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Here-and-Then: Learning by Making Places with Digital Spatial Story Lines

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Abstract

In this article, we introduce and analyze learning experiences made possible by a teaching framework that we have developed and call *digital spatial story lines* (DSSLs). DSSLs offer a novel approach to learning on the move by engaging learners with related conceptual practices of archival curation, digital mapping, and the production of public history. Learners collaborate to make and follow map-based story lines that bridge archival media they curate in public libraries and museums onto city neighborhoods these media describe. Story lines can be followed as tours to explore under- or untold stories about a city's public history at walking scale. To illustrate and study learning within the DSSL framework, we describe and analyze one design iteration from a larger, multi-year research project with local museum, library, and high school partners. Our analysis shows how making and following story lines provided opportunities for pre-service social studies teachers to engage with and learn about the public history of racial segregation, Civil Rights Movement activism, and American Roots Music in Nashville, Tennessee (aka the "Music City"). Our analysis focuses on using archival material to create and share public history as a mobile experience of being both "here-and-then"—a form of palimpsest in which learning on the move layers together historic places and the voices of different historical actors. We end with a discussion of who speaks for the public history of city neighborhoods and the prospects and limitations for teaching and learning with the DSSL framework.

Introduction

A growing body of research develops and studies activities where youth learn by moving through the physical environment. Some of these activities occur in urban regions where relations between people and the designed environment are in question (Cope, 2008; Dennis, 2006;

Gordon, Elwood & Mitchell, 2016; Elwood & Mitchell, 2013; Taylor, 2017; Taylor & Hall, 2013), while others occur in forested areas or nature parks where relations between people and animals, ground, water, or air are the focus of learning (Marin, 2013; Bang & Marin, 2015; Marin & Bang, 2015). Much of this research is possible because of 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. Learning scientists initially used these capacities to support youth participation in scientific practices of data gathering and modeling (e.g., Roschelle, 2003; Tinker & Krajcik, 2001), but with the adoption of smart phones, tablets or other location-aware devices, there has been an ever-increasing range of educational uses. For example, researchers now use these capacities to study learners as they engage in mobile story telling (e.g., Farman, 2012; Price, Jewitt & Sakr, 2016; Sakr, Jewitt & Price, 2016), enter into augmented reality simulations that are organized as games (Squire & Klopfer, 2007), and participate in public processes of urban planning and community development (Dennis, 2006; Elwood & Mitchell, 2013; Taylor & Hall, 2013).

Many of these research projects include aspects that would qualify as a new genre of learning on the move (the topic of this special issue). Learners (youth or adults) engage in activities which require their own mobility for participation (e.g., interacting with landmarks in an AR game environment that uses their moving location). Digital data about their movement and activities are captured and become part of the content of what is learned (e.g., creating waypoints in a conventional use of geo-caching). New forms of interaction and learning are emerging as these socio-technical practices develop, but as Price, Jewitt and Sakr (2016) point out there is,

> … a lack of research that examines how the different representational forms of digital augmentation shape action, interaction and reflection during a digitally augmented mobile learning activity. A key question is how learners use and link this digital information with physical information: what physical information they attend to in relation to the digital, how they interpret the physical in the context of the digital information and how this shapes their understanding of 'place'. (p. 346)

We would add that there has been little attention to mobility as an embodied resource for sense-making and learning (Leander, Phillips & Taylor, 2010; Streeck, 2015), either as it contributes to processes of learning or as something that can be used in designs for learning.

This article introduces and analyzes learning experiences made possible by a teaching framework we have developed and call *digital spatial story lines* (DSSLs). As a teaching framework, DSSLs are a way of "telling about society" (Becker, 2007) that positions people (e.g., students) as story tellers and listeners. DSSLs invite learners to make (or write) stories as layers over interactive digital maps, organized as a path or "story line" through places and regions (or neighborhoods) that can be shared with others, who follow (or "read") story lines as if experiencing a narrative tour. Story lines in the DSSL framework are digital and spatial by allowing learners to use interactive digital mapping and mobile technologies to index and experience digital media such as photographs, news articles, oral history recordings, or popular music. Media found in city libraries, museums, or online archives can be associated with (indexed to) particular places, paths (e.g., streets), and regions (e.g., neighborhoods) to tell stories about the local (in this case urban) environment that the media are "about." Story lines created in the DSSL framework are thus comprised of narrative elements about places (points on a digital map) and paths (lines on a digital map) typically experienced by characters in a story and layered across particular neighborhoods (regions on a digital map) in an environment—in our case Nashville, TN, also known variously as the "Music City". In our design research, the Music City provided a unique unique environment in which to develop DSSLs in relation to the intertwined public history of American Roots music (e.g., gospel, blues, rhythm and blues, and country) and American Civil Rights Movement activism. Both are forms of cultural production and activity that have a rich history and are ongoing in Nashville (i.e., protest or "issue songs" and efforts to slow or redirect the rapid gentrification of city neighborhoods, which displace the working poor and communities of color).

As a teaching framework, we intend for DSSLs to allow learners to bridge multiple and historically separate conceptual practices that each support particular forms of learning. In particular, the DSSL framework invites learners to engage with conceptual practices of professional curation by engaging in archival work to find, select, and organize historical sources (media) and use digital mapping, mobile technologies, and their own bodies to assemble and display narratives as map-based stories that can be used to explore city neighborhoods. Learning

with DSSLs (as intended) happens as learners work together to bridge archival material from library or museum holdings onto the city at walking scale through their map-based story lines. In effect learners are "jail breaking" material that was carefully curated and conserved in public or private collections, in digital form, by making it available as locative media in the very places it represents or "is about" (i.e., imagery, sound or text served to the user on a hand held phone or tablet, in and about a place, path or neighborhood). Likewise, the DSSL framework invites learners to create, share, read and listen to public history about places with rich but often forgotten cultural heritage and legacy (i.e., under or untold aspects of public history in city neighborhoods). Learning with DSSLs is both place-based (Gruenwald, 2003) and organized as a more critical practice (Nespor, 2008) of making (for tellers) and following (for readers or listeners) the history of a city by ordinary residents (including youth) of that city. As a form of learning on the move, mobility is crucial both as the *means* and the *content* of what is learned in the DSSL framework.

This paper is organized as follows. We begin by discussing theoretical perspectives and concepts that inform DSSLs. Subsequently, we illustrate and study learning in the DSSL framework by analyzing one design iteration from a larger multi-year, design-based research project with local museum, library, and high school partners. During this design iteration, pre-service secondary social studies teachers enrolled in a human geography course at a private, research-intensive university used DSSLs to engage with relations between social activism and music in order to learn about the multi-faceted and contested stories of American Roots Music and Civil Rights Movement activism in the Music City. We conduct three levels of analysis, one of which adapts and shows the generalizability of a new dynamic visualization tool we have developed in previous work and call the Interaction Geography Slicer (IGS) (Shapiro, Hall & Owens, 2017; Shapiro & Hall, 2018). Findings and discussion illustrate the prospects and limitations for teaching and learning about public history within the DSSL framework. This paper concludes with a critical discussion of who speaks for the public history of city neighborhoods.

Theoretical Perspective and Concepts

The DSSL framework integrates theories and concepts in the learning sciences and social studies in novel ways to support new approaches to learning on the move. In this section of the article,

we synthesize research and theoretical writing on the nature of "place" in human experience and how socio-technical practices with locative media may contribute to creating aspects of here-and-then that support meaningful learning experiences relevant to social studies education. This framework on learning in relation to here-and-then is carried through the empirical analysis in the remainder of the article.

