starts up, incorporates, and signs agreements with suppliers or customers. Legal matters involve the articles of incorporation, shareholders agreements, and agreements between suppliers or customers and the venture, as well as compliance and tax matters. While the legal costs will depend greatly on facts that are currently unknown, legal costs may run $500 per hour depending on the nature of the work and the skill of the lawyer.

Other costs will include the cost of producing the visual cards. The printing costs will initially cost between $30-46 per booklet. This involves the cost of pre-production, covers, the step cards and binding.[10]

Costs for the customer include proper training in using the Service. We recognize that with a new service, proper training is required, especially where it facilitates a new interaction. If not trained properly, there could be a misinterpretation of the cards by either the patient or medical professional. If misinterpreted, the misinformation leads to a misdiagnosis or increased frustration of the patient or medical professional. The misinterpretation can actually lead to the interaction going slower. Additionally, either the patient or medical professional may refuse to use the Service. The patient, being accustomed to using an interpreter, may refuse to use the

Service either out of fear of a new service, worry of a miscommunication, or comfort in using an interpreter. A medical professional may feel inadequately trained in interacting with a deaf patient and may choose to wait for an interpreter instead. This highlights the need for proper training.

Depending on volume, the final cost to the customer is estimated to be $100 per book, which includes the costs of customization and training.

Overall Benefits

The largest benefit the Service generates for all users is that it saves time for all three groups. The patient does not have to wait as long to see the medical professional, nor does she have to take as much time planning the visit to see the medical professional. The medical professional can use their time more efficiently and the organization can alleviate a bottleneck (the time necessary to properly attend to a deaf patient).The cost of the Service is a benefit to the customer. One hour of interpretation services is $70 per hour.[13] If using the Service saves the customer 1-2 hours of interpretation services, the Service has paid for itself.

Benefits to Deaf Patients

If a deaf patient can now interact directly with a medical professional, an emotional and social connection can now be fostered between the two in a way that is not currently possible. The ability to interact with someone may also directly increase the comfort level of the patient, leading to fuller disclosure as well as making the patient more comfortable in the medical setting. Finally, increased direct interaction between the patient and medical professional will lead to less reliance on third party communication.

Benefits to Medical Professionals

Our Service provides a structure for communication which ultimately will lead to more efficient communication. A primary job function of the medical professional is to seek accurate information.[11] As such, the Service can facilitate a more efficient means of communication as the medical professional can gather information more quickly and efficiently while waiting for an interpreter or simply by interacting directly with the patient. This direct patient access is also important for the medical professional as it allows for a better understanding of patient needs. If the medical professional is interacting with the patient directly, they may pick up on body language or emotion that may not be conveyed or missed by the medical professional if they are also interacting with the interpreter. Medical professionals may also appreciate a stronger emotional or social connection with the deaf patient and not have to rely on a third party for information.

Benefits to Medical Organization

By improving the time it takes to help a deaf patient, the medical organization will help alleviate a bottleneck in its organization. Furthermore, this will help improve the patient experience and improve the overall brand of the organization. Our Service will also save the organization money as it replaces a cumbersome and expensive service in video IP interpretation services, thereby freeing up organizational and insurance funds for other, more efficient purposes. Finally, the Service will help make the organization more compliant with the Americans with Disabilities Act (ADA). While the ADA does not require the Service in medical organizations, it does require that medical organizations such as hospitals "must provide effective means of communication for patients… who are deaf or hard of hearing".[12] As such, the Service will help medical organizations be more accessible to deaf patients.

Risks

With every new product comes risk. We have identified four categories of risk: technical, market, financial, and managerial. While as a whole, the benefit and upside of the Service outweigh the potential risks, it is important to identify and understand the risk involved.

