DATA SCIENCE EDUCATION K-12

Individual Showcase: Data Scavenger Hunt: Actively Authoring Data and Interpreting Movement

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Session Description

The showcase will display a programmable sensor in action for understanding a person's relationship to embodied data collection practices. The activity design is called a *Data Scavenger Hunt*, where participants record data and search through the data to identify different actions within automated graphs. The sensor can be adapted to record many variables from acceleration to light level. Our activity is designed for 8th to 12th graders in out-of-school contexts, so that they explore their physical movement as it relates to data and subsequent visualizations of that data. With this embodied data, there is an inherent relationship to the data, and we explore how that relationship creates opportunities for learning about agency in data collection processes. As such, we highlight the process of active data production rather than passive data collection in our activity. In initial testing, we see how learners are navigating discrepancies between their experiences and the data.

Reflections on Data Scavenger Hunt

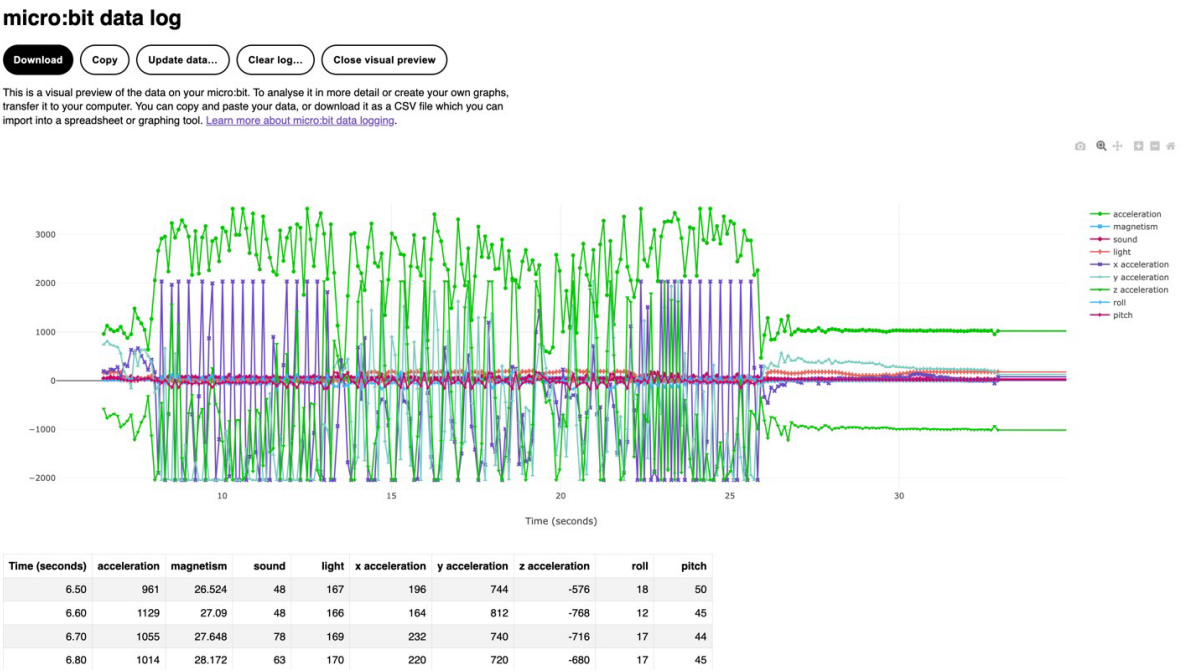
Objectives

Micro:bits, or programmable sensors, offer a way to teach data collection concepts through their data logging add-ons. The programmability and adaptability to decide what to record creates a unique opportunity to gather data with more agency than usual, which opens up conversations for nuanced understandings of active data production (Hardy et al., 2020). In this showcase, we will depict our classroom activity called *Data Scavenger Hunt*, which supports easy data collection on a micro:bit and accessible data visualizations of that data. The activity highlights how data's creation is shaped by humans and how experiences can be represented by data. Designed for 8th to 12th grades, it promotes youth interrogation of data's origins and patterns with self and peer-authored data.

