Digital Weave Loom

By Omolara Aneke

I looked further into expanding on the weaving machine idea I started last term. Attempt one consisted of two heddles attached to each other by rope and thrown over a rod that was rotated back and forth. The intended motion was to alternate lifting each heddle, one after the other with a push of a button. Instead, the motion was reduced due to the weight and design of the heedles. There are obvious limitations to the two fixed heedles alternating, this results in producing only one type of weave design.
Ending the last term with a weaving machine that didn't weave I had choices to make in my pursuit. It was brought to my attention that weaving machines are 1. Hard to make or replicate and 2. They have been done before. The point of pointing out the harsh realities was to get me to focus less on the act of weaving perfectly.

Initial ways to combat this involve me thinking about the possible ways for users to interact with my work and where these interactions might take place. I grappled with a few settings. 1. An education- friendly weaving machine that allows teachers to teach children in schools the art of weaving. In an attempt to introduce children to a broad range of crafts and hobbies. 2. A tool to be used in work spaces whether that be in the home or a studio. In the same way sewing machines are household products for empowering mending and making, I envision a domestic weaving machine that empowers DIY craft fans to rapidly prototype and produce fabric. 3. A large scale

communal tool in public spaces to promote community participation and pride. Viewers can be moved if they so chose to add rows resulting in a long piece of fabric weaved at the hands of all.

I followed along the path of a tool to help practitioners in the production of their own fabric. Just as making something with your hands influences how you engage, appreciate and handle the outcome, I wanted to create a tool that could give users this same feeling. Further inspired by a multitude of sources I began to formulate a solid direction.

I came across a twitter thread showing the work of an online knitting circle who knit weather statistics into fabric. Specific colour threads are chosen depending on the temperature of the weather that day. The act of noting subtle changes over time turned the act of knitting into a calendar of sorts, a physical marker of time. Like a /photo visually actualises changes over time, knitting in this way gives it video/ photo like properties transforming into something worth an object worth a thousand words. I toyed with the idea of doing the same, transforming live API data or a weather sensor data into digestible bits of information for my weaving machine to interpret and act upon.

Harlizius-Klück cites Sadie Plant who suggests that ‘Jacquard’s system of punch card programs brought the information age to the beginning of the 19th century’ (2017). Jacquard did not invent the binary structure of the weave but he created a mechanism that rendered the drawboy, a human pulling a leaver’ useless (Harlizius-Klück, 2017).

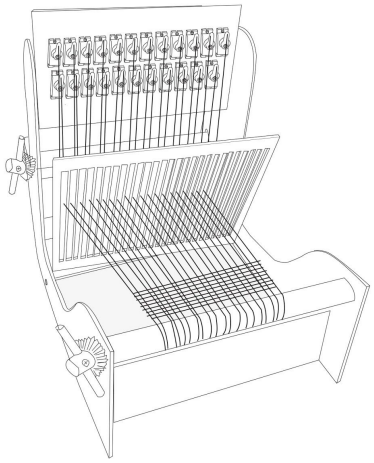
His punch card invention is documented as the first automated loom to store its own information, often considered as the turning point from weaver to machine (Harlizius-Klück, 2017).

In contrast to the above notion, I was intrigued by the approach of Emma Cocker, a contributor to the Weaving Codes – Coding Weaves project, who pulls from the word 'inter', claiming to have no expert level knowledge of either coding or weaving (Cocker,2016). Cocker describes inter to be 'a contingent state of being between, betwixt, amongst, in the midst of' (Cocker,2016). This state describes what I am trying to achieve with my loom. Inter, applied here, refers to my weaving loom not claiming one state over the other, it is neither automated or hand crafted. Instead, it is a unique and enhanced perspective with input from both sides to develop a new way to interact with weave. I propose a way to make clear that technological interventions into the fabric manufacturing process do not have to completely erase human input or history. Instead, harnessing it for new fabrication possibilities for practitioners.

The fabrication of textile relies on weaving patterns, which define how the warp and weft will be assembled (David,2020). Popular weaving styles and patterns differ in relation to geographical location and history (David,2020). Weave and code are often thought to be similar due to the commonality of the two possible states, on/ off, up/ down and 0/ 1 (Sawaya, 2018). Weaving can be represented mathematically using a matrix where 1 stands for warp on weft, 0 stands for weft on warp as well as the inverse (Xin et.al,

2011). This is an idea I draw upon heavily to make a function weaving machine. My arduino program is configured to receive a switch containing 8 0's and 1 from processing. As you interact with the user interface either pressing the numbers 1-through 8 on the keyboard or moving the mouse to the corresponding switch number and pressing the button, the processing sketch communicates with the arduino via serial to turn on the respective servo motor. The up and down motion created acts as the warp, and the left and right motion made by the user acts as the weft to create an interlocked pattern. The warp threads are held by individual servos and move up and down when prompted. My loom is designed in the same vein as a jacquard loom rather than the traditional rigid loom. You can access each warp individually allowing practitioners to design an infinite number of patterns. Pattern designs are limited to what you can research or conjure up as you go as well as the number of servos attached at one time.

