

Walk and Draw: Digital Cartography as Artistic Practice for K-12 Students

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Abstract

Creative cartography is a domain in which maps can serve as both a visual form and a conceptual strategy for learning and artmaking. One specific exploration of this domain presents interesting opportunities for students to understand their surroundings as field explorers, employing skills of observation, exploration, inquiry, and presentation of visual information. By navigating the walking paths and illustrating their sightings and experiences on a map, students can develop visual perception and spatial awareness. Traditionally, this process involves handing out printed maps and markers to the students who are then led on a guided walk. Although such an approach fosters students' creativity, problems may arise in terms of lost or crumpled drawings and the limited visual features of the traditional mediums offered. To address these shortcomings, we introduce a digital mapping tool, *Walk and Draw*, a browser-based application that allows students to follow predetermined walking paths while developing their spatial awareness and documenting their creative process. *Walk and Draw* equips students with a GPS-guided map that can be used for walks in any location as well as drawing features provided with different types of pens, customized colors, and user-drawn stamps to help them make visual connections, visualize data, and understand spatial relationships in places they visit.

This project was created as a collaborative undergraduate research experience between multiple disciplines, including communications, art education, and computer science, as well as in partnership with a local public K–12 school. *Walk and Draw* was developed as a browser-based application using the p5js library to enable ease of development and rapid prototyping of ideas. The program itself presents users with a large map of their current area based on a device's current GPS location and supports both touch- and pen-based drawing.

Students can select multiple pen tips and colors and create stamps to record their journey and provide a setting for creative outputs. The aim of using the Walk and Draw application is to enable student creativity, support exposure to their surroundings, and preserve artistic outputs for public exposition. Walk and Draw has been deployed to approximately 50 K–12 students and community members thus far and has received positive feedback.

1. Introduction

Science and computers play a vital role in the development and creativity of adolescents in our world today.² Tools are therefore required to support student interest and development in science, technology, engineering, art, and mathematics (STEAM). This paper introduces Walk and Draw, a collaborative effort between the disciplines of Computing, Arts, and Interactive Media to support students as they navigate the STEAM disciplines. The Walk and Draw application enables students to experience nature while documenting their findings. We have built an open-source prototype system that supports students in conducting and documenting their experiences in varying environments, thereby providing the opportunities for self-reflection and sharing their experiences with their peers. Ideally, Walk and Draw will support students in their lifelong goals of communication, exploration, and creativity. Walk and Draw may be accessed here: <https://efredericks.github.io/Walk-and-Draw/>.

Creative cartography refers to the artistic and innovative representation of geographic information through maps.¹ We incorporated the concepts of cartography into the Walk and Draw application, including a live map overlay, different pen tips for drawing, and user-defined stamps to enable student creativity in documenting their experiences. The application was developed using the P5js library for creative coding.⁴ Within this application we were able to enable users to express their thoughts, feelings, and emotions relating to their environment.

User feedback was positive following an exhibition at the 2023 Winter Festival in Holland, MI.³ Approximately 50 people experimented with the Walk and Draw application at the event. Future plans include conducting additional tests with users, focusing on those within the K-12 educational system. Walk and Draw was created as a tool that could be used as a way for students to express a creative outlook relating to their surroundings while not being limited to a certain path to follow. The remainder of our paper is organized as follows. Section 2 overviews the Walk and Draw application, followed by Section 3 that highlights how this project supported undergraduate research efforts. Section 4 concludes the paper with the students training and artifacts.

2. Walk and Draw Application

This section presents the Walk and Draw application and highlights the Macatawa Strata project.

a. Overview of Application

Walk and Draw is a browser-based application that was developed to provide an approachable interface to creative cartography for K-12 students. The Walk and Draw application was programmed using the P5js framework,⁴ a JavaScript library that is utilized for creative programming. P5js helps to expand programming to non-traditional developers such as artists, designers, educators, and beginners by providing an easy-to-understand documentation library and programming interface. Features of Walk and Draw include a custom pen-tip selection menu, user-defined stamping canvas tools, and integrated GPS background tracking. Additionally, this project includes custom CSS and HTML elements for style and layout, respectively.

b. Initial Requirements

This project was conceptualized as a method to augment existing practices for guided walks, where students currently use printed maps and markers to record their thoughts and experiences. The derivation of requirements for Walk and Draw was a collaborative process between faculty and undergraduate researchers, where feature desires were discussed, prioritized, and translated to technical possibilities. Moreover, the derivation process was useful from a student perspective in understanding and gaining experience in how to coalesce a technical requirements specification from open discussion with stakeholders from both technical and non-technical backgrounds. While we do not present the full list of requirements for presentation purposes, examples of our high-level requirements are that the application must be usable on heterogeneous devices with touch screen support, must include basic drawing features (e.g., pen tips, colors, erasing, etc.), and provide location-based support to show where the user currently is on a live map.

