Lines We Trace: Comparing Data Displays to Support Youth Sailing

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Abstract: This submission to the special interactive session aims to develop testable design conjectures for a design-based research project involving a youth sailing camp. Youth sailing involves intensely immersive embodied experiences in boats, but also reflection on broader principles and processes. Coordinating between these two levels is often difficult for youth, particularly over a short time frame in an interest-driven environment. We present two existing tools that we believe have the potential to bridge this difficult conceptual and motivational gap, but involve very different epistemological hurdles. Using both existing footage of the tools in action and interactive reworking, we hope to collaborate with other participants to further specify the affordances and constraints of these tools, and potentially more effectively hybridize them toward our curricular goals.

Overview and background

This interactive session will contrast the affordances of two existing tools—GoPro's latest "gauge" displays, and Re-Shape (developed by the second author)—in the context of youth learning to sail small boats. Our purpose is to consider the potential for each tool to contribute to youth's development along two related lines: 1) coordinating between their experiences in boats and the birdseye view typical of sailing instruction, and 2) considering broader principles of sailing and design.

The first author is in the initial phases of a design study (Cobb et al., 2003) during which she identified a general conception of the "no go zone" as a persistent problem of practice in youth sailing camps. Essentially, the "no go zone" is the range of orientations toward the wind at which it is impossible to sail. During a pilot session, students struggling with this concept were shown video of themselves sailing and asked to think about what they could tell from the video and in particular from the GPS-enabled gauges that show speed and cardinal direction. Preliminary analysis suggests that this task helped students coordinate between their experiences in the boats and the birdseye representations that sailors frequently use to illustrate the points of sail. This coordination appeared to be more salient for the focal student and suggests both that highly interactive technology is useful in this domain, and that more work is needed to facilitate coordination between first-person embodied experiences of sailing and group-level processes.

The second author, by contrast, has done significant work in recent years developing and piloting Re-Shape, which allows students to use GPS data to visualize their movements in space-time and compare these to their peers' movements, as well as to aggregate data from other sources (Shapiro, 2017). This tool grew out of work with museum professionals (Shapiro, Hall, & Owens, 2017), and has been used in classes with pre-service Social Studies teachers to help students think about their patterns of movement in relation to demographic information as arranged on a city grid.

Theoretical framing

This presentation draws from and contributes to a growing body of work looking at what researchers are calling "learning on the move" (Marin & Bang, 2015; Marin, 2013; Radinsky et al., 2008; Silvis et al., 2018; Taylor, 2017; Taylor & Hall, 2013). This term helps to organize a diverse body of work that seeks to both describe how people learn by moving through the physical environment, and use these descriptions to help design learning activities that require such movement. Notably, much of this research has been made possible by the steady development of mobile and location-aware technologies, which provide the capacity to geo-locate media collected by learners as well as to generate location data for and about learners' activities. For example, this body of work encompasses theoretical and empirical work that frames learning as place-based and mobile (Danish et al., 2015; Enyedy et al., 2015; Lindgren, 2015; Taylor, 2017; Zimmerman et al., 2016) or characterizes learning as the process by which people "make places" to pursue their own interest-driven learning as they move through physical environments rich with meaning potential (Leander et al., 2010). Furthermore, it also encompasses efforts to design experiences in urban environments where relations between people and the designed environment are in question (Dennis, 2006; Elwood & Mitchell, 2013), study everyday practices in forested areas or nature parks where relations between people and animals, ground, water or air are the focus of learning (Marin & Bang, 2015; Marin, 2013), and look at technologically mediated activities such as mobile story telling (Farmen, 2014; Sakr et al., 2016) and simulations organized as games (Squire & Klopfer, 2007).

