FINAL REPORT
REWIRE

Brenden Faherty and Shirli Samara
MIS 573
Professor Kahai

INTRODUCTION

Strokes are a major problem in the United States, killing about 140,000 Americans every year. Each year over 795,000 people in the United States have a stroke with about 610,000 of these being the first time and it is estimated that the United States spends an average of $34 billion each year on treating these Stroke patients. Strokes are the leading cause of serious long-term disability since they reduce mobility in more than half of stroke survivors aged 65 and over. While the rate of strokes has not been decreasing over the past several decades, medical technologies have advanced enough to decrease the death rate of stroke patients. While the increased rate of survival is a positive, these patients require extensive care, putting more strain on the medical system and increasing costs. Therapy and rehabilitation are timely and expensive with most survivors being dependent on others for an extended duration.

The goal of our product is to provide a product and service to individuals who have suffered from severe strokes in an effort to help them regain mobility in their limbs and increase independence through the power of convenient technology. It will effectively improve the quality of life for our customers, and will hopefully become the leading provider of therapeutic video games to severe stroke patients on a global scale.

The onset of a stroke is caused by the sudden death of brain cells due to the lack of oxygen to a specific area of the brain from blockages or ruptures in brain arteries. Lack of hand-eye coordination and motor functions are a common symptom of stroke victims and can be split into two distinct subsets: right hemiplegic or left hemiplegic. Right hemiplegic patients have trouble moving the left side of their body as well as speech aphasia while left hemiplegic victims

have trouble moving the right side of their body and are constantly anxious with a limited field of vision.

Over the past few semesters, Techworks goal has been to create a video game device designed to redevelop stroke-affected motor functions through the repetitive use of impaired limbs, ultimately making patients more independent. This constant physical therapy encourages neuroplasticity, allowing for the brain to remodel itself after injury through the creation of new nerve cell connections. While the game itself is in the final stages of completion, we have completed a business model to be laid out in order to properly test and market the device. Current issues with rehabilitation techniques stem from insurances only covering physical therapy up to certain milestones or a given amount of time. These current treatments are known to be boring for patients who then stop practicing developmental measures, preventing them from improving. Family members can only go so far working with stroke patients since they may have full-time jobs or other commitments. This gaming device will provide a novel outlet for independent rehabilitation while keeping stroke patients engaged.

While consulting with medical experts, physical therapists and CS students, we were able to complete the game and begin the initial phase of testing. The second phase will be to implement testing on a wider scale through the Shirley Ryan Ability Center. Once the product has gone through the necessary testing strategies and partnerships are established, the ReWire game will be released at an affordable price to physical therapists and Stroke patients alike ultimately helping to increase the efficiency of rehabilitation, thus reducing strain on the medical system.

PROCEDURE FOLLOWED

- Bridged the communication gap between Physical Therapists and Computer Science students in creating a game that provides a novel outlet for independent rehabilitation while keeping stroke patients engaged.

- Managed the Computer Science division in order to effectively add to the code to make it a presentable design that achieved the goals in the rehabilitation of stroke patients.

- Attempted to alpha test the product to satisfy the requirements of physical therapists and current stroke patients in the Binghamton area.

- Attempted to involve the Chicago Team (IT department, neurologist, rehabilitation center) to help beta test the product with a larger group of patients (hopefully from the Shirley Ryan Ability Lab)

- Created a marketing plan by researching other physical therapy devices that provided a similar service to our customers. We were able to analyze how these products were distributed into the Market and what made them successful or unsuccessful in this implementation. Using this information, we were also able to determine an average price point for our product as well as our advice on how techworks should negotiate and receive royalties after the product is delivered to the Shirley Ryan Ability Lab

WHAT WAS ACHIEVED

While we were unable to get in contact with the Shirley Ryan Ability Center due to what we expect to be from the Covid-19 outbreak, our team was able to successfully complete the ReWire device as well as deliver a business plan and marketing strategy to TechWorks. While the original game was initially titled Pick and Place, we were able to completely redesign the products interface as well as rebrand the name to ReWire in order to better attract our target audience.

The Game: What was completed?

Why did we perform the name rebranding to ReWire? It ties the concept of the game to the intended effect on stroke patients brains. You are rewiring your brain like you are rewiring a circuit. This allows the name to better encompass what the device is doing as well as being shorter and catchier to attract players. Pick and Place is long and doesn't explain the reason for using a circuit as the base of the game.

Continuing off that change, we also redefined the games menu. With the help of our Computer Science division, we were able to change the interphase of the game menu to make it easier for players to access and understand. It is now more user friendly and displays the proper ReWire brand name.

Further bug fixes were conducted to make sure that the player couldn't lose the cursor off the screen. Originally, if players accidentally moved a piece outside of the edge of the screen monitor, that piece would be lost for good and there was no way to retrieve or find it. This could

cause problems since pieces could be dragged off the screen and lost as well, preventing the player from completing that level.

A pause feature was also added so that players could take a break and continue at a later date. The pause feature also allowed players to view the menu where they could go back and restart a level or choose a different level. Without the pause feature, the game would continue to run and make noise with the only way to go back to the main menu being to shut off the game and reboot it.

The last thing that was adjusted was the clicker specificity. Now players can adjust how fast the piece is dragged across the screen. Although this may still depend on the type of mouse a person has, the specificity is adjustable. Also pieces will no longer be dragged into place when nearing the correct slot.

The Game: What wasn't completed?

Due to the Covid-19 outbreak, the CS team was unable to add a timer to the game. The timer was supposed to be a metric for which the player could look at in order to get a sense of how they were doing and attempt to beat their previous time to improve. The timer would record how long it took for a player to complete a particular level by moving all of the pieces into the correct slots. This time would then be recorded in the main menu or a new subpage titled "personal best". This would allow players to compare their current times with times in the past and allow them to visually see their improvement. The faster they got, the more mobility they had and the further they were on the path to becoming more independent.

Another functionality that was not included was a level select. Players have to start from the first level of the game every time they open it and must progress through the easier levels first before they move on to the more challenging sections. If a player wants to skip to the more challenging levels they are currently unable to do that directly from the main menu. The CS team was continuing to look into a way to implement this addition but were unable to complete this task for the final iteration of the game.

Communication: What did we complete?

Our team was able to get directly in contact with Laurie Chen at Northwestern University through email. She is the assistant to Dr. Allan Burke, an associate of Susan Sherwood from Techworks. From Ms. Chen, we were able to set up a date and time for a conference call with Dr. Burke to discuss what was currently needed to help patients with strokes. We were able to take notes and get his advice on how to better design our game to accomplish our goals. Dr. Burke's experience as a Neurosurgeon was pivotal in helping us understand how our device would be implemented and how to help physical therapists use our device on patients.

Communication: What was not completed?

We were unable to get in contact with the Shirley Ryan Ability Center to discuss upscale testing of our product. Dr. Burke was supposed to get back to us with the contact information of his connections at the Shirley Ryan Ability Center, however, due to his schedule being overwhelmed by the Covid-19 outbreak he was unable to relay this information to us. Another problem is that many employees working at the Shirley Ryan Ability Lab may be working part

time and are unsure of when their facilities will be back to normal. They wouldn't be able to give us a timeline of when they could test our product due to the uncertainty surrounding the virus outbreak.

FOLLOW-UP REQUIRED

SUMMER 2020

June*	Re-establish communication with Ms. Chen and Dr. Burke to secure our connections at Shirley Ryan Ability Lab
July*	Focus on the metrics of the game (the addition of the timer, add a personal best tab, etc.)
August*	Further focus on new metrics that the physical therapists might suggest as well as change the music in the background of the game

FALL 2020

September*	- Alpha test with Binghamton patients - Convert game into an app for the app store
October*	(Assuming contact with SRAL has been established) Beta test product large scale
November*	Work on adjusting the code to fix any bugs and metrics that need to be added
December*	Negotiate terms with SRAL on the marketing and sale of the product

*Tentative plans, might be disrupted by virus outbreak

WHAT YOU HAVE LEARNED

Brenden

Over the course of this past semester, I have learned a lot from this project. Coming from an engineering background, the emphasis was alway focused on getting the work done and not worrying about what others are doing around you, however, in the real world this doesn't always work out. Constant communication is key to the success of any project. Not only does keeping in contact with your team allow you to notify each other of any problems and keep each other updated, but it also allows members to aid each other and ultimately create a better final product.