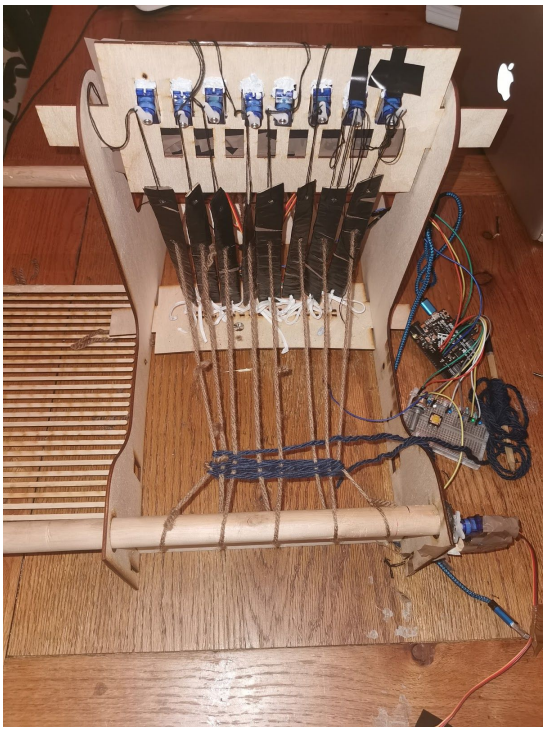
Technical Drawing



My loom is supposed to weave. This does happen and that is a step further than the last iteration. However, the user experience whilst weaving is impacted negatively due to structure and design issues. As I have spent weeks building and learning the quirks to my machine I automatically proceed with a delicate touch. I know my machines' limitations, I built them in. But having the people with knowledge of even weaving try my machine was a great experience as it showed me that what makes sense to me might not make sense to others. In fact the limitations I thought were there were heightened. I sat both my 2 people in front of the machine on separate occasions; one went first, I made a few adjustments, then the other. I explained the instructions to one and told the other to follow the instructions on the screen. The 2nd participants' interactions was particularly illuminating as I made the to machchanges thinking it would improve usability, but that wasn't the case. The first interaction had a built in comb, but I removed it as it was interfering with the thread levels and I gave verbal instructions but I added written ones for commeriality. The 2nd participant found it unsettling to interact with such a delicate frame but she continued. The instructions I wrote we're not specific enough and they could be left to interpretation. She read that she could use the grid to help keep track and not one time did she even try to test it. As she began weaving, pressing 1,3,5,7 she seemed slightly confused at why she had to do with the thread and where the thread should slide through. And lastly she didn't pick up the comb to pat the weave down. The latter point is key in the success of weaving. When she was done she

commented on the delicate nature. I took a few key things from this interaction that will help me better improve the design and user experience for the next attempt.

Digital Loom



More refined versions of my weaving loom would look more refined visually. Not wanting to be tied down into big, robust and difficult to transport shapes, I designed parts to a loom that slotted into each other and could be assembled and disassembled with ease. I didn't want a repeat of last term having to carry an awkward sized structure to and from university every few days. This meant that the foundation was quite weak and not as structurally sound as designing a frame which can be glued or screwed together would have produced. Further developments into shape would include T joints like the boxes on makercase.com, as they can be screwed together solidly but can be

taken apart with some effort. Structural issue with the attachment of the servos also interpreted and how they perform when weaving. My current design has a panel of across the top where the servos are slotted into rectangle holes. These holes appear to be too close together, render the bottom row useless and making more permanent attachment possibilities hard. I underestimated how important this part of the assembly would be and assumed I would be able to slot them in and go. Instead I sellotaped the servo into a secure enough position. Next time I will take the holes at the top and bottom of the actual servo into consideration and screw them into position.

The servo arms are attached to a taut string , cardboard and elastic combination that holds the threads at particular height. Initially I made the frame to hold the threads using springs to keep the tension but this didn't pan out as it would gradually yank down the servo head moving them out of position so the up and down motions were compromised. The elastic works much better as the tension can be adjusted and there isn't as much string on the servo attachments. This ease of tension however slightly changes how big the disparity between the up position and the down position is. The idea is that when the tension is high, the button for the servo is pressed and the tension is released; The elastic snatches the thread towards the base drastically illuminating the up and down positions adding to the users ease and comfort. This is important as when both participants used the machine, they couldn't really see a big enough gap to solidly make the guess where to slide the thread. Instead they stared for a few seconds trying to figure it out.

The user interface will be much more explicit. I came from the point of view that too many words will overwhelm and users wouldn't read it thoroughly. I opted for a short sentence, unfortunately leaving room for misuse. I still make shorter sentences better but I think more needs to be added to leave the guesswork out of it.

In Many African Spaces, weaving is done by poor and underprivileged communities where the skill has been passed down from generation to generation. As my mother and sister both sit at the loom, it is only natural that I acknowledge my privilege and the space I would potentially like to occupy. Though it may sound novel, I would like to take my project further explore weaving machines that are solar powered. My project and the various iterations and spawned ideas stems from this idea. This could be a potential solution to weave automation in Africa where relaguar electricity isn't constant. This machine sits at the cross section between handweaving and digital coding to print an output. The intervention of such technologies in these fields is often seen to both monopolise and exclude those without the means to keep up (David,2020). While some parts of the world have moved on to using fully automated weaving looms, others have held onto the essence of handweaving. This loom potentially seeks to stay away from stark categories as such and exist in the space in between making it comfortable for everyone.

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