c. Demonstration

We next present a series of screenshots to demonstrate features of the Walk and Draw application. Figure 1 shows an overview of the screen layout and Figure 2 highlights the entrance

pop-up window. Following, Figure 3 represents the size and color of the pen tip and Figure 4 highlights the stamping tool canvases, where users can draw their own stamp and then place them on the drawing area. Figure 5 demonstrates the different pen tips and pre-defined objects available for drawing and Figure 6 shows the map overlay and GPS tracking (i.e., blue dot).

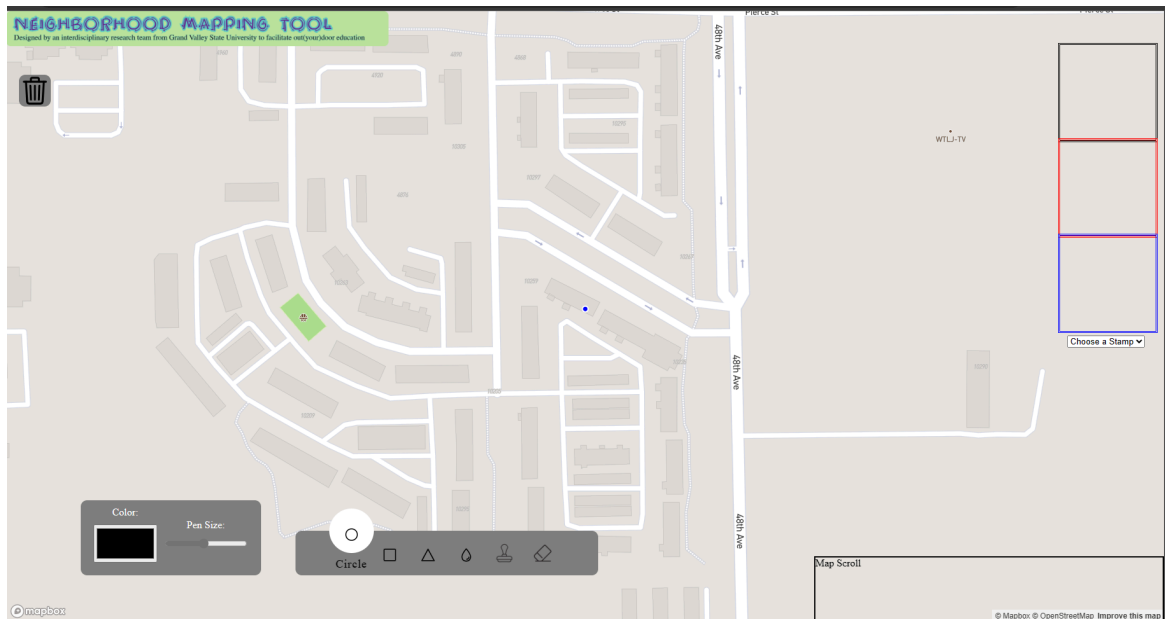


Figure 1: Overview of the Walk and Draw application. The top left corner showcases the “clear” button that allows the user to clear their screen of any drawings. Bottom-left contains: pen color, pen size, and an array of pen tip selections. Side-right showcases the stamping tool, allowing for three stamps to be created and stamped around the screen.

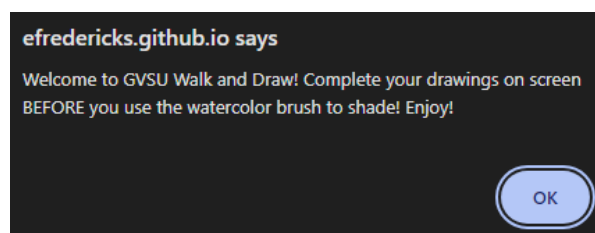


Figure 2: Welcome message displayed to the user upon entrance to the application.

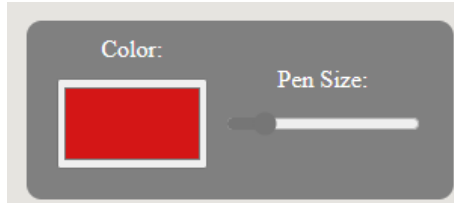


Figure 3: Color selection and size menu. Users can choose from a full RGB color selection menu and various sizes of thickness for pen drawing.