Communication between the core members of our group was phenomenal. I would like to commend Shirli for her organizational and task management skills in which she effectively relayed to the entire team. Her ability to format both presentations and papers alike substantially helped to distinguish our group to our client and anyone we presented the project to.

Susan Sherwood was also incremental in facilitating this project. Her energy and charisma gave everyone on the team a purpose to work toward. Her constant emails, which could get overwhelming at some times, helped to keep us updated on what she was doing as well as gave us ideas on how to further develop our product.

Our communication with the Computer Science team made both Shirli and I better leaders. We were effectively given full control of the CS team since Susan designated them our responsibility. We were directly responsible for keeping in touch with them and working with them to add additional features to the ReWire game as well as fix any bugs we encountered. It also helped me realize how difficult it is to stay on top of people to get their work done and make sure they are on track. As a team, any delay we had affected them and any delay they had affected us. Ultimately, we were able to get a lot done and there is a noticeable difference from the original iteration of the game with the current edition.

In the future, I would like to apply some of the techniques we used at the end of the semester throughout entire products. Setting exact meeting times and deadlines was vital to the completion of our

product. I would like to have facilitated better communication with the CS team as a whole to keep them on track. To do this I would implement a weekly update at the beginning of the week where they would tell us what they had accomplished the previous week and what they planned to accomplish the following week. I understand the difficulty on their part since it was hard for them to judge how long a specific piece of code would take to implement. I would also like to be more consistent about our meeting times with our project coordinator Susan Sherwood. It was difficult to stay in contact with her especially due to the Covid-19 outbreak. If we had stuck to a biweekly update with her at a specific time, I believe our project would have gone even smoother.

As I stated before, the hardest part of this assignment was facilitating all of the moving pieces. The physical therapists had to be updated along with the CS team and the members of Techworks. Furthermore, we then had to contact our connections in Chicago and Northwestern. Dr. Burke and his assistant Laurie Chen were very busy and therefore difficult to contact. However, we successfully got ahold of Dr. Burke early on and this was incremental in aiding us with the game design. With regard to the business strategy, all of the previous steps had to be in place in order to understand the best route to get our product to the market. This was challenging at times due to waiting to hear back from different groups, however, by constantly checking in on one another, we were able to assemble all of the information required and produce a strong plan for future teams to implement.

Shirli

I am extremely happy that I decided to take this course this semester. I think that as an MBA student, this course put together every skill that I had learned throughout the whole program into action and taught me how to combine all my new learned skills to bring a product to the market while working alongside a multidisciplinary team. As a future student doctor and physician, I want to be involved in emerging healthcare startups/products. Working on the ReWire project gave me some perspective on what my involvement in similar projects in the future might look like.

First and foremost, this project taught me project management skills that I had not encountered before or put to practice. I learned how to connect with a client, how to plan milestones for a project, and how to create and work alongside a multidisciplinary team with different skill sets that are essential to the success of the project. I also learned the vital importance of communication and how to work well alongside a partner.

One action that resulted in excellent communication between Brenden and I as partners was the establishment of text messages as our primary way of contacting each other and making sure that we carbon copied each other in every single email that was sent in regards to the project. We also set up weekly meetings in our schedule dedicated to working on milestones, and divided tasks according to our strengths. While I took over the design of our deliverables and the organization of tasks and timelines (including note taking at every meeting), Brenden took over communications with the Computer science team and scripted important emails. Together we worked as one team and also set aside time specifically for brainstorming in order to allow new and innovative ideas to emerge (like when Brenden suggested we rename the game to ReWire). We also set aside time to bond as a team outside of the project through lunch breaks or movie nights. Our approach to developing an excellent team dynamic between us taught me that creating an environment where you build trust with a partner is important in performing well as a team. Also, the division of tasks based on strengths and establishing prefered communication styles from the beginning sets up a good precedence for future performance.

When it came to delivering results to our client, Brenden and I both realized how important it was to keep in constant communication with Susan and receive feedback from her. Susan was phenomenal in keeping in contact with us and communicating with us her vision of the project. Her upbeat personality and excitement for the project made it easy for us to continue being inspired throughout the semester and deliver our best work. We also truly appreciated how open minded she was towards new ideas. While we communicated with her every week, we could have improved the process by setting a specific time each

week that was dedicated to meeting with Susan, just like Brenden and I had done for our team meetings. This would have made the process of delivering results more efficient.

While we were not able to see the product all the way to the end of the project timeline due to the length it took to get in contact with the SRAL and Dr. Burke, I learned that sometimes adjustments need to be made to timelines in order to account for variance. One way we could have improved our project is to have created a Plan B earlier in the process in case communications with SRAL took longer than expected (which is what happened). By having a Plan B already prepared we would have made better use of the time lag in improving the product. Furthermore, Brenden and I both realized that given the large multidisciplinary team, a lot of our next steps were dependent on the performance of the other team members like the Computer Science team. While we couldn't predict exactly their timeline, one improvement could have been to increase communication with them and set milestones for their team as well in order to give them a sense of the timeline expected for the project.

Overall I feel that I have gained a lot from this project. I feel more confident with tackling a new project because I now know what steps to follow in order to achieve results. I also now know which way I communicate best and how to adapt to the communication styles of others. Having a mentor like Professor Kahai, ultimately made the project flow smoother and I learned the importance that a consultant and third party perspective can bring to a project.

TEAM

If we, the MIS Team (Brenden and Shirli), were to work together in the future, we would have to establish our preferred communication from the beginning and divide tasks according to our strengths. If as the MIS Team we were to be assigned as supervisors to the CS Team, we would have to create a milestone chart for the CS team and establish preferred communication styles with them from the beginning. We would also set up weekly check-ins with the CS team to discuss current accomplishments

and how to move forward to the next deliverable. If we, the MIS Team, were to work with Susan and Techworks again, we would set up weekly meetings dedicated to talking face to face with our client and brainstorming ideas with them. If we were to work with Ms. Laurie Chen and Dr. Burke again we would discuss at our first meeting the best way of communication with them and what protocol would be followed if we were to send them any future emails.

CONCLUSION

As we have mentioned in previous sections, the goal of our project is to help aid in the recovery of individuals afflicted by strokes by providing them with a cheap and efficient game that helps them regain their independence. Through our team's constant communication and the facilitation of ideas, we were able to outline a proper path to reaching this goal. Even with some setbacks due to communication delays caused by the Covid-19 Pandemic, Shirli and Brenden were able to deliver an updated version of the ReWire game as well as a Business Plan on how to proceed. The Business Plan helps to outline the best procedures for testing and implementing this rehabilitation device to physical therapists and stroke patients around the world. Future teams will easily be able to continue our work and finalize our project so that it will have the maximum benefit to stroke patients and exceed TechWorks goals. We appreciate the opportunity to have worked on this project and hope to see it finalized and put to use in the coming years.

APPENDIX

A separate file has been attached with all the documents necessary to continue on the project with a new team. Please find below a table of contents for the appendix file and refer to the Appendix document for the full information.

1. Project summary (including Susan's contact info)
2. Spring 2020 Proposal
3. Brainstorm session for implementation
4. Instruction manual (in progress)
5. MIS Team final presentation Spring 2020
6. MIS Team final report Spring 2020
7. A compilation of the most important meeting minute (includes important names and contact info)
8. The Business Plan

Instructions for Players
Welcome to the main menu!

The goal of the game is to challenge you to reach the highest score ...have fun while fill in the circuit board with the missing pieces.