The conceptual basis of the DSSL framework (and story lines made or followed within this framework) is in part based on our own experiences of being in locations where historical events "took place", engaging with media like photographs or music that bring people or sounds from those events into the present, and feeling a kind of displacement or extension of our bodily selves from the here-and-now towards deeper understandings of what may have been experienced by historical actors "here-and-then". For example, on April 19, 1960 in Nashville members of the Student Nonviolent Coordinating Committee (SNCC) and local clergy led a march to the county courthouse, walking in silence to protest an early-morning bombing at the home of a Nashville attorney and city councilman. The councilman was representing student protesters arrested during sit-ins at downtown businesses, the jails were overflowing, and White patrons were avoiding downtown businesses as White hooligans began assaulting non-violent protesters. According to press coverage, silent marchers snaked through the city and surrounded the entrance to the county courthouse. With silent protesters surrounding the mayor, Ben West on the courthouse steps, SNCC Director and Fisk University student Diane Nash asked whether the mayor thought it was morally right to sell products to Black people, but not to let them sit in restaurants or to use facilities where they shopped. West's answer was personal—he felt it was not moral to do so—and given the press coverage, this began a process through which downtown business voluntarily desegregated. This cemented Nashville's reputation as a test bed for forms of non-violent protest, although efforts to end segregation in the city would continue for decades (arguably into the present).

When approaching the courthouse steps today, one passes over a grass-covered public area (usually empty), climbs a series of stone steps, and arrives at bronze doors leading into a massive stone building. This is the place where Ms. Nash asked her question, but other than a brass plaque noticed by our students and incorporated into their story line, there is no physical evidence of what took place in 1960—specifically the hundreds of silent faces surrounding Mayor West and Ms. Nash, clearly visible in historical photos of the event. A primary goal of the

DSSL framework is bringing archival media to the courthouse steps, as part of making and following story lines that persist as a form of public history in digital overlay. Engaging with historical media while in place, we argue, creates an experience of "touching the past" (Auslander, 2013; see also Brædder et al., 2017), in which modal engagements with media and location come together to furnish a place that is both here-and-then, and to "place" people in a liminal position as a learner (e.g., both a student in present time, and a student protester in past time).

Describing these layered moments in the context of reenacting traumatic events, Auslander (2013) quotes from a young African American man participating in the reenactment of a slave auction:

> I can't explain it something happened to me up there, standing on that block. I looked out there, and it wasn't just my eyes I was seeing through. I was seeing what somebody else saw, a long time ago, being torn away from everyone they loved. I felt what my ancestors must have gone through… Up there on that same block, I guess you could say I was touching the past and, the past, well, it was touching me. (p. 162)

We do not advocate putting learners in reenactments that would re-inscribe historical trauma, nor do we think a juxtaposition of past and present, alone would necessarily support learning. Instead, by designing and studying how learners make and follow story lines in the DSSL framework, we hope to create and use experiences of here-and-then that invite interprative use of historical materials and deepen their understanding of public history.

Clearly the sites described above (a slave auction block, the courthouse steps) are more than coordinate locations in mid-South cities—points or lines that can be found with smart phones using GPS signals and a digital street grid. Depending on how human presence is contextualized, they become places that can create a deep resonance between life in the present and a living, cultural past. This distinction between measured space and lived places has been a theme in critical geography for several decades (e.g., Anderson, 2008; Soja, 1998; Massey, 2005), and it informs our understanding of how places are made (told) and followed (heard, by and with bodies on the move) along story lines in the DSSL framework. While learning can be deeply informed by or based in places (Gruenewald, 2003), these places are themselves not static or entirely local (Nespor, 2008). They are constantly under assembly and potentially open in

their meaning, and it is in this open sense of assembly that we argue people also can learn by making places. As the critical geographer Doreen Massey (2005) argued,

> … space is always under construction. Precisely because space on this reading is a product of relations-between, relations which are necessarily embedded material practices which have to be carried out, it is always in the process of being made. It is never finished; never closed. Perhaps we could imagine space as a simultaneity of stories-so-far. (p. 9)

If spaces are layered in this way—made up of a simultaneity of "stories-thus-far"—then they are also fragmentary and multiple, open to many possible meanings. For example, when passing through a city street intersection, one enters a dense "semiotic aggregate" (Scollon & Scollon, 2003) made up of signage (including advertising), paving that divides the road surface into marked lanes, and traffic lights cycled by code and (increasingly) sensors that detect vehicular and pedestrian traffic. These layers of cultural material shape meaningful human activity, often in powerful ways that can restrict access for people, prohibit or constrain their activity, and selectively provide (or withhold) information they might find useful (e.g., Shaw & Graham, 2017, ask who has an "informational right to the city" in the current context of large-scale, opt-in data gathering).

Asymmetries of power and information layering are important, but they do not entirely determine the experience of mobility in and through places, along paths, or in city neighborhoods. The DSSL framework assumes that places are made (at least in part) through processes of augmentation and selective assembly, as people move in and through city neighborhoods. What appears as a "point" in mapped space can be engaged as a "place" while on the move (or not), and in similar fashion, lines can become paths, and regions can be experienced as neighborhoods. Layers of cultural material that have come before (i.e., "stories thus far") can be followed up in present activity, but it is also possible to add layers of one's own, and to share these layers with others. In this active sense, we think of and design for learning as making and following places—the drawing together of "stories-thus-far" with what people bring to or enact while moving through places in the city.

These assumptions align with a steady influx of social studies research on place-based learning and learning with digital tools and resources (Kerr, 2016; Mason, Berson, Diem, Hicks, Lee, & Dralle, 2000; Resor, 2010; Craig, 2017). This research speaks to the persistent value of

engaging with historical reasoning and moving into and through places to leverage local histories for learning. In particular, when exploring places where historic phenomena occur, geography practices compliment the practices of historical analysis. For example, Alibrandi and Sarnoff (2006) used Global Information Systems (GIS) to engage learners in investigations of questions like, "How did this happen here? Why here and not somewhere else?" In a different line of work, Shaver (1981) asks "How can the school contribute to the continuity of the society by preserving and passing on its traditions and values while also contributing to appropriate social change by helping youth to question current social forms and solutions" (p. 125). How can learning in social studies, and in history classrooms more specifically, be about the past but also look to learning that connects past (what was) to present (what is) and to the future (what could be/what we could make it)? These questions naturally blend historical inquiry with spatial inquiry and invite re-thinking how disciplinary practices in both geography and history can lead to rich conceptual understandings and meaningful learning.

DSSLs also draw from the concept of a "palimpsest of place" (Graham, 2010) to describe processes of drawing together or mixing virtual and physical information in place, to support human activity in the present or for the future (e.g., using OpenStreetMap tools for crowd-sourced disaster mapping). In literary studies, "palimpsest" refers to faint traces of earlier writing when parchment (animal hide) was cleaned and re-used by subsequent authors. In our usage (following Graham), we refer to the layering together of diverse sources of information that can lead to striking juxtapositions when layers are read (or experienced) in relation to each other in place (e.g., using historical media to re-contextualize the experience of a place like the courthouse steps, described above). As public uses of location-aware devices and information sharing infrastructures have grown (i.e., Web 2.0 communication standards), people other than professional geographers or cartographers have gathered, produced, and shared layers of information about (and linked to) places of interest. "Neo-geography" practices of are no longer the exclusive domain of professionals and may, as Wood (2010; Bryan & Wood, 2015) argued, bring about the "death of cartography" and the rise of "counter mapping"—making and sharing maps that "talk back" to official versions of human activity in places, and so offer a spatial form of counter narrative that can bring forward under- or un-told stories about history and culture.

Notions of counter mapping highlight several practices of historical thinking that we have adapted in DSSLs (e.g., Seixas & Morton, 2013; Wineburg, et al., 2011). We focus in particular

on practices of contextualization and sourcing, and we seek a balance between approaches that encourage a learner's sense of agency in choosing topics for historical inquiry (e.g., when exploring primary source material, what are personally-relevant questions for inquiry) but also guard against naïve forms of "presentism" (e.g., conflating today's values with those of the historical context being studied, or interpreting historical sources without considering the perspective either of historical actors or the authors of source texts).