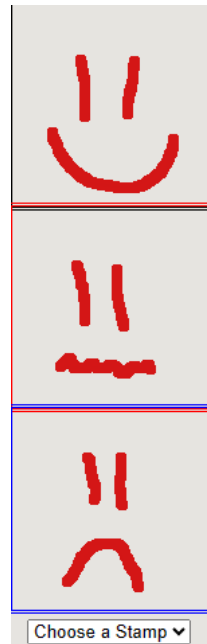


Figure 4: Stamping portion of the screen. Users can use any color, shape, or size to draw on these canvases. The dropdown menu allows the user to select a stamp for re-use throughout the drawing area.



Figure 5: Pen tip selection menu. Users can select circle, square, triangle, water color, stamp, or a spot correction tool (eraser).

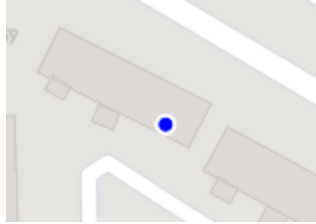


Figure 6: Map overlay with active user location using GPS tracking.



Figure 7: Application displayed on a tablet.

While we have made significant progress on our initial requirements, Walk and Draw is still a work-in-progress application undergoing revision. Following our successful alpha testing we identified several key areas that require iteration, including the user interface, saving mechanism, and providing a method for better sharing of student works. As such, we are currently working on iterating our project based on user feedback. Our GitHub repository may be found here: <https://github.com/efredericks/Walk-and-Draw>.

d. Macatawa Strata - Walks

Macatawa Strata is a continuing project that aims to understand the history of Lake Macatawa and its surrounding community.³ One aspect of this project is to accompany K-12 students on guided walks through the environment, where the students are equipped with drawing tools for cataloging their experiences and are directed to stop and reflect on their surroundings.

Previously these experiences were mainly accomplished with pen and paper, however incorporating electronic storage and the ability to easily share and display student drawings was required by those involved.

e. Assessing Learning Outcomes and Community Feedback

This application is intended for use in outreach activities and supporting K-12 classroom experiences, and as such there are no formal learning outcomes to be assessed. Rather, students are encouraged to experience their surroundings and reflect on its meaning to them and to their community. As part of an initial user test, Walk and Draw was demonstrated to approximately 50 community members of varying age and background.³ Overall user feedback was positive, with some minor points provided that will be used to improve future versions of the application. This feedback includes issues with item selection while drawing and certain user interface elements being improperly placed on screens of varying size. In general though, users were able to immediately use the application with little to no instruction required.

3. Student Training and Project Artifacts

This project was developed as a collaboration between faculty and students in different disciplines, comprising Computer Science, Art, and Interactive Media backgrounds. Each faculty member worked with undergraduate students within their respective disciplines for training and project support. The undergraduate researcher for the Walk and Draw application led its development, met weekly with faculty to develop requirements and tasks and present their progress, and supported deployment initiatives. Undergraduate researchers that worked with K-12 students directly supervised traditional walks and provided important feedback on initial requirements and program features.

The goal of the Walk and Draw application was to support development of an open-source, device-independent application that can be used for K-12 outreach activities in creative cartography. Throughout the development of the project we focused on ensuring that the core requirements of our collaborators were met. In the near term we plan to enhance our existing features and support test deployments to groups of students with the aim of soliciting feedback for future upgrades.

Threats to Validity. This paper presents our application for and experiences in supporting outreach endeavors in creative cartography. As such, we have identified the following threats to validity for this work. First, our application has not been fully tested "in the field" as of yet and still needs to be used by the target age group to fully understand any shortcomings or latent bugs we have missed. Second, we have developed Walk and Draw as a browser-based application

with the intention that it is device-independent. However, we have mainly tested it on iPads and laptops and have not yet tested it on a wide range of devices that may be used during an outreach activity. Third, our device relies on IP-based location information rather than onboard GPS information and may report an invalid position when used on a walk. These threats to validity will be explored in future research activities as we continue development on this application.

4. Conclusion

The Walk and Draw application, a collaborative effort across Computing, Arts, and Interactive Media, is an open source tool for helping K-12 students explore STEAM disciplines as part of the Macatawa Strata project. By integrating creative cartography principles, the application encourages users to artistically represent their experiences and emotions related to their environment. Walk and Draw was presented at the 2023 Winter Festival, where attendants indicated a genuine interest in our application. Moving forward, additional studies will be used to refine the application as needed for its formal deployment.

Future work. This paper has presented a proof-of-concept version of our application, Walk and Draw. As such, we envision the following efforts as future work. First, we aim to revise the interface to provide a more user-friendly experience. Second, we plan to incorporate better mechanisms for saving and sharing student work. Third, we plan to deploy Walk and Draw to our target population of students to ensure that our application satisfies their needs.

Acknowledgements

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References

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