Implicit and explicit epistemological orientations

Traditional youth sailing instruction is an intensely collaborative, hands-on activity. Unlike many classroom structures where youth are expected to listen to detailed instructions ahead of time and then execute once before moving on to the next topic, sailing is understood to be a personal, embodied learning experience—there's only so much that can be achieved through talking, sailing has to be performed and practiced. Even so, a certain amount of instruction happens outside of the boats, sometimes to ensure safety and collaboration, and sometimes in an effort to make connections to broader principles of sailing. The technological tools presented in this interactive demonstration have the potential to help bridge the gulf between broader principles or group-level coordination and individual performance in small boats, but each has its own affordances that influence its implicit epistemological position.

Much like sailing instruction, action cameras such as the GoPro are frequently used to capture an individual's experiences, which can later be shared with an audience on reviewing. While working with friends (or using technological innovations like drones) can allow for more traditional cinematography, most action camera footage is shot either from a first-person perspective (e.g. mounted on a helmet) or first-person-adjacent (e.g. a selfie stick that captures the subject's face or shoulder along with the close-tied footage). The new system of gauges provides a birdseye record by including a location trace and average speed over time. Still, the dominant cultural assumption is that videos are meant to be watched as they are displayed (in real time, or sped up if edited for timelapse). The GoPro footage with coordinated gauges thus shares significant epistemological orientations with traditional sailing instruction—the main action is an individual experience that can be explained to others later, but never quite experienced or shared by those not present during the original event.

The Re-Shape tool, by contrast, emphasizes the group-level processes; while individual GPS traces constitute the most salient data, the focus of the tool is on the aggregate, and on comparisons between group-level aggregate data and imported data displays (such as city-level demographic information). Furthermore, the tool is built to be manipulated, rather than simply watched. Thus, use of the tool is a creative experience implying an active epistemological stance to a productive investigative activity, rather than the passive reception of an imperfect copy of an earlier experience. This tool thus offers the potential for an experience with the broader principles of sailing that is on its face far removed from traditional sailing instruction, but ultimately shares epistemological assumptions behind the curricular decision to just put kids in boats.

Specific commonalities and differences

Both tools involved in this demonstration are aimed at helping students to coordinate between their first-person experiences and a representation of those experiences over time. In the case of the GoPro gauges, the individual camera is coordinated with a birdseye representation of the location and speed over time (see figure 1); in the case of the coordinated multi-angle video, the placement of two of the cameras also adds to the coordination between ego view and birdseye view (see figure 2); in the case of the Re-Shape tool, the first person account is less explicit (i.e. there is no ego-view footage, only the GPS trace; see figure 3).

Both tools also make some effort toward coordinating individual traces with broader phenomena. In the case of the Re-Shape tool, individual GPS traces are visible on a map over which other individual traces can be overlaid. The map itself can also include relevant large-scale data displays—in the case of the social studies class, demographic data from the city was included to illustrate a curricular point. With the gauges, more of the work of coordinating with broader phenomena is left to the user—the gauges include a trace of the average speed, and a GPS trace over time, but there is little scaffolding to coordinate these even with each other, let alone with geography or wind, which are the curricular goals.

Finally, while in both cases the user is able to move through space-time as represented in the tool—either by scrolling the video or by manipulating what data are displayed—the Re-Shape tool is specifically designed to invite this kind of reworking of the data display, whereas the GoPro gauges are simply an add-on to video, which is often read by users as a passive display.

Table 1: Major design features of each tool (see figures 1–3 for illustrations).

Design feature	**Conjectured contribution to learning**	**GoPro Gauges alone (figure 1)**	**GoPro Gauges w/ coordinated display (figure 2)**	**Re-Shape tool (figure 3)**
GPS trace	help establish third-person perspective & continuity over time	upper left corner	upper right corner	main display

First-person view	make explicit connections to first-hand embodied experiences	none	secondary displays	none
Coordination with other data sources	help coordinate between first-hand experience and group-level processes	none	tertiary display of static map	secondary display (e.g. demographic data) integrated into main display
Invites manipulation	provoke exploratory epistemological stance (vs. typical "received" knowledge)	less apparent	less apparent	major goal of tool

