

Design directs Engineering

Grand Challenge Scholars Program Portfolio

Provide access to clean water

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My Reflections -

Being a GCSP scholar entails being a global participant in advances, challenges, and new opportunities. As a learner at Olin College, a citizen of India who sees the challenges of the

developing world, and an engineering student who wants to address developing world issues with technology, I hope to be a grand challenges scholar throughout my life. The projects and experience I will describe in this portfolio provide a good foundation to explore the grand challenges in depth in the future.

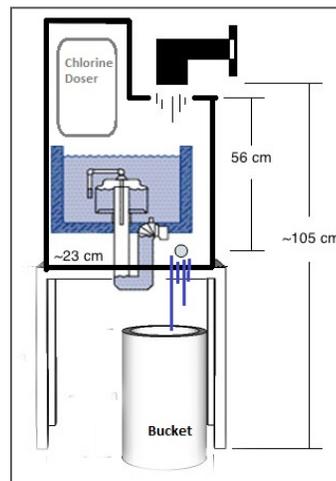
I tailored my college education to the areas of engineering, psychology, and design. I've explored these fields through the study of electrical and computer engineering, with a focus in software and user-experience. My exposure to the relationship between engineering, design and psychology included the *Myndr* project, a smartphone application for the elderly that have mild memory loss. It brought together research on the elderly and their interactions with technology, the psychological study of dementia and Alzheimer's, and iPhone app development frameworks. Another project that allowed me to focus on a Grand Challenge, while integrate engineering and user experience design, was the *Zimba* project in Calcutta, India. *Zimba* is a water chlorinator that eliminates bacteria from tap water, making drinkable water for the poor. Despite being an Indian who grew up in India, I have never explored the social welfare and entrepreneurship space at home. Working with *Zimba* gave me that exposure, and allowed me to experience the struggles of a small-time entrepreneur, the challenges of manufacturing at scale, and the coordination required to interface with NGOs and external communities to deploy units.

The experiences with *Myndr* and *Zimba* have proven that working with the elderly in healthcare and drinking water for the poor are grand challenges. Not only are they part of the Grand Challenges program, but they are complex contextually too. The fields offer a tremendous amount of growth for technology, but they require careful design and engineering to fit into peoples' lives. For instance, inexperience with digital technology means the elderly will use it differently from today's youth. For example, I see first graders today navigating the iPad effortlessly, while an eighty-year old woman was fearful that she won't understand it when I showed her the device. Designing for the poor requires the integration of affordability and future sustainability for measurable success. These requirements make these spaces the grand challenges as the NAE sees them today. I am confident that with my project exposure in these areas of healthcare and clean water set me up to tackle the Grand Challenges in greater depth in the future. Since I plan to move back to India in the future, and I am motivated to further explore technology for the elderly and drinking water for the poor at home. These areas provide tremendous opportunity to make a difference in the lives of my fellow citizens.

Grand Challenge Project –

Born and brought up in India, I have witnessed the struggles for clean water among my people. Along with dollar-a-day salaries, the lack of access to education leads to sickness and mortality rates that are unseen in many other parts of the world. My interest in addressing these issues has driven me to work on the grand challenge of providing access to safe drinking water. Fortunately, my time at Olin gave me the opportunity to work on the *Zimba*, a device for removing bacteria from drinking water.

During a class at Olin called Affordable Design and Entrepreneurship (ADE), I spend the semester working with business and engineering students on the *Zimba*. The *Zimba* project is an initiative by Suprio Das in conjunction with MIT, in Kolkata, India and Dhaka, Bangladesh, and rural villages around both cities. The *Zimba* dispenses chlorine into water to provide cheap, drinkable, and clean water to the poor who cannot afford to dedicate extra resources to boil their water daily. In the Fall 2012 semester, the ADE team started on this project with the hopes to help Suprio with some of the technical aspects of the *Zimba*. The project expanded to include a social development dimension, as we found that NGOs, who were deploying the pilot projects, wanted specific technical requirements met. These requirements included: making the product more aesthetically pleasing, creating a supply chain around the delivery and refill of chlorine, and reducing the height of the *Zimba*.