Design

Activity involves pairs where each person has their own micro:bit. The micro:bits are programmed with data logging code, such that they track light level, sound level, roll, pitch, and acceleration as X, Y, Z, and strength. There is a list of activities for each person to complete with the micro:bit recording their performance. The activities may include doing 5 jumping jacks, 5 tosses of the micro:bit in the air, running for 30 seconds, 5 push-ups, or moving the micro:bit in the dark/shade 5 times. Each person completes the same four activities in a random order in private, while keeping track of their order. Then, they return and share their micro:bit data with each other and it is their goal to identify the order in which their partner completed the activities. The pair accesses their data through a micro:bit data log web page, which automatically shows the full dataset (with the option to download as a CSV file) and visualizes all of the variables against time on the same plot as shown **in Figure 1**.

With their graph, youth search for trends and translate them into their partner's actions. This is when youth are expected to discuss with each other about what they are noticing and explain their claims about which sequence they believe their partner used. Some discussions may involve: recognizing what a jump looks like in the graph, deciding which variables work best for their pattern, and asking about their peer's personal choices when executing the activities. They record their reasoning, and they reveal their order to their partner. Facilitators provide technical and social support throughout the session. The design is customizable based on the youth's level of experience with programming and creating data visualizations.



Time (seconds)	acceleration	magnetism	sound	light	x acceleration	y acceleration	z acceleration	roll	pitch
6.50	961	26.524	48	167	196	744	-576	18	50
6.60	1129	27.09	48	166	164	812	-768	12	45
6.70	1055	27.648	78	169	232	740	-716	17	44
6.80	1014	28.172	63	170	220	720	-680	17	45

Figure 1. Example of micro:bit data log and the automated visual preview of data.

Theoretical connections

Similar to prior work exploring personal relationships to data, proximity to data (whether as its experiencer or author) plays a significant role in how people understand and work with it (Lee et al., 2021a). Relationships and interactions with data are situated by a person's knowledge and context (Wilkerson & Polman, 2020). Moreover, data is a human artifact shaped by its author and the tools used for collection (Hardy et al., 2020). Recognizing the situated and contextual nature of data does not always happen in classrooms, where the data provided are secondary sources of experiences that learners have not participated firsthand.

Learning experiences that include the firsthand experience of data generation and collection offer learners insight into the impact of their choices through the process. In their relationship with the data, learners recall embodied activities to make sense and interpret data (Lee et al., 2021b). They navigate discrepancies between their remembered experience and their tool's recording, which especially promotes questioning and inquiry when data is embodied (Ching et al., 2016; Lee et al., 2021b). It is a reminder that data is not objective, and that it is shaped by people and the context. The emerging inquiry in comparing experiences with data is a type of searching for information that is expected to be within the data. This search, or "scavenger hunt", builds intuitive questions around how to examine embodied data at different scales over time and how variables relate to one another in aggregate (Konold et al., 2015). The reflection of embodied sensor data lends itself to the examination of more personal data, where the process of data production may be hidden.

Initial Testing & Implications

Our research team tested this design in a few out of school contexts. Preliminary iterations show that learners are quick to pick up on visual cues in the graph as they relate to embodied movement. For example, if a person is to jump, then there is a clear rise and fall in a few of the acceleration variables. With this, youth will choose to count the peaks or dips to get their best estimate for how many jumps occurred. They draw connections between moment-to-moment movement and specific patterns in the graph. Since youth are creating and recording data about their movement, it

opens the conversation to the privacy of wearables and sensors that record information about their movement. Overall, the activity highlights embodied data collection practices and sensemaking around personally collected data. We believe the searching process may be significant for understanding how youth engage in active data production and requires further exploration.

References

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