Directions

1.) On the opening screen, you will see three different options: Left, Middle and Right. These choices correspond to the pieces starting point where you will then have to drag them to the opposite side of the screen.
    a.) For the Left option
2.) Click the desired module and the first level will immediately begin.
3.) click on a circuit piece ie. (Batteries, resistors and capacitors) and drag it to its corresponding shaded in area on the tan circuit board

The purpose ...Through large repetitive motions, the player are designed to facilitate relearning physical

PT
Download and Executing

1. Download Stroke Rehab Game Demo folder containing the game files
2. Click on Rehab game.exe to launch the game
3. A window should appear with options to change the games resolution (windowed mode recommended)
4. Once the game starts you will be presented onto the main menu. Click on **Left**, **Middle**, or **Right** to start the game or click on **Quit** to exit the application

How to Play

1. Levels can be assigned based on the patient's specific circumstances.
2. **Left** levels have click and drag exercises that go from left to right, **Right** levels have exercises that go from right to left, and **Middle** levels go from down to up.
3. Levels 1-10 steadily increase the number of objects that the player needs to move from 1 object to 10. Levels 11-17 contain levels that mix shapes, while 18-20 mix colors. The last level has a moving block.
4. You can exit the game by pressing the main menu button button, or skip through levels with the skip button or space bar.
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APPENDIX
ALL FILES RELATED TO REWIRE PROJECT

Brenden F. & Shirli S. - MIS 573

TABLE OF CONTENTS

PROJECT SUMMARY

Techworks' goal has been to create a video game device designed to redevelop stroke-affected motor functions through the repetitive use of impaired limbs, ultimately making patients more independent. This constant physical therapy encourages neuroplasticity, allowing for the brain to remodel itself after injury through the creation of new nerve cell connections. By bridging the communication gap between Physical Therapists and our Computer Science team, we hope to expand upon the current iteration of the game to ensure that it provides a novel outlet for independent rehabilitation.

In the next two months, the final steps of the Management Information Systems team are to develop and create a business strategy for the implementation of Rewire in the treatment of stroke patients after preliminary device testing at the Shirley Ryan Ability Center facilities.

CLIENT AND MAIN POINT OF CONTACT:

SUSAN SHERWOOD; director@ctandi.org, 607-624-1090
TechWorks address: 321 Water Street, Binghamton NY 13901

Proposal for The Center for Technology & Innovation REWIRE Project

Contents:

Project Abstract

The goal of this project is to finalize the development and create a business strategy for the implementation of a therapeutic video game system in the treatment of stroke patients. The onset of a stroke is caused by the sudden death of brain cells due to the lack of oxygen to a specific area of the brain from blockages or ruptures in brain arteries. Lack of hand-eye coordination and motor functions are a common symptom of stroke victims and can be split into two distinct subsets: right hemiplegic or left hemiplegic. Right hemiplegic patients have trouble moving the left side of their body as well as speech aphasia while left hemiplegic victims have trouble moving the right side of their body and are constantly anxious with a limited field of vision.

Over the past few semesters, Techworks goal has been to create a video game device designed to redevelop stroke-affected motor functions through the repetitive use of impaired limbs, ultimately making patients more independent. This constant physical therapy encourages neuroplasticity, allowing for the brain to remodel itself after injury through the creation of new nerve cell connections. While the game itself is in the final stages of completion, a business model must be laid out to properly test and market the device. Current issues with rehabilitation techniques stem from the insurances only covering Physical

Therapy up to certain milestones. These current treatments are known to be boring for patients who then stop practicing treatments preventing them from improving. Family members can only go so far working with stroke patients since they have full-time jobs. This gaming device will provide a novel outlet for independent rehabilitation while keeping stroke patients engaged.

While consulting with medical experts, physical therapists and CS students, we will be able to complete the game and begin the initial phase of testing on stroke patient volunteers in the area. The second phase will be to implement testing on a wider scale through the Chicago IT department. Once the product has gone through the necessary testing strategies and partnerships are established, the Pick and Place device will be further marketed to Universal Instruments of whom inspiration for the project began through their circuit board design.

Statement of Goals and Objectives

The goal of this project is to finalize the development and create a business strategy for the implementation of a therapeutic video game system in the treatment of stroke patients. The objectives of this project are:

- Bridge the communication gap between Physical Therapists and Computer Science students in creating a game that provides a novel outlet for independent rehabilitation while keeping stroke patients engaged.
- Alpha Test the product to satisfy the requirements of physical therapists and current stroke patients in the Binghamton area.
- Involve the Chicago Team (IT department, neurologist, rehabilitation center) to help beta test the product with a larger group of patients (hopefully from the Shirley Ryan Ability Center)
- Create a Business Strategy by developing a Marketing Plan for Introduction of the product to Universal Instruments in hopes of a partnership

Technical, Procedural and Scheduling Constraints

Technical:

- No previous experience with Unity programming, hindering our ability to improve the videogame ourselves. Our team must rely on the Computer Science students
- Game sometimes does not work appropriately on different operating systems
- Downloading program takes a long time

Procedural:

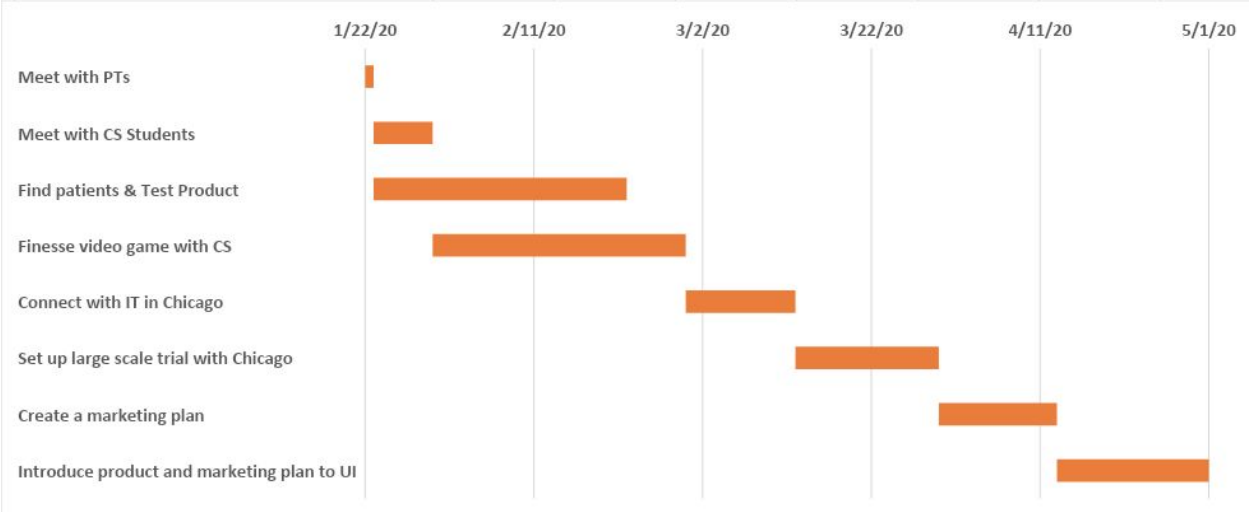
- Finding stroke patients to test the video game takes time and is unpredictable
- Medical constraints on what we are allowed to observe during PT hours
- Working with a large multidisciplinary team can be difficult in communicating and understanding everything appropriately

Scheduling:

- Finding a time when all members of the multidisciplinary team are available to meet (director of Techworks, CS students, Physical Therapists, our Team members)
- Different time zones between Binghamton and Chicago making scheduling difficult

Schedule of tasks, milestones, and deliverables

Tasks	Start Date	End Date	Duration (Days)
Meet with PTs	1/22/2020	1/23/2020	1
Meet with CS Students	1/23/2020	1/30/2020	7
Find patients & Test Product	1/23/2020	2/22/2020	30
Finesse video game with CS	1/30/2020	2/29/2020	30
Connect with IT in Chicago	2/29/2020	3/13/2020	13
Set up large scale trial with Chicago	3/13/2020	3/30/2020	17
Create a marketing plan	3/30/2020	4/13/2020	14
Introduce product and marketing plan to UI	4/13/2020	5/1/2020	18



Meetings with Professor Kahai:
February 27th, 2020: 12 PM to 1 PM
March 24rd, 2020: 12 PM to 1 PM
April 23rd, 2020: 12 PM to 1 PM

<u>Itemization of Time, Manpower, Computer, and Financial Commitments</u>

Time required by Director of TechWorks:	Hours:
Background Interview	1.5 hrs
Discussing current Gaming Model	4 hrs
Feedback on Video Game	2hrs
Phone call updates	1hr
Time required by Physical Therapists:	
Background Interview	2 hrs
Scheduling stroke patient interview	2hrs
Testing video game	2hrs
Video game feedback	1hr
Phone call Updates	1hr
Time required by Computer Science Students:	
System updates and upgrades	4hrs
Training to use new features	2hrs
Creating the instruction manual	1hr

Time required by Chicago IT:

Set up testing strategy for large scale testing	2hrs
Brainstorm business strategy	2hrs
Discuss business strategy	2hrs
Implement strategy	2hrs
Solidify IT partnership	2hrs

Time Required by Universal Instruments:

Brainstorm marketing strategy	3hrs
Discuss marketing strategy	3hrs
Finalize marketing strategy	2hrs

Miscellaneous:

Patient interviews	2hrs
Feedback and update emails/phone calls	2hrs
Communication with Shirley Ryan Ability Center	1hr
etc...	