Making a story line in the DSSL framework requires attention to the perspectives of historical actors in source material and locating these materials in time and place when necessary for narrative coherence. As our students gathered and combined archival material to make story lines, they made inferences that connected source materials to the broader historical context and considered what historical actors might have perceived or experienced (Seixas & Morton, 2013). We see this as an alternative to teaching social sciences in ways that lose the "story" of public history, resulting in lists of named events and actors, ordered through time in what Calder (2013) has called "chaos stories" with little or no narrative coherence. Calder attributes this loss of coherence to a focus on sourcing as a discrete academic skill (e.g., a shallow use of sources to answer document-based questions), rather than focusing on historical narratives as an interpretive practice of sense making. The DSSL framework similarly focuses on sourcing and contextualization as resources for telling under or untold stories as an approach to making public history when teaching social sciences.

Our goal in the DSSL framework has been to invite students to use primary sources as central evidence and to build map-based stories in ways that reflect what is known about the broader historical context. Our designs are open to students' interest and background experiences, but we also intend to engage learners with historical thinking practices that ground story lines in plausible interpretation and (re)tellings. Doing so frames history not as a single narrative but rather a collection of narratives, including those that challenge or counter the dominant or taken-for-granted accounts that circulate in more formal teaching. For example, McKnight and Chandler (2009) argued that there is value in students creating historical stories of resistance in social studies classrooms. When students are positioned only as passive recipients of historical narratives, we give the impression of a singular historical truth and devalue (or erase) students' experiences or accounts of historical events that circulate in their own cultural

community. This can position students from traditionally marginalized communities not as historical actors, who can change society, but as people upon whom history acts.

In summary, the DSSL framework integrates work in the learning sciences and social studies to explore how people can learn in practices of making, sharing, and following stories about human activity and culture that are about and organized along places, paths, and neighborhoods and rendered (or made portable) in the form of interactive digital maps. If, as Goodwin (2017) argued, all human sense-making is organized and layered over "substrates" of what has come before, organizing present experience and projecting future action by drawing selectively from resources in this substrate, then our development of DSSLs as a teaching framework seeks to make use of forms of sense-making and learning that have long been part of human society. In this sense, learning by making and following story lines about public history offers a new way of "telling about society" (Becker, 2007) that can be explored in collaborative design research between learning scientists, researchers and practitioners in social studies education, and communities engaged with this research and teaching.

Empirical Setting and Methods

The empirical setting of the design iteration analyzed in this paper was a human geography course required for prospective teachers of high school social studies. The course included readings across a range of disciplines and topics, including: critical geography (e.g., Soja (1998) on spatial justice in cities), teaching new forms of spatial thinking and analysis (e.g., Taylor & Hall, 2013), using counter narrative and counter mapping to understand community history (e.g., Solorzano and Yosso (2002) on counter-storytelling), the history of African American contributions to American Roots Music (e.g., Hughes (2015) on relations between country and soul music in Nashville and Memphis, TN; see also Brook, 2014 and Carawan & Carawan, 1995), and racial discrimination in programs for urban renewal over the recent history of Nashville, TN (e.g., Houston (2012) on routing an inter-state highway through the city during the 1960's and 1970's).

In total, seven pre-service teachers enrolled in the course and took part in this design study. Empirical data were gathered over five days of instruction occurring mid-way through the course during which the DSSL teaching framework was used. Data collected included multi-perspective audio and video records of students' interaction in the classroom and in city archives

(i.e., using table-top and stationary cameras) and as they moved through city neighborhoods (i.e., students wore digital cameras and audio recorders). Data also included students' assignments, photographs of students' work, and digital maps or other artifacts produced by students. Altogether, the resulting corpus of materials was extensive, including over 70 hours of digital video and audio with location data (i.e., GPS tracks) captured as students walked in the city. Importantly, students also completed a pre/post task we called a "Day in the Life" story telling challenge before and after they made, shared, and followed story lines. This storytelling challenge consisted of a table-top environment that included maps (from the 1960s and today), news articles (e.g., front pages from two Nashville newspapers on the day of the Silent March), and historical photographs taken by news photographers at major events in the city during the sit-in movement (e.g., photographs of protesters being led out of downtown businesses and arrested). Specifically, we asked students in teams to create a map-based story about a Day in the Life of characters of their choosing from the historical photographs. Student teams worked for approximately an hour on this task, and we captured video and audio records of their talk, exploration of maps and other media on the table top, and their presentation of map-based stories to peers and the course instructor.

A DSSL Activity Structure for Bridging Archives to City Neighborhoods

The DSSL activity structure used in this design iteration illustrates one of many possible approaches to teaching with story lines in ways that use mobility to bridge between classrooms, public archives, and city neighborhoods. We briefly describe the organization of three activities taught during class sessions (over three weeks). Students' responses to and work during these activities are used as data in our subsequent analysis.

Activity 1: Working with archival material

Students (organized in teams of 3 and 4) visited the archives and gallery spaces of our local library partner. To start, students worked with archival material provided by the library related to the history of two city neighborhoods—the historic Jefferson Street corridor, home to once-famous musical venues and a vibrant African American community from the 1940's to 1970's, and the downtown Nashville business district, site of lunch counter sit-ins and an economic

boycott protesting segregation during the same historical period. Students also had access to what we called "sandboxes"—collections of photographs, oral history recordings, maps, and "chart topper" songs related to music and social activism from the 1950's through the 1970's in Nashville. They were tasked with choosing a topic related to cultural heritage and civil rights activism, and they curated digital copies of relevant archival materials that could be used to tell an historical narrative at walking scale in one or the other city neighborhood.

After working with the archive and developing a topic/theme, students developed a plan for making a digital, map-based story line that used archival materials they had selected to create a walkable, tour-like path through the city. One team planned to focus on the downtown business district to tell about lunch counter sit-ins in the 1960's, organized by members of the newly formed Student Nonviolent Coordinating Committee (SNCC, led in part by Dr. James Lawson), which eventually led to the desegregation of downtown businesses in the Music City. We refer to these students as the Nashville Civil Rights Tour (NCRT) team in the remainder of the article. The other team planned to focus on an Interstate highway project that began in the late 1950's and significantly impacted the predominantly African American community along Jefferson Street (e.g., razing business and entertainment districts and leading to resident displacement for purposes of "urban renewal"). We refer to these students as the Historic Jefferson Street Tour (HJST) team in the remainder of the article. Figure 1 shows the NCRT team working in the library archives (left image) with a "Shoppers & Visitors Map of Downtown Friendly Nashville" (circa 1956), which they carried into the city while making their story line (right image) about civil rights activism and lunch counter sit-ins in city.

Figure 1. Pre-service teachers on the Nashville Civil Rights Tour (NCRT) team explore the history of civil rights activism in public archives (left image), and then they walk digital media they have curated into the city neighborhood these media describe (right image).

Activity 2: Walking archival materials into the city to make a story line

In the second activity, each team visited the neighborhood in which their historical narrative would take place, walking paths and visiting places to geotag digital media along a story line they were making in the city (i.e., bridging archival media to the city at walking scale, as shown in the right image of Figure 1). Students used an application called LiveTrekker™ on their smart phones to capture a GPS track and associate curated media (e.g., photographs, audio recordings) to this track as they walked and began to "make" their story line through their respective city neighborhoods. While walking they discovered things not found in the library archives, and used cameras on their phones to add these as elements to narratives about places along the story line. Following this activity in the city (and before sharing and following story lines), students refined and organized their stories about historical events (i.e., by editing their stories outside of class) to produce a final map-based story line in the LiveTrekker™ app. Each team also made a song playlist, provided as a "soundtrack" to accompany their story line. Thus, their final products were map-based stories about historical events in Nashville neighborhoods that could be followed by walking along a path shown in LiveTrekker as an interactive digital map. Places along this path were described in "blog entries", using a combination of text, photographs, voice recordings from oral history interviews, and songs (available on an accompanying playlist). For example, Figure 2 illustrates parts of the LiveTrekker interactive interface and three of 54 different blog entries from the story line made by the NCRT team exploring civil rights activism in downtown Nashville. The first blog entry (left image in the figure) quotes from a speech given at Fisk University by Dr. King as the sit-in protests were underway; the 42nd blog entry (middle image) presents a selection from an oral history interview in which a past-time participant describes a "Silent March" by over 3000 protesters after the bombing of the home of an attorney representing incarcerated student protesters. The oral history selection plays[1]:

> You got downtown, it was like si:::lence! All you could hear was ((*makes sound of footfalls*)) No::by laughin' no::body talkin' ((*repeats sound of footfalls*)) And it was like-

[1] Transcript conventions for talk by students or other voice recordings include: stretch:::ed pronunciation is shown with embedded colons; ((*activity descriptions*)) are italicized within double parens; emPHASIS is shown with capitalization; left brackets show the [onset of overlapping talk across turns.

and its- as they would go by... It almost had the effect on the men working downtown, as nine one one had, you know how you just saw like... This can't be real! Because you got this big- like a grea::t big snake of people comin' out of this community. And the silence. But it was SO:: powerful. It was SO:: clever, it was like- like history froze for a moment.