Technical Risk	Technical risk is the risk that either something goes wrong during development or some technical issue arises after development. These risks affect the venture as well as the customer (medical professional or organization). If successful, the largest risk is that medical professionals or organizations may start to rely more on the Service rather than using the Service properly in conjunction with an interpreter. If medical professionals and organizations over-rely on the Service and use interpreters less, information may not be conveyed properly and the interaction will be incomplete. Medical professionals and organizations need to be aware and understand the important role an interpreter plays in proper interaction between Deaf individuals and medical professionals.
Market Risk	The Service's main competition will be video IP interpretation services such as Sorenson Communications.[14] Such services rely on videophones so that an interpreter, patient and medical professional can communicate via the internet in real time. Services like Sorenson are established in the marketplace. As such, these services can use their market position to either develop a similar service or use their existing sales and marketing network to try and compete with the Service.
	The main benefit of such a service such as Sorenson is near instant interpretation services without the need to wait for an interpreter to physically be at the appointment. However, the main drawback is the cost involved in implementing the system (typically, the cost is per minute) and the cumbersome nature of the interaction. Because it is over a videophone, the interaction will not be as smooth as an in-person interaction. The patient and medical professional, in the same room together, will have to use the services of an individual who is not in the same room and may not pick up on body language or subtle emotional clues that someone in the room may gather.
	Another issue is the potential market size for the Service. At the moment, the deaf community is relatively small compared to other markets. Medical organizations and professionals may not wish to invest more time and resources in a service that addresses the needs of a relatively small market. While the Service is potentially scalable to other markets and languages, more development and research will need to be done to address a larger segment and market.
Financial Risk	Depending on the structure of the venture (for-profit vs. non-profit) the first financial risk is finding financial backers, either investors or donors. The second risk is the relatively small market size (see above). The initial investment required to fully develop the Service, customize the Service to the needs of each medical organization, as well as costs of producing the Service (see above) are at risk if initial investment is too low. Legal risk is another risk that related to financial risk. If, for example, there is a miscommunication using the Service, a lawsuit may result from that miscommunication. The venture will have to acquire insurance to protect the venture from lawsuits and the venture will have to employ legal assistance in starting the venture (incorporation costs) as well as counsel the venture as it moves beyond the startup phase. These risks exist if the venture is for-profit or non-profit.
Managerial Risks	Finding effective managers is a key to the success of the venture. Successful managers will not only have to understand the business and customers, but also the users. As such, managers will have to be effectively trained to not only use the Service, but also trained to understand the needs of the medical organizations, professionals, and patients being served by the Service. Furthermore, the managers will have to be aware and understand the risks associated with the Service, such as those highlighted above, as well as new and unforeseen risks. Managers will also have to

adapt to a changing landscape in the healthcare market, and be able to respond to new laws, market changes, and users.

6. Conclusion

The service we have developed is a stepping stone for the larger-scale integration of language independent communication and interaction services that offer amazing potential for adoption in the United States and internationally. As medical intervention in the form of cochlear implants reaches closer to a point where hearing abilities can be largely restored, our product development team is looking to adapt the service for a broader audience of individuals who face communicative barriers on a daily basis. By offering service providers the opportunity to engage individuals with fundamentally different communication abilities –i.e. different language and reading/writing capabilities, – we offer the ability to increase potential customer bases and move everyday interactions beyond the reliance on third-party communication.

Endnotes

1.   Interview with Mike Ciero, 2/6/11.

2.   Id.

3.   "RID - Member Center." RID - Registry of Interpreters for the Deaf. 2011. Web. 7 Apr. 2011. <http://rid.org/member_center/overview/index.cfm>.

4.   "Interpreters and Translators." U.S. Bureau of Labor Statistics. 21 July 2010. Web. 7 Apr. 2011. <http://www.bls.gov/oco/ocos175.htm>.

5.   "AHA : Resource Center : Fast Facts on US Hospitals." American Hospital Association. 6 Dec. 2010. Web. 7 Apr. 2011. <http://www.aha.org/aha/resource-center/Statistics-and-Studies/fast-facts.html>.

6.   U.S. Census Bureau. (2000). Language Use and English-Speaking Ability: 2000.

7.   Estimate based on discussion with Terry Bauer, CEO of HealthCare Management Consultants (www.healthcare-consulting.com/hcmc.html).

8.   Source: http://www.bls.gov/oco/ocos175.htm. Assuming $70k average salary, daily wage is 70,000/260 work days = $270/day. Hourly wage is 270/8 hours = $33.75. $270 * 30 days/month = $8,100/month. Adding 15% markup for miscellaneous costs: $8,100 * 1.15 = $9,315/month.

9.   Source: http://www.bls.gov/oco/ocos090.htm Assuming $75,000 average yearly salary (for top 10% of graphic designers), daily wage is 75,000/260 days = $288 day plus additional 15% markup for miscellaneous costs 288*1.15 = $331/day * 30 days = $9,936/month.

10.   Costs from Case Western Reserve University Printing Services: Preproduction - $15; Covers - $2; Step Cards (based on 23 impressions) - $12.65; Binding - $5; Scoring - $5; Folding - $3. Total initial cost for one print = $45.65. However, it should be noted that the $15 preproduction costs is a onetime fee.

11.   Institute of Medicine (1996). Primary Care: America's Health in a New Era. National Academies Press. p. 32 (available at http://books.nap.edu/openbook.php?record_id=5152&page=32 as of 4/11/2011).

12.   U.S. Department of Justice Civil Rights Division, Disability Rights Section, ADA Business Brief: Communicating with People who are Deaf or Hard of Hearing in Hospital Settings (Oct. 2003 http://www.ada.gov/hospcombr.htm last updated August 11, 2005. Retrieved April 11, 2011).

13.   Interview with Mike Ciero, 2/6/11.

14.   http://www.sorenson.com/

APPENDIX

Graphics Used in Prototype of Visual Interactive System

On the following pages are the prototype cards that we designed and printed. The color code is as follows:

Light Blue - Action Cards

Green - Procedure

Orange - Symptoms

Dark Blue - Diagnosis Cards