<u>Project Costs and Benefits</u>

Costs:

- Training
- Time commitment to upgrading game system
- System updates and maintenance
- Testing Time

Benefits:

- Increase independence of stroke patient
- Ability to adapt to a dynamic environment
- Usability at home
- Decrease strain on physical therapists & family members
- Engages stroke patients
- Innovative

<u>BRAINSTORM SESSION FOR IMPLEMENTATION</u>

Change the name: From Pick&Place to Rewire

MOTTO: “Rewire Your Brain Like Rewiring a Circuit”

The goal of this game is to move pieces into their correct positions on a circuit board as quickly and precisely as possible to proceed to the next level. Through large, repetitive movements, this game is designed to increase your range of motion rewiring your brain as you are rewiring the circuit.

Leaderboard:

There needs to be a timer in-top right corner. Once a level is complete, the time is recorded and stays on the leaderboard screen until that time is beat whether it be this playthrough or another. The record will be recorded for each and every level. Also, after beating a level, the game should not go directly to the next level. It should go to the leaderboard so you can compare your current time to your best score. This encourages competition and provides an incentive for the players to play that level again.

INSTRUCTION MANUAL - (WORK IN PROGRESS)

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CURRENT & FUTURE REWIRE PROGRESS - PPT AT END OF PROJECT SPRING 2020

What is a Stroke?

Statistics

- In the US alone, over 700,000 patients a year suffer from strokes
- Over ⅔ of these patients survive and require rehabilitation
- Strokes occur when blood flow is blocked to the brain, or there is bleeding of the brain

Symptoms

- Stroke victims may have difficulty with muscle control due to weakened or paralyzed limbs aka paresthesias
- Chronic pain due to damage to nervous system
- Aphasia concerning the understanding of language

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Rehabilitation

- The goals of rehab is to help survivors become as independent as possible
- Ensure the best possible quality of life with their limitations
- There is no cure since there is no way to reverse brain damage
- Skills can be relearned through repetitive movements circumventing damaged areas through neuroplasticity

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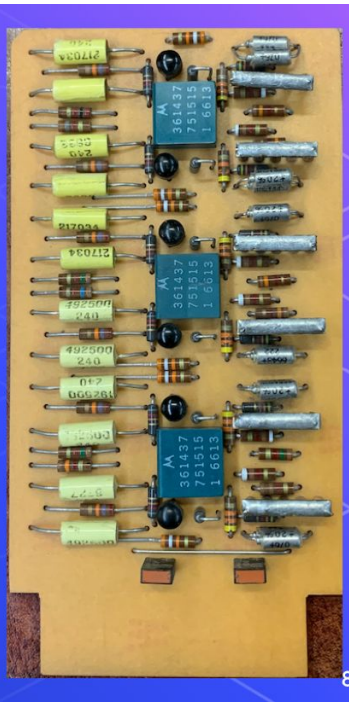
Why ReWire?

- Where's the connection between circuitry and strokes?
- It's simple: Players are rewiring their brain like rewiring a circuit



8

Shirley Ryan AbilityLab in Chicago

- We plan on partnering with SRAL for the upscaling of the device and large scale testing on stroke patients
- Our contacts include Dr. Burke who is part of the neurology department at Northwestern University and their IT Team

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Fixed Game Bugs:

1. Redefined main menu
2. Cursor can't leave Screen
3. Incorporated Pause Feature
4. Clicker Specificity

Future Additions To The Game:

5. Add Timer
6. Add Sensitivity Adjust
7. Level Select

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Accomplishments

- Added onto pre-existing code to successfully optimize the system on both PC and MacOS devices delivering a complete final iteration of the game
- Facilitated Communication with Northwestern Medical through our connection Dr. Alan Burke and are waiting for further correspondence (due to Covid-19 Outbreak)
- Completed the Business and Marketing Strategy to get our product to where it is desperately needed

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Constraints

Technical

- No previous experience with programming; Must rely on CS students
- Game sometimes does not work appropriately on different operating systems
- Long downloading time

Environmental

- CoronaVirus

Procedural

- Finding stroke patients to test the video game takes time and is unpredictable
- Medical constraints on what we are allowed to observe during PT hours
- Working with a large multidisciplinary team can be difficult in communicating and understanding everything appropriately

Scheduling

- Finding a time when all members of the multidisciplinary team are available to meet (director of Techworks, CS students, Physical Therapists, our Team members)
- Different time zones between Binghamton and Chicago making scheduling difficult

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Cost and Restraints

Costs

- Training
- Time commitment to upgrading game system
- System updates and maintenance
- Testing Time

Benefits

- Increase independence of stroke patient
- Ability to adapt to a dynamic environment
- Usability at home
- Decrease strain on physical therapists & family members
- Engages stroke patients
- Innovative

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Where to Next and Advice for the Next Team

- Connection with Dr. Burke already established - future teams will have to utilize this source to connect with SRAL
  - After contact is made with SRAC, the new team must follow the steps outlined in our Business Plan and Appendix in order to get our device to market in the most effective way
- Ensure last few additions are added to the game
  - The future team will want to constantly update the current code and take in any feedback they receive from physical therapists, stroke patients and SRAL
- Continue to keep in contact with the Shirley Ryan AbilityLab and discuss future plans with them

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FINAL REPORT SPRING 2020

INTRODUCTION

Strokes are a major problem in the United States, killing about 140,000 Americans every year. Each year over 795,000 people in the United States have a stroke with about 610,000 of these being the first time and it is estimated that the United States spends an average of $34 billion each year on treating these Stroke patients. Strokes are the leading cause of serious long-term disability since they reduce mobility in more than half of stroke survivors aged 65 and over. While the rate of strokes has not been decreasing over the past several decades, medical technologies have advanced enough to decrease the death rate of stroke patients. While the increased rate of survival is a positive, these patients require extensive care, putting more strain on the medical system and increasing costs. Therapy and rehabilitation are timely and expensive with most survivors being dependent on others for an extended duration.

The goal of our product is to provide a product and service to individuals who have suffered from severe strokes in an effort to help them regain mobility in their limbs and increase independence through the power of convenient technology. It will effectively improve the quality of life for our customers, and will hopefully become the leading provider of therapeutic video games to severe stroke patients on a global scale.

The onset of a stroke is caused by the sudden death of brain cells due to the lack of oxygen to a specific area of the brain from blockages or ruptures in brain arteries. Lack of hand-eye coordination and motor functions are a common symptom of stroke victims and can be split into two distinct subsets: right hemiplegic or left hemiplegic. Right hemiplegic patients have

trouble moving the left side of their body as well as speech aphasia while left hemiplegic victims have trouble moving the right side of their body and are constantly anxious with a limited field of vision.

Over the past few semesters, Techworks goal has been to create a video game device designed to redevelop stroke-affected motor functions through the repetitive use of impaired limbs, ultimately making patients more independent. This constant physical therapy encourages neuroplasticity, allowing for the brain to remodel itself after injury through the creation of new nerve cell connections. While the game itself is in the final stages of completion, we have completed a business model to be laid out in order to properly test and market the device. Current issues with rehabilitation techniques stem from insurances only covering physical therapy up to certain milestones or a given amount of time. These current treatments are known to be boring for patients who then stop practicing developmental measures, preventing them from improving. Family members can only go so far working with stroke patients since they may have full-time jobs or other commitments. This gaming device will provide a novel outlet for independent rehabilitation while keeping stroke patients engaged.