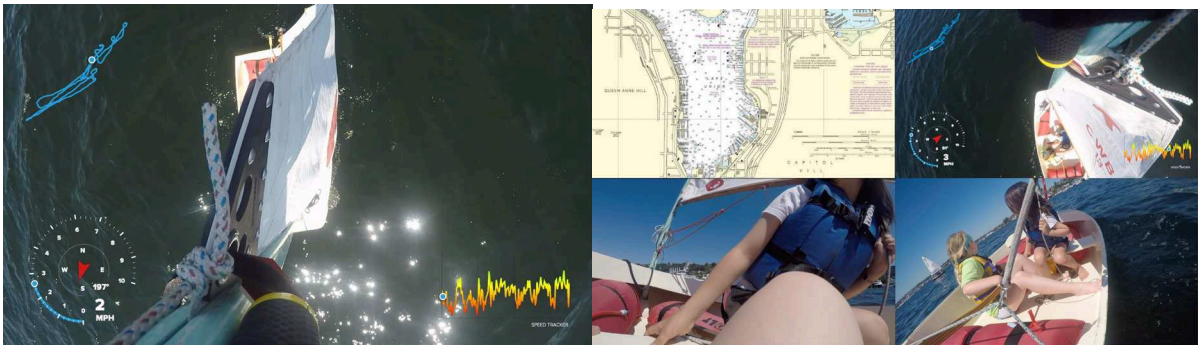

Figure 1 (left). Screenshot of top-down boat-level video showing GPS displays, as shown to students.
Figure 2 (right). Screenshot of coordinated video from three cameras (and a static chart) showing GPS displays.

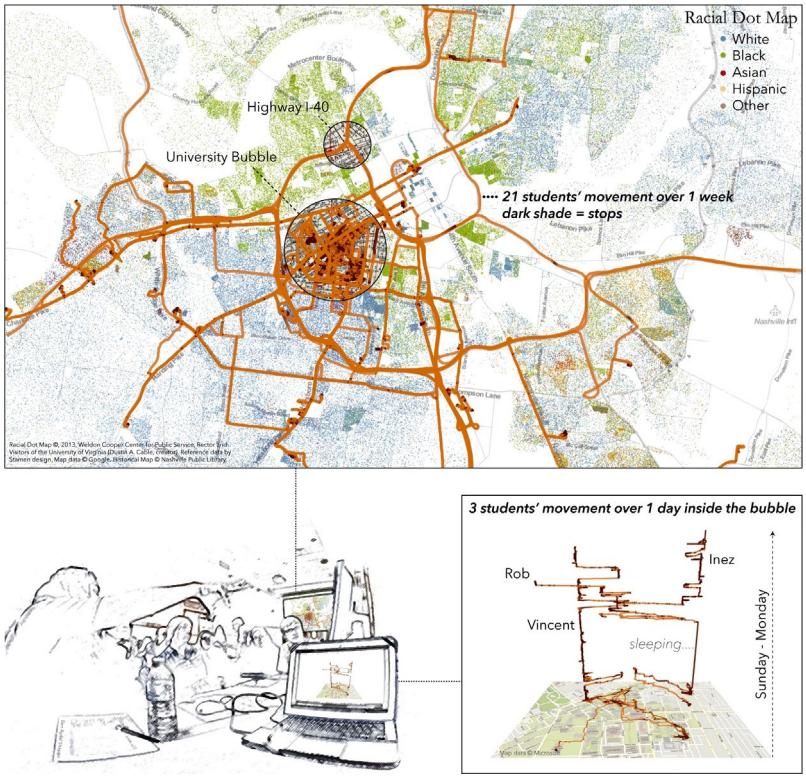

Figure 3. Screenshot from Re-Shape tool (top and right) with still of pre-service Social Studies teachers (left). Full demonstration available at https://youtu.be/H8vd_HX9RVs.

Next steps

The aim of this interactive demonstration is to generate testable design conjectures, whether from existing tools or novel hybridizations (or novel tools). Given that we intend to approach this problem with youth, we are hoping to think through some of the assumptions and potential stumbling blocks with colleagues and potential collaborators before we iterate in practice with young sailors.

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