Left: *Zimba* used by a community in Dhaka, Bangladesh. Right: The *Zimba* is diagrammed with dimensions superimposed. Currently, the *Zimba* is 90cm tall; it needs to be reduced to 56 cm.

This led to the team to focus on two main aspects of the *Zimba* project. On the social side, the

team weighed the social impact against the business cost of the *Zimba* to meet the requirements of the NGOs. On the technical side, we worked on an important technical requirement -- shortening the height of the siphon so that it is small enough to fit under hand pumps and taps (shown in the diagram below).

In December 2012, the team visited Suprio in Calcutta and learned about the backstory to the *Zimba*, how the device is manufactured, and the next steps and challenges for the *Zimba* product. We found there to be many moving parts to this project. To ensure that we were capturing the full picture of the *Zimba* and its impact on the Calcutta community, we also met users of the trial *Zimbas* in the Howrah Dump. At this landfill, we interviewed slum-dwellers who are using the *Zimba* and spoke to them about their perceptions of the product, what they like and dislike, and how they think it can influence their lives. The stories we captured of these people helped us fill in the framework of *Zimba*.

This interactive experience was powerful for me. It is a side of India that I've always seen and heard, but never spoken back to. Listening to these families, I realized how much willpower and optimism they had for each new day. They wanted the best for their kids; they scavenged the dumping ground to collect scraps and sell them for a living; they were eager to try the *Zimba* because it could make the lives of their children healthier. Some families had women do the money management in the household and others saw their younger generations prosper and move out of the slums. Being there and listening to fellow Indians talk about their lives really showed me how polarizing the rich-poor gap in our tech-consumed country can be. And more importantly, it showed me that these communities are also trying for success and trying to lead better lives for the future.

Today, *Zimba* is under development by Suprio Das. The initial trials in the Howrah Dump helped our team figure out whether *Zimba* is really meeting the needs of the people and how they'd like the project to change to be more meaningful to their lives.

On a personal level, I learned how to work with a social system and a physical product that would need to be mass-produced for poor people and be maintained, restocked, and embraced by the community for their future wellbeing. When I move back to India and want to work with a non-profit organization that focuses on engineering for humanity, these are valuable social and technical lessons. I believe there is a very delicate balance that exists between providing something to a community that they value and use and providing a device that is fancy and draws their attention, but doesn't meet their needs. This integration of social, economic, and engineering tasks surrounding the *Zimba* makes it the big project of my GCSP career.

International Awareness –

International awareness has been a part of my entire life. I grew up between India and the USA. I was born and brought up in India till age 5. Then, I moved to the USA till 8th grade, before finishing secondary school in India. Then I came to Olin for college. These alternating experiences in a developing and developed world have certainly given me a broad perspective in how I view my life and the challenges and successes that come with it.

Having lived in India during my adolescence, I was exposed to the rich-poor divide in the country early on. When my classmates at college ask me what the life in India is like, I make sure to mention both. There are the rich people - the ones with the businesses, the cricket teams, the tea plantations. However, they live side-by-side the slum dwellers who make it through by begging on the streets and tapping on car windows and without really having a plan or structure in life.

That's the India I used to describe to my college friends. When I visited India this past semester on behalf of Olin for the *Zimba* project, some of that perception changed. I was in a realm of India that I haven't been to before -- social development. Sure, I've been around poverty and the working class, but never had I spent a significant amount of time with an entrepreneur working for social welfare.

Speaking and experiencing with the inventor, Suprio Das, about *Zimba* and seeing it deployed in the field, gave me a source of inspiration for the future of my country. Initiatives like *Zimba* are small steps of progress, but they are representative of a growing sector of entrepreneurship in India. There are people like Suprio who just want to do good for the backward societies of India. Nothing in return, just greater happiness and health for the users of *Zimba*. Spending time with a philanthropist like him helped me understand that there are people in the world who are slowly bridging that rich-poor divide.