While consulting with medical experts, physical therapists and CS students, we were able to complete the game and begin the initial phase of testing. The second phase will be to implement testing on a wider scale through the Shirley Ryan Ability Center. Once the product has gone through the necessary testing strategies and partnerships are established, the ReWire game will be released at an affordable price to physical therapists and Stroke patients alike ultimately helping to increase the efficiency of rehabilitation, thus reducing strain on the medical system.

PROCEDURE FOLLOWED

- Bridged the communication gap between Physical Therapists and Computer Science students in creating a game that provides a novel outlet for independent rehabilitation while keeping stroke patients engaged.
- Managed the Computer Science division in order to effectively add to the code to make it a presentable design that achieved the goals in the rehabilitation of stroke patients.
- Attempted to alpha test the product to satisfy the requirements of physical therapists and current stroke patients in the Binghamton area.
- Attempted to involve the Chicago Team (IT department, neurologist, rehabilitation center) to help beta test the product with a larger group of patients (hopefully from the Shirley Ryan Ability Lab)
- Created a marketing plan by researching other physical therapy devices that provided a similar service to our customers. We were able to analyze how these products were distributed into the Market and what made them successful or unsuccessful in this implementation. Using this information, we were also able to determine an average price

point for our product as well as our advice on how techworks should negotiate and receive royalties after the product is delivered to the Shirley Ryan Ability Lab

WHAT WAS ACHIEVED

While we were unable to get in contact with the Shirley Ryan Ability Center due to what we expect to be from the Covid-19 outbreak, our team was able to successfully complete the ReWire device as well as deliver a business plan and marketing strategy to TechWorks. While the original game was initially titled Pick and Place, we were able to completely redesign the products interface as well as rebrand the name to ReWire in order to better attract our target audience.

The Game: What was completed?

Why did we perform the name rebranding to ReWire? It ties the concept of the game to the intended effect on stroke patients brains. You are rewiring your brain like you are rewiring a circuit. This allows the name to better encompass what the device is doing as well as being shorter and catchier to attract players. Pick and Place is long and doesn't explain the reason for using a circuit as the base of the game.

Continuing off that change, we also redefined the games menu. With the help of our Computer Science division, we were able to change the interphase of the game menu to make it easier for players to access and understand. It is now more user friendly and displays the proper ReWire brand name.

Further bug fixes were conducted to make sure that the player couldn't lose the cursor off the screen. Originally, if players accidentally moved a piece outside of the edge of the screen monitor, that piece would be lost for good and there was no way to retrieve or find it. This could cause problems since pieces could be dragged off the screen and lost as well, preventing the player from completing that level.

A pause feature was also added so that players could take a break and continue at a later date. The pause feature also allowed players to view the menu where they could go back and restart a level or choose a different level. Without the pause feature, the game would continue to run and make noise with the only way to go back to the main menu being to shut off the game and reboot it.

The last thing that was adjusted was the clicker specificity. Now players can adjust how fast the piece is dragged across the screen. Although this may still depend on the type of mouse a person has, the specificity is adjustable. Also pieces will no longer be dragged into place when nearing the correct slot.

The Game: What wasn't completed?

Due to the Covid-19 outbreak, the CS team was unable to add a timer to the game. The timer was supposed to be a metric for which the player could look at in order to get a sense of how they were doing and attempt to beat their previous time to improve. The timer would record how long it took for a player to complete a particular level by moving all of the pieces into the correct slots. This time would then be recorded in the main menu or a new subpage titled "personal best". This would allow players to compare their current times with times in the past

and allow them to visually see their improvement. The faster they got, the more mobility they had and the further they were on the path to becoming more independent.

Another functionality that was not included was a level select. Players have to start from the first level of the game every time they open it and must progress through the easier levels first before they move on to the more challenging sections. If a player wants to skip to the more challenging levels they are currently unable to do that directly from the main menu. The CS team was continuing to look into a way to implement this addition but were unable to complete this task for the final iteration of the game.

Communication: What did we complete?

Our team was able to get directly in contact with Laurie Chen at Northwestern University through email. She is the assistant to Dr. Allan Burke, an associate of Susan Sherwood from Techworks. From Ms. Chen, we were able to set up a date and time for a conference call with Dr. Burke to discuss what was currently needed to help patients with strokes. We were able to take notes and get his advice on how to better design our game to accomplish our goals. Dr. Burke's experience as a Neurosurgeon was pivotal in helping us understand how our device would be implemented and how to help physical therapists use our device on patients.

Communication: What was not completed?

We were unable to get in contact with the Shirley Ryan Ability Center to discuss upscale testing of our product. Dr. Burke was supposed to get back to us with the contact information of his connections at the Shirley Ryan Ability Center, however, due to his schedule being overwhelmed by the Covid-19 outbreak he was unable to relay this information to us. Another problem is that many employees working at the Shirley Ryan Ability Lab may be working part time and are unsure of when their facilities will be back to normal. They wouldn't be able to give us a timeline of when they could test our product due to the uncertainty surrounding the virus outbreak.

FOLLOW-UP REQUIRED by new team

SUMMER 2020

June*	Re-establish communication with Ms. Chen and Dr. Burke to secure our connections at Shirley Ryan Ability Lab
July*	Focus on the metrics of the game (the addition of the timer, add a personal best tab, etc.)
August*	Further focus on new metrics that the physical therapists might suggest as well as change the music in the background of the game

FALL 2020

September*	- Alpha test with Binghamton patients - Convert game into an app for the app store

October*	(Assuming contact with SRAL has been established) Beta test product large scale
November*	Work on adjusting the code to fix any bugs and metrics that need to be added
December*	Negotiate terms with SRAL on the marketing and sale of the product

*Tentative plans, might be disrupted by virus outbreak

IMPORTANT MEETING MINUTES (that might be useful to new team)

2/4/2020 Meeting Minutes

- Work with Chicago and contact them to find out what they can offer us
- Why does SRRC want to work with us? Bc programmers never listen and they never get what they want. The reason they are choosing us is that we will listen to what they want!
- Dr. burke went to college with Susan (50 years connection)
- Sue will help us and know everyone in town and a talented physical therapist
- Ginny wants her changes made before she sends it out to patients
- The product needs to be a product that's close to completion
- Human intervention policy in Chicago - we cant research without that permission
- Create a presentation and instructions and implement ginny's changes into the program
- THe PAUSE feature needs to be implemented asap
- We need to send chicago a presentation to get them to give us permission to recruit patients to test product and get more people on board
- We might need to work with chicago asap bc we dont seem to have any patients here in bing
- PT KAY in Arizona sent videos of patients; she might be able to help us find some patients
- Susan will send us the digital records from last semester - it will have the source code for the 3d version and the code that Cassandra and spencer had
- Laurie Chen - office assistant - only way to get in touch with Dr. Burke - worth calling her to tell her what we are trying to accomplish on her and dr. burkes behalf
- Tramatic brain injury is what they deal wit a lot - want us to make the game cool for everybody
- PLAYER, PT, DR welcome menu (patient can't change)

Goals

- Make ginny happy
- Get in touch with KaY
- Chris is in Florida and might help us find a patient
- We should let Susan know when we will have the game ready by
- Send Dr. Burke a presentation
- We will work directly with Chicago and coney it all to CS
- Make sure we know what we want and deliver what we say what we will deliver, also find out what the rehabilitation want
- The game has to work on mac 100%
- Create a PPT to introduce idea to Chicago

    - Make sure we show in ppt that we understand the field of strokes (maybe include research papers)
    - Make it more inclusive
- A business strategy for distribution of a therapeutic game (DISTRIBUTION)
- Create a business and marketing distribution plan to tell the SRRC Administrators
- SRRC takes it under their license - techworks makes a small commission from it - co-own and co-share - SRRC WANT TO MAKE A PROFIT since they are doing all the work
- We may or we may not work at all with UI - they need to know what's going on and that we are trying to solidify a partnership with SRRC
- SRRC - managing, production, implementation, give us data - They have funding, people, the service, and they care bc they know we can deliver
- Idea: app, or fitbit with time and location of what they are doing
- It will take 3 weeks to get SRRC to get the patients - What is needed for the human intervention application and the SRRC Decision-making process
- SRRC is used to pay a lot of money for an app that doesn't work
- Pricing idea - there be a comment in the welcome page "this is brought to you at a low cost, please consider as part of your charitable giving a donation to techworks" - SRRC is stellar at fundraising

2/17/2020 Meeting Minutes

Marketing

1.) Discuss Competitors
    a.) Current motion sensor way beyond the scope of our project
    b.) More engaging than the circuit board
    c.) Records a wider array of motion

    What is Shirley Ryans Requirements?