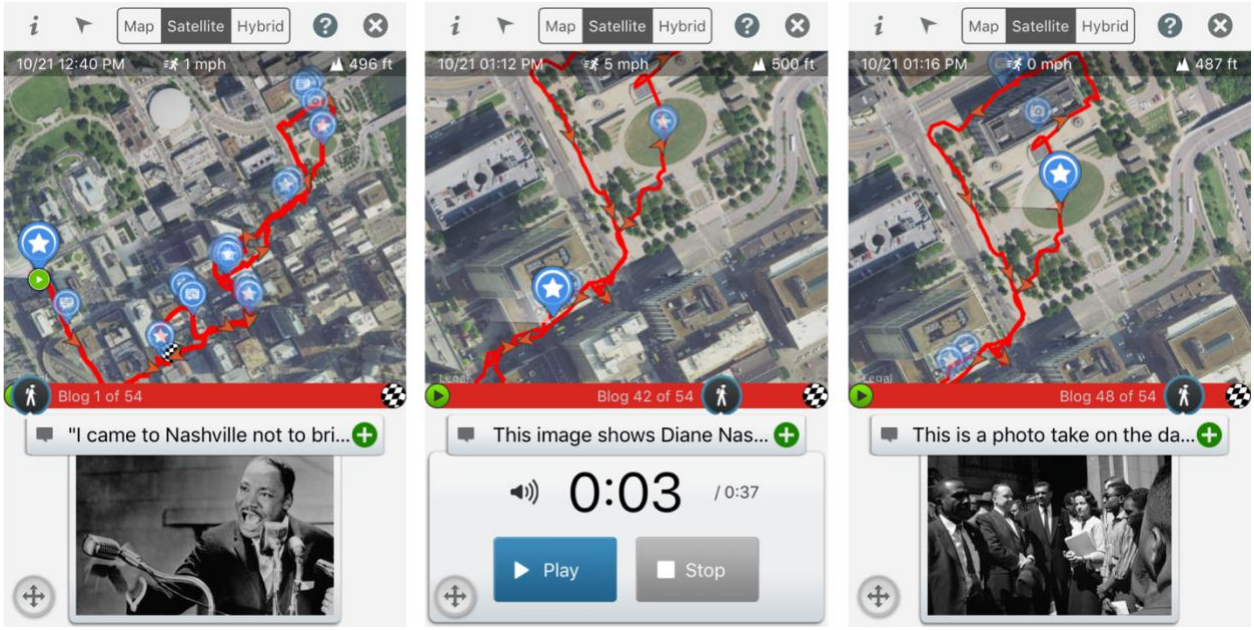

Figure 2. Three of 54 blog entries from a map-based story line made by a team of pre-service, secondary social studies teachers (NCRT team), telling the history of lunch counter sit-ins as part of non-violent protest against segregation and racial discrimination in Nashville, TN.

Activity 3: Following story lines in city neighborhoods

In the third activity, each team shared their story line by sending a URL to members of the other team, who then followed their peers' story line by visiting the city neighborhood it described and walking together as if on a guided tour. While following story lines, each team typically had the LiveTrekker application open on several phones, and they also listened to the associated song playlist either using headphones or by turning one phone's speaker on at maximum volume (i.e., to create a shared soundscape with their peers). In this way each team could experience a mix of archival media (i.e., digital photographs, text, audio selections from oral histories, and songs) while walking along a story line in the city.

Importantly, consistent with the intentions of the DSSL teaching framework, media stored in public archives (in this design study, the library) were carried into and indexed onto places in the city by "makers" of story lines, and these same media were later available to augment the experience of places encountered by "followers" along the story line.

Learning While Making and Following Story Lines

To explore learning while making and following story lines we conduct three interrelated levels of analysis. First, we use a dynamic visualization tool—the Interaction Geography Slicer (IGS; see Shapiro, Hall and Owens (2017))—to provide an overview of how making and following one teams' story line (the Nashville Civil Rights Tour) is organized over space and time at a walking scale (Activities 2 and 3). Subsequently, we use the IGS to select two sequences of interaction, one from each student team (makers and followers) for more detailed analysis and use traditional methods of interaction analysis (Hall & Stevens, 2015; Jordan & Henderson, 1995) to examine the embodied experience of engaging with the palimpsest of place—being here-and-then—while making and following a story line. Finally, we compare and contrast team performances on the Day in the Life pre/post story challenge.

Analysis of mobility while making and following story lines

Figure 3 is a screenshot from the IGS that visualizes and integrates different sources of data collected from the NCRT team making (Activity 2) and the HJST team of students following (Activity 3) a story line the makers titled, "Nashville Civil Rights Tour." Since IGS visualizations will not be familiar to education and learning sciences researchers, we explain how to read this static display and how the dynamic visualization capabilities of the IGS help to analyze making and following story lines as phenomena that extend over space and time.

Figure 3. Screenshot from the IGS showing data from 2 teams of students making (blue) and following (red) the Nashville Civil Rights Tour story line. © Authors. Reprinted by Permission.

On the left of the figure is a conventional digital map of 2D space showing where the makers' story line was located (i.e., "plan view"). Overlaid on this map are two colored paths: The blue path shows the movement of the NCRT team making this story line (i.e., the path walked and captured in LiveTrekker during Activity 2), while the red path shows the movement of the HJST team, as they later followed the story line (i.e., in Activity 3). Darker shades of color along each path indicate where teams stopped, while lighter shades indicate where teams were moving. The right of the figure shows each team's movement in a "space-time view" where time is measured on the horizontal axis in minutes. The vertical axis in the space-time view mirrors vertical movement in the plan view. Horizontal movement in the plan view is not represented in the space-time view. The map or plan view can be freely rotated and scaled, which changes what is visible in the space-time view (i.e., the analyst can "slice" through interaction visually by changing the scale of space and time). Importantly, the starting point of each teams' movement in the space-time view is aligned in space-time to support comparative analysis even though teams respectively made and followed this story line at different times.

Figure 3 also displays turns at talk from each individual on each team (color shade indicates speaker; see key at bottom for each team of students). Transcripts of speaking turns are grouped into one-minute chunks of conversation along movement paths in both the plan and space-time views. One of these conversations for each team is highlighted in Figure 3 to show how the IGS allows an analyst to highlight and examine individual turns of talk, either as colored lines (i.e., showing the length and sequential distribution of turns) or as transcripts of spoken conversation along paths in the space-time view. Both selected conversations (by makers and followers) occurred at the same place for each team (i.e., the courthouse steps) but at different times during their traversal from the start of the story line.

