**Micro:Bit Beat Box Build**

1. Context

I went to San Francisco to do a keynote for RedHat last year and met the Co.Lab girls who were running a Raspberry Pi Camera workshop. I did a Micro:Bite workshop for them and they loved it so I gave them my set of Micro:Bits to keep. The Director of Co.Lab said that she would love to collaborate with us to develop a Micro:Bit program in the future and I said I would love to. Eight months later, they came back to me and asked me if I wanted to design a curriculum for Co.Lab’s first international program in London. They said they would like to do something with music and the Micro:Bit and I said as our Young Coders MeetUp is very much focused on gender parity and as it is a girl coding program asked to bring in three female young coders from our Young Coders Community. In October we started our partnership with RedHat to discuss the details of the program, which my mother, Grace, co-ordinated and in November we started to plan Micro:Bit and Music activities for our Young Coders MeetUp Development phase. Rehanna Alsoltane ran a Mini.Mu Micro:Bit glove workshop, which inspired me to develop a Musical BeatBox so that a group of people could make music together with Micro:Bit gloves using Radio signals. I ran this workshop at the Tate Modern on the 30th of January, 2019 with Nishka, Avye and Avni inviting 12 girls from Wapping High School and Central Foundation for Girls School. It was really successful - Nishka, Avye and Avni each mentored a table of girls alongside female RedHat Mentors. I felt such a sense of achievement because all the people collaborated so well together to make 3 musical performances. There were 5 million social media impressions just from the day (see @Redhat, @Hackerfemo and @Gowolade).

2. Ideation

I begin with knowing that RedHat wanted a collaborative program to incorporate the Micro:Bit and music.I decided to build on the idea of a musical glove and create a prototype for a collaborative musical tool to enable people to make music together. However as a keen musician ( playing the cello in an orchestra) I wanted to make sure that any music made would sound harmonious and I was fortunate enough to meet up with my first mentor, David Whale, to work out the limits of the Micro:Bit with my idea. He helped me to draw up the schematics for my project. I had to do all the work with David providing critical feedback and steering me in the right direction for the technical aspects of the build . I decided that I wanted to have 4 Micro:Bits and one Speaker on the board that the group of participants played music through. I decided to have each Micro:Bit play different elements of the musical construct; Harmony, Lower Melody, Higher Melody and Rhythm. This follows the music theory that I have learnt playing the cello.

Overall I wanted introduce the Micro:Bit to the participants then get them to build a musical glove which played music when triggered by different inputs. Then, in their groups, they would build to a musical performance where each group (3 in total) collaborated together to make music with their Micro:Bit BeatBox, using their Micro:Bit gloves this time to send radio signals to the Micro:Bits on the Micro:Bit BeatBox. They would have to code their microbit gloves using MakeCode to send signals using different radio groups.

3. The Build

There was three elements to the build; the coding, the designing the boxes to be laser cut and the electrics. The coding first. This involved using MakeCode to program each Micro:Bit to respond to radio signals by playing different notes. Each Micro:Bit had a select amount of harmonious notes it could play. I had Neil Bogie as a mentor for this part. Again, as any good mentor does, he didn’t do any of the coding but gave me support, encouragement and advice when I got stuck. This part was very frustrating and hard going. I had to alternate between Blocks and JavaScript which caused problems of its own, such as code going missing, functions being renamed and amendments being reverted back to previous versions. At the same time I had to prototype the Microbit BeatBox where I encountered a number of dead ends. For example, I couldn’t work out how to get four Micro:Bits to work from one speaker because it required a combination of resistors that dampened the sound. In the end I used two speakers each with one Micro:Bits linked to the left audio channel and another to the right audio channel. When I got the first prototype working at our makerspace, South London Makerspace, our testers said that they weren’t sure which Micro:Bit they were controlling so I added Neo Pixels to the Design. This involved experimenting with the beatbox template for laser cutting to include them and provide access to the Micro:Bit and the speakers.

The third part of the build involved the electrics - all the wiring. Linking four Micro:Bits to two speakers and Neo Pixels to each Micro:Bit -using crocodile clips became unmanageable. This became obvious when I did a demo at BETT and found it really difficult to identify a loose wire. Although, it wasn’t a fantastic 'show and tell’ a third mentor,Thomas Stratford, offered to teach me how to make wiring looms and use rings to connect the wires from the speakers and Neo Pixels to the Micro:Bits. That made the biggest difference creating order out of chaos. I spent hours and hours soldering, crimping, hot gluing and screwing wires together, along with laser-cutting and engraving logos onto the boxes and fine-tuning the code. At the same time I had to develop the workshop outline too, not to mention, going to school.

4. Outcome

It was the toughest project I have done to date, developing something with a deadline, to deliver the workshop at the Tate Modern for a client (RedHat) and to form a team with three other, female, young coding mentors. It was awesome. I hope that we’ve inspired the 12 girls from the schools to carryon coding. I am presently building the musical BeatBoxes to give their schools so they can continue collaborating with their peers. Me and the other young coding mentors will run the workshop in our own communities. All the materials and resources, including the code, has been put on GitHub as open source and Co.Lab will continue the program in the coming months. Overall, I am really pleased with the musical BeatBox as the sounds that come out of it, and the way you have to collaborate, reflects quite a jazzy-style musical experience where improvisation and just jamming works really well. I am looking forward to seeing what other people do with it. I would love to show case what I have done at the Coolest Projects event in March.

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