2.) Discuss Marketing Ideas
    a.) Rebranding to Rewire?
    b.) Put in app form at low price
    c.) Target Players over Physical Therapists

3.) Implement Metrics to show player improvement
    a.) The most important feature we don't have is finding a way to tell whether or not the patient is improving. If the patient doesn't show improvement, our game is not worth playing
    b.) We need to finalize metrics and make sure that the players "score" is recorded in-game on a leaderboard so that they know their past benchmarks
        i.) Timer - how fast they complete the level
        ii.) Precision? - how close to the target
        iii.) Directness? - path of movement

Tasks:

- Set up followup email to Laurie and set up a conference call to better understand what they want out of our game and what audience we are creating the game for

    - Have the Ryan Center PT students test the game to see what it might need
- Create a document with an outline of the convo with the SRC and Dr. Burke so that we go in prepared
- Get George Garcia onboard garcia.illinois@gmail.com → oculus quest **(815)-298-4823** have travis hit him up
- Talk to ginny and sue to get the medical terminology down - but this is not priority
- Allan Burke phone number: **708-822-3500 (DO NOT USE THIS UNLESS ITS AN EMERGENCY)**
- Laurie Chen phone number: **708-941-5195 (ALWAYS EMAIL MS. CHEN FIRST)** **lauriechen4019@gmail.com**

Updates:

- 4 excited students that know how to use unity use them
- George Garcia - the Unity game teacher.
    - Oculus quest $400
    - Excited for developing a game - we can get him on board for us
    - Sue might provide us with the money

Brainstorm:

- The new yorker jigsaw puzzle game
- PC Magazine called wired - look for an inspirational idea to update REWIRE game
- It's important to cross the line - needs to have horizontal spread - maybe we could do this with the delay in a mouse
- The purpose of this game is to be an independent at home game for patients
- Ginni and Sue want the therapists to set the parameter for the game/app - They want it to be more specialized - but do we agree with this?
- We need help in defining in medical terms that this is for specific severely stroke patients - but this can be done after we decide which patients we want to help in the first time
- We don't need to go big with this but we need to define a starting and ending skillset to get the app to fit those patients
- Rewiring plugboards - line tracing program in folder (for advanced players)
- Info about Dr. Burke:
    - into Art History

Questions to ask when working on the game:

- Ask PTs what might be engaging for the target patient?
- Can they do it at home without hurting themselves without a physical therapist?
- Is it possible that by the end of the game the patient is cured?
- When should a PT prescribe the game to a patient?
- Are dealing with patients that have the most severe case of a stroke?
- What audience does SRC want us to develop
- Doctor Burke has already seen a version of the game - we need to ask him which way we want to go with the game
    - Pose question to PTs
        - Musics effect on the brain
        - Which patients should the PTs choose

- Get input from those who understand how PT works

Metting with Dr. Burke Notes 2/20/2020
5:30 PM EST Conference Call
Dr. Burke - Personal: 708-822-3500

1. What do you know about the game?
    a. **When did you play the game last?**
    December 2019
    b. **What were your likes and dislikes?**
    Right speed and enough levels that it was goign at the right direction
    Room too improve without being too easy
    He likes the slow process of the game
    c. **What would you change about it?**
    After a while people catch on, so they want to track monthly progress
    d. **What do you think about the game's potential?**
        i. **What are some of the bare min requirements that you think we can incorporate into this game?**
            - Timer system is great idea:
            - How fast someone can go? Exhausted quickly and then they stop after a couple of levels
            - Timing down will help patients
            - You completed 5 tasks in 20 min, and then where they fit on scale, and then a way to compare someone 4 weeks later.
            - Initially evaluated with scores. Then reevaluated in a month with percentiles. Range of motion,

2. **What do you think the intended target audience for the game should be?**
    a. We think that at this stage it is helpful for the most severe cases outside of PT
    Moderate to severe patients
    Shirley Ryan Ability Lab and their outpatient clinics

3. **What sort of measurement systems do you currently implement to determine stroke patients' progress?**
    a. **Do you think adding a timer is a good idea?**
    b. **How would we be able to identify improvement?**
        - Move rings onto something else - how many were they able to move in how many minutes, what's expected and how much change there has been.
        - Able to move so many objects here, here is where you scoere now over earlies. Numeric score to see where they stand
        - What the base line, whats expected. Average time - need data for this from SRAC
        - Can sRAC provide this data? - yes they can
        - Copy of exam he had to fill out - Richard Harey next friday get a copy
        - 30 years ago they became the leading money making in the hospital - every insurer is going for them so they had to document everything especially improvement

- Home 48 hrs after surgery and home pt 2 days later and couldn't leave hospital without contact
- Our game cant provide all types of PT - this is very goal directed (maybe give players a potential reference starting time which they can try to beat. Numeric Values)
- Minimaly active patients

c. Precision for progress?

4. Susan mentioned the SRAC, do you have an affiliation with them?
    a. What is currently being used at the SRAC?
    b. What type of patients do you send to the center?
    c. Do you know if SRAC would be willing to work with us and what would some of their requirements for the game be?
    The wheels move slowly. Having Harvey on our side is a major plus.

5. Marketing of device (sold or for free)-> discuss monetization scenarios
    a. You sell the game, we want some sort of royalty
    b. Game is for free, incorporation of some sort of donation request

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Laurie - Work: 312-944-0063 ; Personal: 708-941-5195

1. Set up meeting call with Dr. Burke to go over requirements
2. Ask her what communication has gone on between Techworks and Dr. Burke/ SRAC in the past? When was this? What iteration of the game did they see?
3. Do you know if Dr. Burke has any expectations or requirements that we should be aware of before discussing the current model of the game with him?
4. What are your connections with **SRAC? 312-238-1000**

Shirley Ryan Ability Lab

1.) What are your requirements?
2.) What have you seen currently with the game?
    a.) Likes
    b.) Dislikes
3.) Timeline and access to SRAL PTs? Have you tested products in the past and what was the methodology?

BUSINESS PLAN

FAST FACTS

Founded: 2019

Headquarters: Binghamton, NY

Founders: Center for Technology and Innovation (TechWorks)

Target Audience: Severe Stroke Patients and Physical Therapists

QUICK DESCRIPTION

The Center for Technology and Innovation is a Binghamton based technology company. We have focused on designing breakthrough technology to help stroke patients recover full mobility through engaging video games. ReWire is a video game product challenging patients to rebuild brain circuitry for movement of their affected arms and hands.

OUR MISSION

Provide a product and service to individuals who have suffered from severe strokes in an effort to help them regain mobility in their limbs and independence through the power of convenient technology.

OUR VISION

Improve the quality of life for our customers, and become the leading provider of therapeutic video games to severe stroke patients on a global scale.

EXECUTIVE SUMMARY

TechWorks goal is to continue developing ReWire, a video game designed to redevelop stroke-affected motor functions through the repetitive use of impaired limbs. This constant physical therapy encourages neuroplasticity, allowing for the brain to remodel itself after injury through the creation of new nerve cell connections.

ReWire has the potential to change the lives of those affected by severe strokes, ultimately making them more independent and aid physical therapists and patient families in helping their loved one gain a better quality of life.

With the successful communication between our Physical Therapist Team, Management Information Systems Team, and Computer Science Team, we hope to expand upon the current iteration of the game to ensure that it provides a novel outlet for independent rehabilitation.