The IGS sits atop a collection of multi-perspective video and audio recordings, which have been synchronized and can be examined in relation to movement and talk over common space and time (i.e., when and where these digital records were captured). Figure 3 displays two video frames from individual members of each team occurring during each selected and respective conversation to illustrate how multi-perspective video can be played while simultaneously studying people's movement and conversation. In dynamic use, the IGS allows an analyst to select places or paths, and to rescale both time and space while working with video

recordings and transcript. During interactive visualization (Figure 3 is a static image only), an analyst can use the IGS to examine movement, read transcript, or view video along traversal paths at different spatial or temporal scales. The IGS also allows selection of speakers in linked transcripts, thus it can be used to analyze where and how much team members make spoken contributions while making or following a story line (e.g., one of the makers spoke relatively little, but he was very active as the team photographer while making the Nashville Civil Rights Tour story line). In use, the IGS display makes visible places along paths where movement speeds up or slows down, where conversation within the team intensifies or lessens, and what team members are doing together as they move in relation to the surrounding (digitally mapped) environment. These interactive scaling, selection, and viewing capabilities are what we mean by "slicing" (i.e., *slicing* records of interaction that are distributed over geography). We are still exploring how map and time-based interaction analysis can be used to study learning on the move, but we offer the analysis in this article as one among a small number of early uses of the IGS (Shapiro, Hall & Owens, 2017; Shapiro & Pearman, 2017; Shapiro & Hall, 2018).

In this way, the IGS allows us to describe making and following story lines at different scales of mobility. For example, Figure 3 shows how both teams started at the same location (the former site of an African American church, now used as a bank parking lot), but the makers (blue path) walked the path more quickly (by 10 minutes, during Activity 2) than the followers (red path), who attempted to walk the same path one week later (Activity 3). We can also use the IGS to compare qualities of walking or wayfinding for each team, such as pace and duration along common path segments of the story line. For example, the makers exhibited a more sinuous or continuous movement path, while the followers exhibited a more broken up or discontinuous path and regularly stopped for lengthy periods of time. What these differences in the pace and duration of walking in the city might mean were explored further by using the IGS to examine and compare the transcript and video records for each team as they made or followed the story line.

For example, makers slowed to locate places they had mapped and planned to visit while in the archives (e.g., the site of a sit-in protest), then they took photographs and discussed how to geotag media from the archives and their own photographs in their story line—i.e., makers were *telling* about historical events in the city, a process that continued even after they returned to the archives and their classroom (i.e., makers refined their story line and added digital media in

subsequent days, before Activity 3). Followers, in contrast, stopped both when they were lost (e.g., noticed they were off the path of the story line) and when they wished to view photographs or listen to recorded sound associated with places or paths in the story line (e.g., songs or oral history segments). For example, from minutes 37 to 43 (red path, space-time view) followers were listening to oral history recollections from a man who participated in the "Silent March" almost 60 years before (see transcript for Blog entry #42, above and Figure 2), who described how it looked and felt to be marching, 3000 strong, without a sound.

In summary, Figure 3 is a snapshot of how the IGS supports new ways to see, interact with, and interpret talk and interaction on the move in the built environment. Using the indexing and slicing capabilities of the IGS, we can explore seemingly basic, but currently missing information (in contemporary tools) from multiple sources of data that are synchronized by common time and place. In this case of making and following DSSL story lines, the IGS shows differences in pacing and the length of time spent in places that suggest quite different forms of activity across student teams. Making or telling the story of civil rights activism in the downtown business district involved processes of assembly, using the body at walking scale to index or geotag archival media to places along a developing story line. Following or listening to the finished story line was a very different activity. Again walking, but with a different pace and rhythm, students viewed historical images, listened to spoken word and sound recordings, and experienced archival media in the very places those media described. Both forms of activity—making or telling story lines, following or listening to these story lines—used locative technology to bridge media from archives to city neighborhoods in the service of a new form of public history.

Betty: He::y look religion!
Irene: Look what?
Betty: ((*laughs*))
[I just said look religion],
but what it- what I meant
was- look a bible verse!
Nora: [Tying in our themes.]
Betty: But no, that's one of our
themes, so this is perfect.
Irene: ((*pointing at plaque*))
Yeh!

B: Ye::s::: ((*arms sweep up*))
I: Bombed! ((*raises phone*))
Kyle: ((*points*)) This is perfect.
I: BOOM! Nashville, thanks for-
((*takes photo of plaque*))
B: I KNEW ((*claps hands*)) there
would be a plaque! (2 sec)
This is really cool, actually.
(4 sec)
I like it if- ["This memorial
commemorates the civility of
those demonstrators."
K: [((*walks to
courthouse doors, peers in*))

N: ((*fanning with map*)) They make
it sound like segregation ended,
like right at that moment
though, which is not the case.
B: It's not, but it more or less
[did because]-
I: [But it isn't] ((*walks to
courthouse doors, peers in*))
B: -one of the things in my oral
history that they talked about
was how unique it is that... in
Nashville desegregation didn't
start with a court case. It started
with a community decision and
the [mayor talking on the steps.
N: [Uh huh.
B: So it is kind of- it it like- WAS
kind of the end of segregation.
Not literally [but...] essentially.
N: [Yeh.]

N: Alright so let's walk [around] and
see if there's still something at that
Sheriff's office- slash jail location?
And then head back!
I: [Around?]
I'm really impressed about like
Nashville's effort to like, document
these things.
B: Yeh, but actually-
I: Because we're looking at it from a
specific lens? There's so many other
things that have happened in
Nashville, but like- Nashville is kind
of like, famous for the civil rights
movement, right? But like- I don't
know, I just wasn't expecting it to be
as-
B: As complete as [it is?
I: [Placardized as it is.
K: ((*laughing*))

Figure 4. Transcript as the NCRT team (makers) approached the threshold to the courthouse entrance, discovered an official plaque commemorating the end of segregation in Nashville, and offered a more critical account of these historical events.

Interaction analysis of the embodied experience of here-and-then

While each team's movement and talk as they walked along paths of making or following could be explored by "slicing" through space and time with the IGS, understanding what makers and followers of the Nashville Civil Rights Tour were doing and saying at places along the story line requires a different level of analysis. Integrating and exploring multiple forms of data is a challenge for traditional methods of interaction analysis, but this is necessary for detailed study of learning on the move (e.g., Marin, 2013; Marin & Bang, 2015; Taylor, 2017; Taylor & Hall, 2013). In this section, we closely examine the conversations highlighted in Figure 3, using methods of interaction and conversation analysis. These conversations occurred when each team found and stood on the threshold of the entrance to the courthouse—the same place where Ms. Nash and Mayor West stood on April 19, 1960. The IGS was used both to identify these sequences of interaction (i.e., both teams stop at this location in plan and space-time views) and to review multi-perspective audio and video records for more detailed analysis of interaction at a critical place on the story line. Transcripts in this section were partial and selective (Duranti, 2003), developed to examine in detail how the experience of here-and-then was assembled as

each team engaged with the courthouse steps. Similar to analyses of visitor groups moving through designed spaces in museums or public parks (Shapiro, Hall & Owens, 2017; see also Marin, 2013; Taylor, 2017; Christidou, 2018; Steier, 2014; Roberts & Lyons, 2017), we found rising and falling contours of engagement and personal alignment as teams moved through the city. Peak moments of engagement involved complex shifts in footing or stance (Goffman, 1979; Goodwin, 2007, 2017) that were literally on the move as each team found, explored, and made sense of the courthouse steps as part of an ongoing story line.

Figure 4 shows a transcript as the makers discovered a plaque commemorating the Silent March to the courthouse steps, which they photographed and included in their story line. They had already placed (or geo-tagged) a photograph of SNCC leader, Diane Nash speaking with Mayor Ben West, along the path of their story line, but they had not yet realized the encounter took place on the courthouse steps and discovered the historical plaque when they arrived at these steps. Set in metal and stone, the plaque tells a story from the perspective the City's political leadership:

> April 19, 1960
> "And the people shouted with a great shout; so that the wall fell down."
> Joshua 6:20
>
> On the 19th of April, 1960, Nashville proclaimed itself a beacon of civility, common sense and reconciliation.
>
> Following months of civil rights sit-ins, the home of black City Councilman Z. Alexander Looby was bombed in the early hours of the morning, and several thousand marchers walked to this courthouse in protest.
>
> In the charged atmosphere of that afternoon, Mayor Ben West broke the impasse as he told the crowd that he believed it morally wrong for store owners to sell to blacks while denying them service at lunch counters. He made this statement in a polite exchange with Fisk student Diane Nash.
>
> And in Nashville, the walls of segregation crumbled.
>
> This memorial commemorates the civility of those demonstrators, Mayor Ben West, and our community on that day. May we continue to live together as one God-fearing community forever.