Left: A team member of *Zimba* interacts with women near the *Zimba*.
Right: A team member does ideation with inventor, Suprio Das.

For me, it exemplified the beauty in observing the diversity in life. No better than a country like India where the struggles and the success of an entrepreneur follow one another in constant succession. The challenge of being an entrepreneur in India isn't just confined to the next website. It means providing for the masses – the people who don't know what iPhones are and have never seen Facebook. They are the ones who bear the manual labor hours to feed their families and send their children to school. Listening to Suprio's story brought me down to earth and away from the famed, idealized start-up experience. Sure, we have Silicon Valley and tech startups in Boston, but where is the innovation really needed? It is in this world of scarcity and poverty. This is the space where entrepreneurship can manifest in creative ways and provide solutions that help the poor lead less difficult lives.

Service Learning

Another area of opportunity I see for technology and design to help humanity is in ageing. I think that as the Baby Boomer generation enters old age, there is a huge opportunity to create products and services that make their lives easier. More specifically, many are exposed to the technology explosion of the past ten years and use smartphones today. This opens us the opportunity to design for use cases as they age.

One particular opportunity is the onset of memory loss, due to ailments such as Alzheimer's disease. Memory loss can lead to a strain in personal relationships. Over time, conversations get reduced to the same repetitive questions and answers. The person finds it difficult to function independently and requires the help of a spouse, or a child or a professional caretaker.

Our independent research team is building an app called *Myndr*. It is a smartphone app to help a person with memory loss regain some agency in their life. The app provides three main functions: Do, Ask, and Call. 'Do' provides step-by-step instructions to the person on how to

perform an activity; 'Ask' provides general Q&A for the person; 'Call' provides a list of close people that the person can call. All of this information is customized by the care taker. *Myndr* ideally integrates into the person's life and provide some of the answers to their repetitive tasks and questions. The aim is to remove this repetitive noise in a caretaker-person's relationship. By letting the app take care of repetitive interactions, the caretaker can focus on more meaningful conversations.

Myndr is the brainchild of visiting professor to Olin College, Aaron Boxer. In conjunction with some professors, 3 of us students are working with Aaron to improve *Myndr*. We want to understand how it can fit into an elderly person's life, and provide that lost content they are constantly searching for.

That said, the initial questions of usability for *Myndr* have been challenging to answer. The fundamental question being: how comfortable and intuitive are smartphones for the elderly? This was when I got involved with the Needham community's elderly to do some usability testing. Those of us on this project went to a senior center in the town, to a retirement home called North Hill, and met other elderly to hear their experiences with smartphones and how they use them if handed one. And the results were very interesting. Most had never used a smartphone before and didn't know what its use over a normal telephone was. Those that did have an iPhone/iPad use a few pre-loaded apps and didn't download much more than the standard. Most users that never handled a smartphone before had trouble with the touch gesture and either pressed too hard, too long, or used their fingernails.

These community outreach visits gave me a way to meet some very interesting people. I met war veterans and retired engineers and stay-at-home moms (now grandmothers). I heard their life stories and how technology has affected who they are today and how their communication with the younger generations of their family has changed over time. I heard what they would or wouldn't use a smartphone for -- whether it would even be a helpful addition to their lives.



Above: One of our professors presents Myndr to a preliminary tester.

The exposure to the Needham community was a great part of this experience. Sometimes it is easy to forget that smartphones and digital devices can impact people in different ways or have no impact or influence in their lives at all. As someone who is always surrounded by and developing technology, it was a nice break to hear the other side of things.

The lesson I've learned from this project is that technology doesn't have a universal connotation. While it is easy for people my age to get excited by what it does and can do, there are segments of the human population that is unfamiliar with touchscreens, iPhones, and many other 'common' technologies.. The new knowledge I gained from this experience is that design impacts its target users and also their periphery. The elderly encounter technology in startlingly different ways. It is up to us designers today to keep these views in check throughout the design process.