ReWire is currently seeking a partnership with Shirley Ryan Ability Lab in Chicago. ReWire is willing to share 80% of the profits gained with their partner or have the TechWorks name cited for donations within each product. With this partnership, ReWire and Shirley Ryan Ability Lab will be able to provide both a product and a service to patients, their families, and their physical therapists.

Project Abstract

The goal of this project is to implement a therapeutic video game system in the treatment of stroke patients. The onset of a stroke is caused by the sudden death of brain cells due to the lack of oxygen to a specific area of the brain from blockages or ruptures in brain arteries. Lack of hand-eye coordination and motor functions are a common symptom of stroke victims and can be split into two distinct subsets: right hemiplegic or left hemiplegic. Right hemiplegic patients have trouble moving the left side of their body as well as speech aphasia, while left hemiplegic victims have trouble moving the right side of their body and are constantly anxious with a limited field of vision.

Over the past few semesters, Techworks goal has been to create a video game device designed to redevelop stroke-affected motor functions through the repetitive use of impaired limbs, ultimately making patients more independent. This constant physical therapy encourages neuroplasticity, allowing for the brain to remodel itself after injury through the creation of new nerve cell connections. While the game itself is in the final stages of completion, a business model must be laid out to properly test and market the device. Current issues with rehabilitation techniques stem from medical insurance only covering physical therapy up to certain milestones. These current treatments are known to be boring for patients who stop practicing treatments prematurely, preventing them from improving. Families have a limited amount of time that they can dedicate to their stroke-affected family member since they have full-time jobs. This gaming device will provide a novel outlet for independent rehabilitation while keeping stroke patients engaged.

While consulting with medical experts, physical therapists, management information systems members, and CS students will be able to complete the game and begin the initial phase of testing on stroke patient volunteers in the area. The second phase of testing will be implemented on a wider scale through the Chicago IT department.

Statement of Goals and Objectives

The goal of this project is to finalize and successfully test the ReWire stroke game so it is ready for implementation in a therapeutic setting. The objectives of this project are:

- Bridge the communication gap between Physical Therapists and Computer Science students in creating a game that provides a novel outlet for independent rehabilitation while keeping stroke patients engaged.

- Alpha Test the product to satisfy the requirements of physical therapists and current stroke patients in the Binghamton area.

- Involve the Chicago Team (IT department, neurologist, rehabilitation center) to help beta test the product with a larger group of patients (hopefully from the Shirley Ryan Ability Lab)

MARKET OPPORTUNITY

Our business has the potential to be very valuable because there is an urgent need for independent therapy for anyone who has suffered from a stroke. There is already an established ecosystem within the physical therapy community that is willing to expand its techniques in order to give clients the best possible care and rehabilitation. Our product focuses on players with very severe symptoms including paralysis and motor control impediments.

There have been several other video game systems developed for stroke patients, however, they are usually tagged with a price point way above the affordable range for an individual after they have completed their physical therapy with a personal therapist. The ReWire system offers a low price and allows for players to be independent in their rehabilitation process while keeping them engaged and motivated.

MARKETING

Our Customers

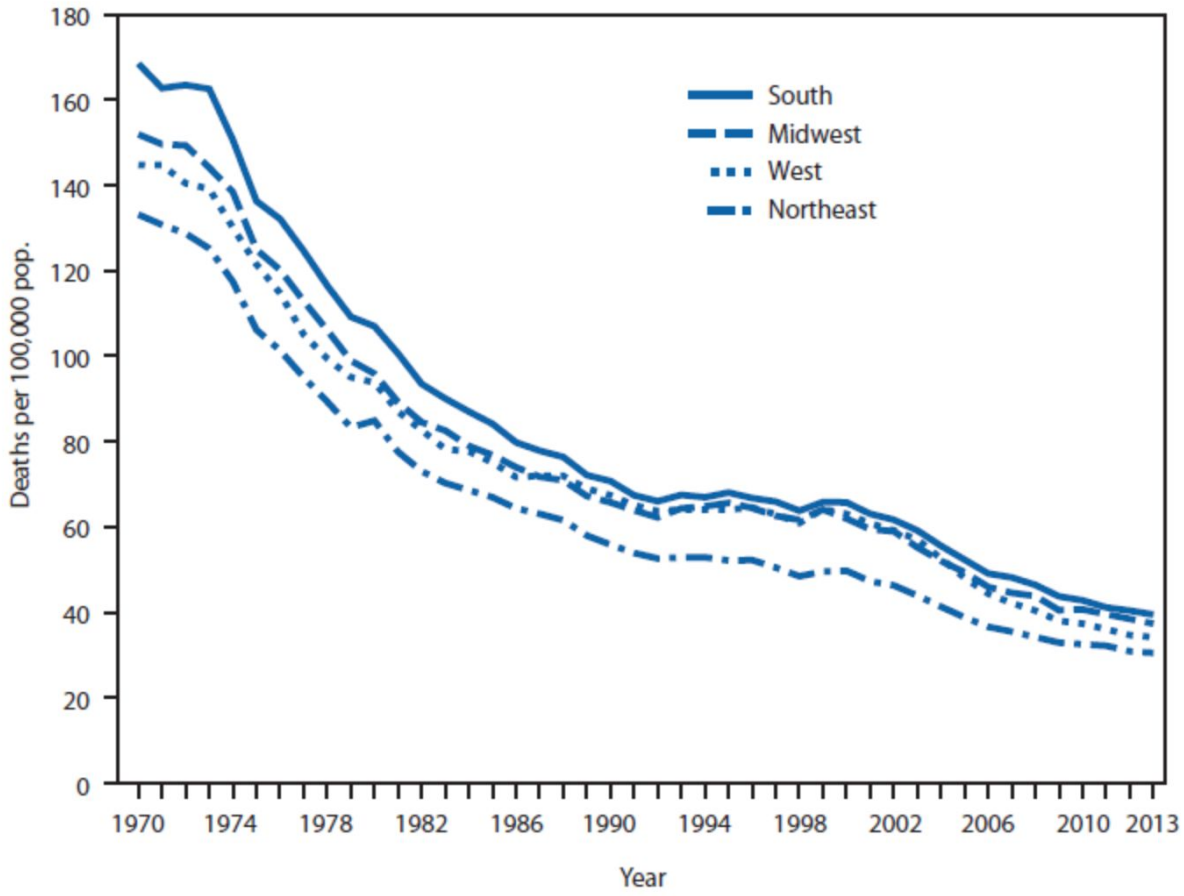
Our target market is english speaking families with access to either a laptop or desktop computer in the United States who have family members affected by a stroke. Our target market is a niche market aimed towards people with the most severe deficits after a stroke. The number one reason many patients stop their physical therapy is because their exercises are not stimulating enough to keep them interested. It is our hope that patients using ReWire will recover quicker when they are engaged and have the ability to continue practicing their rehabilitation from the comfort of their home. The game's easy-to-use interface supports individuals of all ages and tracks their progress as they continue playing.

After making contact and concluding negotiations with the Shirley Ryan Ability Lab, their physical therapists should be able to utilize our game software. With their credentials and testing backing our product, we will then be able to establish the ReWire brand for players outside of the facilities themselves. Players will then be able to independently play ReWire and work on their rehabilitation without the aid of family members and therapists. Our goal is to help seamlessly integrate people with these conditions into society so that they are able to function in everyday life.

Our Market

While the number of stroke patients per percent of the population has remained relatively stable throughout the past 50 years, the death rate due to strokes has significantly decreased. This means that because more people are surviving strokes, more people are in need of rehabilitative

therapy. Our target market is steadily growing. The ecosystem for these technologies is also constantly expanding and becoming more developed as rehabilitation tools evolve with the growing number of people recovering from strokes.



* Per 100,000 standard population.

"QuickStats: Age–Adjusted Death Rates* for Stroke,† by U.S. Census Region§ - United States, 1970–2013." Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, www.cdc.gov/mmwr/preview/mmwrhtml/mm6413a9.htm.