Philip Bredesen Mayor April 19, 1995

After reading the plaque, the makers gave a more critical assessment (shown in Figure 4), referring to historical sources they found in the archives, including oral history descriptions of a relatively gradual, voluntary desegregation by downtown eating and shopping establishments (i.e., the walls of segregation did not "fall" or even "crumble" very quickly). As they began searching for the county jail, the makers appreciated efforts by the city to remember civil rights activism by placing historical markers along the path they were making (i.e., they found and included photographs of several markers).

Several things are important for our analysis of learning in this strip of interaction. First, a central theme for the makers was the role of the African American church in organizing and supporting non-violent protests, and this theme was their reason for deciding to start their story line at the site of the church in which the sit-ins were planned (i.e., their narrative begins at the location of a church that was razed to make way for a bank parking lot). This helps to explain the evident delight of Betty and Nora when they found a scriptural reference on the city's commemorative plaque, which they linked to the church theme they developed earlier in the archive ("that's one of our themes, so this is perfect"). In this sense, they discovered the city had inscribed an official story (the plaque) that lined up thematically (if not accurately) with sources they found in public archives and carried into the city.

Still, even as they celebrated discovery of the plaque, their ecstatic announcements of "Bombed!" followed by "BOOM!" appeared to have no deliberate meaning in relation to the precipitating event of the story of the Silent March, planned and undertaken by student activists after the *bombing* of Councilman Looby's home. This shearing apart of present and past, shows how the excitement of making discoveries while walking in the present (i.e., making the story line) sometimes over rode the assembly of a story about past time—the team's narrative was still very much under construction. Finally, as the makers challenged the plaque's claim that desegregation ended rapidly, they referred to an oral history recording in the public archive as an evidentiary source ("one of the things in my oral history that they talked about"), even though this did not settle the veracity of the story "placardized" by the city on the side of the courthouse. We know from students' work in the classroom and the public archives that most (makers and followers) had little or no personal experience in downtown Nashville, either in its present

configuration or regarding its history of civil rights activism. This helps to explain why the maker team was "impressed" with the city's commemoration of activism, since in a personal (and mobile) sense, it was a discovery for them.

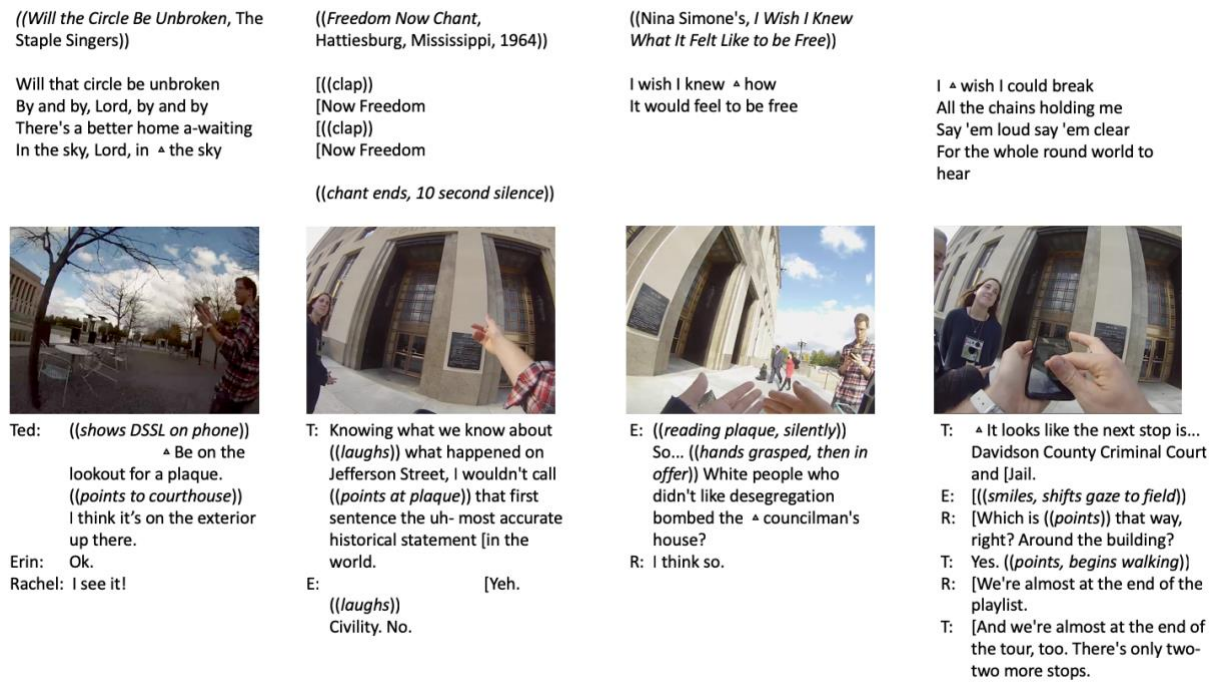

Figure 5. Transcript of the HJST team (followers) making sense of the historical plaque, visible in the Nashville Civil Rights Tour story line and etched in stone at the courthouse steps. Song lyrics (top panel) and talk (bottom panel) unfolded together as followers stood where Ms. Nash questioned Mayor Ben West.

Unlike the makers, the following team identified the courthouse from a distance and began searching for the plaque (i.e., they could view photos of the Nash /Webster exchange and the plaque along a mapped path before either was visible along their path of movement). Upon arrival, and much like the makers, the following team was skeptical about the commemorative plaque's description of a sudden end to desegregation in Nashville. As shown in more detail in the transcript in Figure 5, they questioned the historical accuracy of the official story by comparison with what they learned about economic and racial discrimination in Nashville's segregated African American community at the time (i.e., "what we know about what happened on Jefferson Street"), which was a central topic in the story line they made and shared with the other team (i.e., makers swapped and then followed story lines in Activity 3). Also shown in

Figure 5, the followers were listening to a song playlist as they approached the courthouse steps. While it is not possible to fully represent the soundscape offered with these songs in this article, we show latching between song lyrics and student utterances (i.e., using small open triangles across song and talk panels) to show what could be heard as the followers talked about historical events on the courthouse steps (readers may wish to listen to these songs while examining Figure 5).

Following the story line unfolded in a complex and changing soundscape. As shown in the top panel of Figure 5, the lyrics to a traditional Christian hymn were playing from Rachel's phone as the followers searched for the plaque visible in a photograph on Ted's phone (he carried the completed story line in map form; see Figure 2). As the followers crossed the grass-covered plaza in front of the courthouse (between the first and second columns in Figure 5), the song playlist started a chant (*Freedom Now Chant*) that rose in volume and accelerated as the followers climbed the courthouse steps.

Within this emerging soundscape, and as the chant accelerated, the "now" of walking in the city mixed together with a delayed sense of "Now!", recorded decades earlier in Hattiesburgh, Mississippi. Their engagement with historical events at the courthouse steps "took place" (Lefebvre, 1991) in and through interactions among members of the team and with the story line they carried and followed—i.e., their activity simultaneously unfolded within and produced the courthouse steps as a meaningful place. As the *Freedom Now Chant* ended, followers stopped at the threshold of the courthouse entrance, within visual range of the city plaque memorializing the end of segregation in Nashville. Inside a hearable stillness created by the end of the chant, they appeared to be reading the plaque (10 seconds of silence in column 2 of Figure 5). Ted broke this silence with a challenge to the official story of the plaque, framed as a contrast with what "we know" about discrimination in other parts of the city, which continued well beyond the day of the Silent March. Erin joined in Ted's critique, highlighting the absence of "civility" in the public history they had found in the archives and their own field work in city neighborhoods.