Interdisciplinary Experience

The *Myndr* research project is the intersection of many different disciplines. *Myndr* is a smartphone app for the elderly with mild memory loss or Alzheimer's. Developing this technology requires a knowledge of app development, behavioral psychology and dementia and Alzheimer's, and a background in design thinking and practice. This mesh of engineering, psychology, and design makes the *Myndr* project very interdisciplinary.

Because I don't have a close friend or family member with memory loss, I immersed myself in the world of dementia and Alzheimer's. The goal here was to read about the lives of people interacting with a patient. How did they interact? What are common symptoms and effects of memory loss on a human being? What were the challenges for the surrounding family that is taking care of this person?

After building this background knowledge, I put myself into a setting that our users often experience. At a retirement center, I spoke with elderly at all stages of memory loss and age. There was one woman who had some memory loss and kept repeating the same stories over again. A man in the dining room was walking back to his room, but couldn't remember where it was. He had to ask people several times on the way back. And others barely had any memory loss and were pretty sharp with their recollections of life stories.

Speaking to all of these people and exposing them to the *Myndr* app on the iPhone produced some very interesting results. Explaining the app took widely ranging amounts of time and effort, from several minutes to several hours. This fusion of technology and design testing helped the team frame *Myndr* from different perspectives, and it provided the basis for our app revisions for the future.

The interdisciplinary project requires an interdisciplinary team. The team consists of three students -- a electrical and computer engineer, a design engineer, and a mechanical engineer. We are also working with the primary inventor and developer of *Myndr*, who is a retired engineer,

and two professors - one teaches computer science and the other teaches anthropology. Having people with diverse educations encourages us to think of every design decision and problem statement from a variety of angles.

Entrepreneurial Experience

My entrepreneurial experience has come from witnessing constraints. My dad is an entrepreneur in India now and so is the developer of *Myndr* and the inventor of *Zimba*. Each of these people has told me about the challenges of an entrepreneur to build their vision into a tangible product with very limited time, money, and human capital. Being an entrepreneur means being a hacker. Being someone that is resourceful and can meet their goals with what they can grab in their reach. And most of the time, it is a path of high resistance.

My experiences with Suprio Das, the inventor of the *Zimba*, have been about company mission and future planning to scale up production. The former was in order to learn about the core drivers behind the *Zimba* project -- what made him do it, why does he want to do it, what is the end that he visions. Suprio undertook the *Zimba* project after witnessing signs of bacterial pollution in Calcutta's water system. He understands the health effects on families and children who are drinking poisonous water. His dream is to increase the chances of survival for these poorer communities in India.

With regards to scaling up for impact purposes, it needs to be mass manufactured. Currently, Suprio is working with Olin, MIT, and two full-time employees to produce and test run the *Zimba*. In time, if the product looks promising, there may be huge contracts to mass produce. What is the plan that he has for this scale-up in production? How and where and with how many people? These conversations have taught me that entrepreneurship isn't just about having an idea and making a prototype. It is about figuring out ways to get that prototype to the world and make it accessible for people to experience.

Conversations with Aaron on the high-tech *Myndr* project center around usability. When the entrepreneur releases his product in the app store, how will it reach the elderly that are the audience? How will scaling of the app be reached and who will maintain its performance? Interestingly, these questions also dealt with scalability, but not from a product commercialization point of view. Conveniently, the Apple appstore and today's tech blogs do a

great job of that. The important thing here is the upkeep of the app from a performance and feature standpoint. Which features are users using and what are they asking for? How can their needs be met? What personalities and skill sets are required to build the right team for the project?

Speaking with these entrepreneurs as I work alongside them has taught me a lot about having a clear vision and executing with a plan. I learned that designing the right framework to support both a product and a service is needed for a great user experience. The most important is seeing through the ultimate vision and ensuring that the intermediate steps move the entrepreneur closer to the finish line.