As seen by the data, our product has a growing market. From 1970 to 2013, there was an increase in survival rates of stroke patients per 100,000 individuals. In the US alone, close to 800,000 patients a year suffer from strokes. Approximately ⅔ of these patients survive and require different degrees of rehabilitation. Strokes occur when blood flow is blocked to the brain, or there is bleeding in the surrounding area.

Our Expansion

ReWire has many plans for expansion and growth. As illustrated by the previous data, the trend in our business ecosystem is on the rise as more and more families and physical therapists are seeking ways to help their surviving stroke affected family members and patients. Our current market is based in the United States, but we have plans to expand to Europe and other continents in the near future.

Our first plan for expansion is to develop the videogame into an app that can easily be downloaded through the app store. This will result in the use of ReWire on a larger scale, and include new monitoring systems for the physical therapists and family members. These additions would include using predictive AI software to generate high quality metrics and share that data with healthcare providers.

Our second plan for expansion is to create a 3D version of ReWire in order to provide an innovative and entertaining rehabilitation game to keep patients engaged during their physical therapy.

Our Pricing Strategy

Our pricing strategy has been devised by examining and analyzing the price of our competitors. For our video game, we have devised a strategy based on the tangible products in our competition such as other therapeutic devices. Our product is comparable in functionality to our competitors so we have priced our device at slightly below their range to increase market infiltration. Our product will sell at $1,000 including the application subscription for the first year to large scale rehabilitation facilities.

We have priced our application for individual at home use to be $10/month. Customers will begin paying $10/month at the beginning of each month. Our competitors range up to $300 for the application so we have devised this pricing method to keep it lower and more affordable on a monthly basis for these families. The total will be $120/year for the user. As we devise plans for classroom use and for the app to be on a larger scale, app price will increase appropriately.

"ReWire: Rewire your brain like you're Rewiring a circuit!"

COMPETITION

	MusicGlove Hand Therapy (Direct)	FitMi Home Therapy (Direct)	Arm Skates (Indirect)	Mirror Box (Indirect)	ReWire
Price	$349.00	$349.00	$100	$80	$15/month
No additional accessories required					

Can be used independently by player	✗	✗	✗	✓ YES!	✓ YES!
Engaging	✓ YES!	✓ YES!	✗	✗	✓ YES!
Targets most severe stroke cases	✗	✓ YES!	✓ YES!	✓ YES!	✓ YES!

"Tools to Spark Recovery." ***Flint Rehab*****, www.flintrehab.com/.**

Competitive Landscape

Direct competitors of ReWire include products that offer stroke therapy through the use of a computer system. We performed a thorough search using market research and found only a few products that would compete directly with ReWire, although no products had the features or price comparable to our product. Primary competitors for ReWire include MusicGlove Hand Therapy and FitMi Home Therapy.

MusicGlove Hand Therapy

MusicGlove works by motivating users to perform hundreds of therapeutic hand and finger exercises while playing an engaging musical game. To use the device, you simply put the MusicGlove on your hand and press play. Then, follow along and make the appropriate pinching movements when each musical note floats down the screen. The player is incentivized to play as they can choose from a wide array of songs to perform providing a sense of familiarity. Songs contain different difficulty levels and can vary in speed between switching positions.

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Strengths

Hand sensor glove that combines with a fun music game to keep players entertained during rehabilitation. The player can choose from a variety of songs.

Pricing

MusicGlove retails at a maximum of around $349.00

Weaknesses

Can only be used on one hand. A separate device must be bought for the opposite hand. Only focuses on hand grip movement improvements.

FitMi Home Therapy

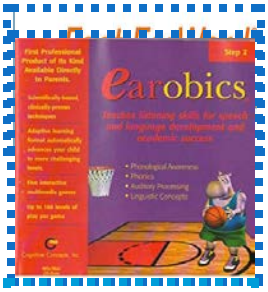
FitMi is a home neurorehab device designed for patient recovery from head to toe. It helps stroke affected patients improve their ability to walk and use their affected side by exercising the full-body, including hands, arms, core and legs.

Strengths	Pricing	Weaknesses
Device can be used to strengthen different types of body parts and can be used by players of all levels of recovery.	FitMi retail at around $349.00	Requires multiple accessories to accommodate the player. Pieces need to be charged and can get lost.

Indirect Competitors

Indirect competitors are businesses that offer slightly different products and services, but target the same group of customers with the goal of satisfying the same need. These are sometimes also known as substitutes. Our primary indirect competitors include rehabilitation programs and devices
that are not computer based.

Other stroke related disabilities including speech impediments are also targeted by this indirect competitors. Speech therapy can improve reading and language comprehension. People with severe strokes have difficulty processing and repeating sounds they were previously familiar with. This Therapy includes a wide variety of exercises that target specific linguistic deficits and may range from computer-assisted software programs a speech and language therapist.



Arm Skates If you have restricted range of motion in your affected arm, then an arm skate can help introduce more movement into your arm. Arm skates are designed more for flexibility training than strength training. This device may act as a complimentary accessory for more severe cases where players can't pick up a mouse.

Mirror Box

Mirror therapy can be used to help stroke patients struggling with different degrees of paralysis. When a mirror is placed over the affected hand, the reflection of the patient's functional hand can be used to "trick" the brain. Even though your affected hand may not actually be moving and you logically know better, this process can help retrain your brain to gain back functionality in your hand.

Speech Therapy Computer Programs

There are several "brain training" programs designed to build skills in identifying sounds and remembering auditory information, including FastForWard and Earobics

Advertising Strategies

The Shirley Ryan Ability Lab will be responsible for any advertising for this product after testing is completed.

How We Differ From Our Competitors

While our direct competitors are all of a substantially higher pricing point, our ReWire device is specifically designed to help the most severe stroke players at the lowest price possible.

SWOT ANALYSIS

STRENGTHS

- Established Ecosystem
- Motivated Team
- Diverse Experience
- Great Value
- Priced Right

OPPORTUNITIES

- New Market Segments
- Industry Technology Trends
- New Services
- New Innovations
- Key partnerships

WEAKNESSES

- Limited target audience
- No Budget
- Remote/Virtual Team
- Freelance/Volunt-e er workers
- Initial Marketing

THREATS

- Economy Movement
- CoronaVirus
- Coding Obstacles
- Competitor Actions
- Loss of key staff
- Market Demand

Shirli Samara

Shirli is currently a graduate student at Binghamton University in the One-Year Master of Business Administration program with a focus on Healthcare, concluding her studies in May of 2020. She received her Bachelor of Science in Biochemistry in December of 2018 in conjunction with the Pre-Health concentration. Shirli's interests lie within the field of healthcare administration and she looks forward to learning more about the intricacies of administrative work that goes into achieving high-quality patient care. As a current Research/Teaching Assistant for the Healthcare Operations and Analytics course, Shirli is responsible for conducting literature reviews, comparing America's healthcare systems to other countries, including Singapore and Canada, in order to identify gaps in the system and determine potential solutions to increase the quality of patient care. Furthermore, Shirli has used her business knowledge to develop a strategy for an IT-related phone and earpiece application that would revolutionize the way individuals with auditory disorders sense the world around them using innovations in AI technology. She created a marketing plan, designed a business outline, and researched competitors and the market in order to determine the potential of product success. Shirli's team placed 1st out of 11 teams of graduate students.

Brenden Faherty

Currently, Brenden is a graduate student at Binghamton University in the One-Year Master of Business Administration program with a focus on Healthcare, concluding his studies in May of 2020. He has an undergraduate degree in Biomedical Engineering in conjunction with the Pre-Health concentration. He is deeply committed to contribute as much as he can to exceed expectations and make a lasting impact on the medical care industry. For his Senior Design Project in Biomedical Engineering, he helped lead a team of five individuals to develop a therapeutic device that aided children suffering from Sensory Processing Disorder. The Dizzy Disc device was aimed to stimulate children's vestibular and proprioceptive systems in order to develop their sensory-motor skills. His team worked alongside children, their therapists, as well as different processing labs throughout Upstate New York, in order to successfully create a functional device that is currently being implemented in therapeutic settings. His research experience has allowed him to work cohesively with a diverse team and directly interact with patients in order to ensure them the greatest happiness through the development of crucial learning and physical skills.