As Erin appeared to continue reading (column 3 in Figure 5), the sound of a piano introduction to the next song began playing, and into this developing soundscape, Erin expressed seemingly genuine puzzlement by asking, "So... White people who didn't like desegregation bombed the Δcouncilman's house?" The dissonant (minor key) tonal quality of Nina Simone's

singing can be heard on the song playlist as Erin finished her question ("I wish I knew how, ΔIt would feel to be free"). Rachel responded, "I think so" as Ms. Simone finished the first lyric. As the next lyric started ("ΔI wish I could break, All the chains holding me"), Ted announced, "ΔIt looks like the next stop is... Davidson County Criminal Court and Jail"). His utterance aligned with the beat structure of the song, while Erin smiled and looked out over the grass-covered plaza in front of the courthouse.

The strip of interaction modeled in transcript in Figure 5 drew together many aspects of the DSSL framework in a brief moment while walking in the city. The story line and song playlist carried on the follower's phones offered a narrative overlay assembled out of historical source material and personal discoveries made by the makers as they moved from the university classroom (e.g., discussion of assigned readings), into the public archives, and then out into Nashville's downtown business district. Walking archival media into the city created the potential for exploring relations between multiple historical sources (the commemorative plaque, news reports from 1960, fragments selected from oral history recordings, and protest songs used by students at the time). What students "made" offered a potential experience that was actualized "on the move" while others followed the story line, including challenges to the city's bid to memorialize a history in which "the walls of segregation crumbled" once Mayor Ben West acknowledged the immorality of discriminatory business practices.

Ted's assessment of the official (memorializing) narrative about the end of segregation was produced in place (the courthouse steps). But it was also *interstitial*, since his utterance (a counter narrative on the move) drew together three different settings in the city: 1) the courthouse steps—here-and-then , 2) Jefferson Street—the neighborhood setting for Ted and his team's separate story line about loss of cultural heritage in the African American community between 1950 and 1970, and 3) the library archives—the source of most, but not all of the media bound together in the story line that Ted and his team followed in the city (as well as the one they made and shared with peers). Ted's utterance was also *inter-textual*, in the sense that it put into critical comparison an official account of desegregation and racial discrimination with his own studies, on the move across public archives and city neighborhoods in the Music City. As a matter of "learning transfer" (Bransford & Schwartz, 1999; Beach, 1999), learning on the move in this case involved (literally) walking information from public archives through city neighborhoods, along paths, and into the places this information was "about". Irene's following

question ("So... White people...") further contributed to the layering together of here-and-then. After walking through the city and engaging with past-time accounts of the Silent March, she stood in the place where SNCC Director Nash questioned Mayor West and asked her own question about the motives of White people. Her footing (Goffman, 1979) in this utterance, literally assembled by walking in the city, aligned herself and her peers within the conversation Nash started 55 years earlier. As we have argued more generally for the DSSL framework as a form of teaching about public history, mobility was both the means and the content of what Ted and his peers were learning about the Music City.

Changes in story telling before and after the DSSL activity structure

To this point we have analyzed (1) aspects of mobility while making or following a story line and (2) how teams engaged with the here-and-then of the courthouse steps as a place in a story line. Both levels of analysis show processes that may support learning on the move within the DSSL activity structure. In this section, we report on a third line of analysis, asking if student teams' understanding of the history of civil rights activism in Nashville changed, by comparing their performance on a storytelling challenge task before and after they participated in the DSSL activity structure.

As we described earlier (Empirical Setting & Methods), the teams in this case study were given the same challenge task before Activity 1 and after Activity 3. Team performances on the challenge task used historical material in complex ways, and here we present a descriptive analysis of changes in team story-telling performance from the first to the second administration of the task. First, we recorded and transcribed team presentations of completed Day in the Life stories, then we coded transcripts for elements referring to people (Who), action and events (What), location (Where), time (When) and motivations or reasons for actions (Why). These codes for WH elements resemble the common structure of journalistic storytelling (Craig, 2006) and provide relatively low-inference descriptions of story complexity or depth. Initial coding of this content was done in group meetings of the research team. After resolving minor disagreements, coding to consensus agreement was completed by two of the authors. While a full analysis of changes in student teams' performances on the challenge task is beyond the scope of this article, we describe several differences as evidence to suggest that teams learned both about the city and its history while participating in DSSL activities over a three-week period.

Students found the Day in the Life challenge task quite difficult. In their performance before DSSL activities (i.e., before making or following story lines), it was obvious they were not familiar with city neighborhoods shown on the maps or described in news articles and historical photographs that we gave them. Students struggled to find locations for events in news reporting. They were hesitant to tell stories if they could not use correct names, dates, and locations for events included in their stories about people selected from the photographs we gave them. During their second performance on the same challenge task (three weeks later, after completing DSSL activities 1 to 3), students remarked on how different the challenge felt to them, since (by their own account) they now knew something about city neighborhoods shown in the maps and historical events reported in news articles we provided as part of the challenge. This is not surprising but indicates they felt they learned new things as a result of making and following story lines in DSSL activities. Though some students had visited city neighborhoods on their own, the experience of making and following story lines put them in a different relation to places. For example, Irene, a member of the NCRT team (see Figure 3) described her experience of visiting city neighborhoods with a purpose:

> I think it's different when you're doing something purposeful in a place versus just being in a place, like the meaning you make of that place is a lot different than when you're just there for whatever event, like I'm just there for lunch or just going to the art crawl or whatever, it's different than having a purposeful kind of interaction with a place. (Interview, after completing second Day in the Life challenge task)

In terms of content, the depth and narrative structure of stories told by teams in the Day in the Life challenge task reflected which archival media or historical they chose. The makers of the Nashville Civil Rights Tour (Irene and NCRT team mates) pursued a continuous focus on themes related to civil rights activism throughout the study. They told stories about civil rights protests in both of their challenge task responses, and they explored similar themes in the story line they made during DSSL activities. For example, in their challenge task response after the DSSL activities, they revisited contested relations between protesters, business owners, and the police as a basic narrative structure, but over the top of these protest events, they added a second

narrative layer in which members of the Student Nonviolent Coordinating Committee (SNCC) from two historically-Black colleges (Morehouse College and Fisk University) collaborated to train and spread tactics of non-violent civil protest. As a result, the structure of their response to the challenge task after DSSL activities was considerably more complex.

In contrast, the team making a story line about loss of musical heritage along Jefferson Street (Ted and his HJST team mates; see Figure 4), worked on different themes as the design study progressed. In their response to the challenge task before DSSL activities, they chose to focus on student protests in segregated downtown businesses. During their DSSL activities, we asked them to focus on life in the city's segregated, African American community during the 1960's. They made a story line about how an interstate highway was routed through the heart of this community and destroyed its business district. Consistent with the story line they made, in their response to the challenge task after DSSL activities, the HSJT team created a story in which White university students (similar to themselves) protested discriminatory practices in urban planning that routed the interstate highway through the African American community. Since the story line the HJST team made shifted to a different topic. (i.e., loss of businesses and cultural heritage in the African American community), they may have had less of an opportunity to use what they learned incrementally when responding to the Day in the Life challenge task.

	HJST Team (Community Heritage focus)			NCRT Team (Civil Rights focus)		
	Story before DSSL Activities	Story after DSSL Activities	% change	Story before DSSL Activities	Story after DSSL Activities	% change
Who (persons)	5	6	20%	7	7	0%
What (events)	8	10	25%	11	27	145%
Where (places)	6	10	67%	10	12	20%
When (times)	2	2	0%	2	4	100%
Why (reasons)	2	2	0%	4	7	75%
Word count	284	303	7%	360	674	87%

Table 1. Changes in length and elaborative detail in Day in the Life stories told by student teams before and after participating in DSSL Activities.

These observed differences in approach and story depth were consistent with results of our coding for WH story elements, shown in Table 1. In the second challenge task , each team's Day in the Life story was more elaborate, by including more historical events (e.g., from 11 to 27 What codes, a 145% increase for the Civil Rights-focused team) and more named places (including places students visited and included in map-based stories during the lessons). As mentioned above, the team with a more consistent focus on Civil Rights showed a more dramatic increase in map-based story elaboration. One explanation for this is that they may have learned more about their focal topic, but another is that the history of a student-led, nonviolent sit-in movement was more fully documented in archival media they worked with during the DSSL activities. Whatever influenced changes in story telling in this study, the narrative complexity of stories increased in ways that were consistent with learning about the public history of city neighborhoods during the design study.

Looking more closely at the map-based stories told in response to the challenge task, it was likely that students dug deeper into relations between historical actors by using material they found while making and following story lines. For example, the NCRT team (Civil Rights focus) told of the day's activities for a Black student protester and a White business owner (selected from a news photo of a downtown protest event). Both attended segregated churches, but with very different purposes and outcomes. The Black student protester ended his day in jail, singing gospel songs in solidarity with student peers, while the White business owner attended an evening church service and ended his day at home. Their more elaborate story at the end of the design study reflected source material they found in the library archives (Activity 1) and incorporated into their story line about civil rights protests in the downtown business district (Activity 2). For example, their story line included an excerpt from an oral history interview conducted with the daughter of owner of a restaurant shown in a challenge task photograph. In the interview, the daughter described agonizing discussions with her father at home, challenging his decision not to serve Black patrons for fear of losing his business. This moral dilemma, as well as rules of non-violent protest learned while in the library archive, are evidently in play as Kyle (a member of the NCRT Team) gives their response to the challenge task after DSSL activities:

> You see the manager in the top right window ((*points at photograph*)), uh, he doesn't look very happy with the situation. So, we figured he called the cops and asked them to disperse the crowd. They refused to leave and they got arrested. Um, we didn't think that there would be some sort of, like physical escalation because you could have gotten arrested without that having to happen. And like one of the rules of conduct was, like not to do that, so I think they probably avoided that. And then we have him get arrested and then go to jail, and that's where he spent the rest of the evening. (Excerpt from challenge task story after DSSL Activities)

In summary, our descriptive analysis of changes in story-telling offers some evidence that students in our design study learned about the public history of the city (e.g., the location of churches and businesses in city neighborhoods, and what took place there as students and community leaders challenged segregation in 1960). They also took up the task of telling under- or untold stories from multiple perspectives in ways that were both more elaborate and showed more attention to historical context (e.g., the risks faced by students, the role of Black and White churches). These changes in story telling over time are not particularly surprising (i.e., in all three DSSL activities, students engaged with historical and geographic materials that were new to them), but they are encouraging for further development and study of the DSSL framework.

Findings and Discussion

We began this article by describing what may be possible if we combine location-aware technologies, spatial indexing and retrieval of digital media in archival collections, and ways of telling about city neighborhoods that foreground perspectives either forgotten or erased by existing public history. Bringing these different elements together remains a challenge, but a growing body of research shows what is possible through approaches to mobile storytelling, digital augmentation of how people experience their environment, and new forms of public participation in public planning and community development. Our contribution has been to develop a framework for making, sharing, and following story lines as a form of public history. In this article, we reported on design research within this framework, and described early results from a case study of learning by making places within the DSSL framework. In light of these findings, we argue that making and following story lines about public history offers a new genre

of learning on the move, which is the focus of this special issue of the journal. By moving between (or bridging) historical archives and city neighborhoods to make, share, and follow story lines, participants in our study used their own mobility as both the means and the content of what they learned. In the following sections, we summarize key findings from our work and discuss both limitations and ways to expand the DSSL framework described in this paper.

Making and following public history with story lines

We offer a framework for teaching and learning about public history at a different spatial and temporal scale than more traditional forms of instruction (i.e., neighborhood history is privileged over national history, and past events are connected to people and places today). We intend for the DSSL framework to offer teachers and students the opportunity to see a neighborhood and the city as a living history, sometimes written over but rich with remnants, reminders, and memorials to the cultural heritage of the people and places that make up their city.

Analysis and findings in this article provide an early look at the potential power of making, sharing, and following story lines as learning that is experienced at a walking scale. We first examined the coarse structure of activities of making and following story lines as a team activity (e.g., analysis of paths, pacing, and distributions of talk and interaction using the Interaction Geography Slicer). *Making* story lines was an incremental process. It began as teams created a path that served as the spine of their still-developing story line and continued as teams made decisions about how to index archival material (or new discoveries made while walking) onto places along the path of their narrative (e.g., the NCRT team indexed an oral history fragment that described the Silent March along a path leading to the Courthouse steps). Further editing and refinement was completed online (e.g., adding rules of non-violent civil protest and thematically-linked songs), before the story line was shared with followers. In contrast, *following* the completed story lines was a sense-making experience that proceeded more slowly, as the HJST team (followers) paused to listen to songs or oral history selections, and attempted to align historical images with what could be found or seen from their current location in the city. While makers of the NCRT story line struggled to place curated archival (or discovered) media in historically-relevant places to build a narrative layer over the city neighborhood, the team following this story line struggled to find and engage with places foregrounded in the narrative layer they carried into the city. As evident in the IGS visualization (Figure 3), the pace and

experience of following a story line alternated between being "in the city" (sometimes lost) and being "in the story line" (e.g., as Erin put it when the following team reached images of the Silent March and the Nash/West encounter, "It's all really coming together."). Both making (Activities 1 and 2) and following (Activity 3) story lines proceeded at a walking scale in city neighborhoods, using media that learners curated and carried out of public library archives. The mobility required to make and follow a story line was, itself, a practice of contextualization and historical interpretation.

We next analyzed moments of historical sense-making for both making and following teams in one place along the NCRT story line—the Courthouse steps (Figures 3 and 4). Using a closer analysis of talk-in-interaction, we asked how learners engaged with places that were made and experienced as palimpsests—assemblages of digital media layered over places in the physical or built environment. As the pace of mobility slowed and team members engaged with places in the story line, their interactions produced embodied experiences of being in the past while in the present (i.e., here-and-then as a palimpsest of place). While our evidence is speculative (e.g., the role of music for followers engaging with narrative elements of the Courthouse steps), we described how followers (and earlier, makers) engaged with public history in ways that were both *intertextual* (comparing different stories about what happened in the Music City) and *interstitial* (bridging and layering archival media onto places they visited). Activities we designed and studied within the DSSL framework clearly enlisted learners' bodies as resources in a new form of learning on the move. Bodies on the move together were both a *means* for learning (e.g., finding places described in archival media, indexing and layering these media together in place) and part of the *content* of what might be learned (e.g., while walking in the city, positioning learners as historical actors in the here-and-then).

Finally, we asked how students' understanding of the city and its history grew over the course of the design study, by analyzing changes in how teams responded to a challenge task, completed before and after DSSL activities of making and following story lines. Clearly students participating in the study learned about city neighborhoods and events that took place there, but we also found suggestive evidence that they were able to create and tell more complex stories about racial discrimination and civil rights activism in the public history of their city. We also found evidence that they understood these as a continuing challenge for the Music City. However, our analysis of how these changes in map-based story telling took place is preliminary

and only suggestive. In particular, while we argue that the experience of here-and-then is important in learning by making and following these stories as a form of public history, the evidence for this conjecture must be developed further. Our research in this area continues (e.g., studies of how students use a repository of map-based stories consistent with the DSSL framework). Much more can be done. We invite others into this relatively new design space for creating new genre of learning on the move and encourage others to study how learning is organized and consequential in these activities.

Designs for learning on the move with the DSSL framework

We have demonstrated the DSSL framework is feasible, despite challenges encountered when using different types of location-aware devices (e.g., different operating systems on smart phones or tablets), unpredictable wireless service from typical cellular data plans, and digital mapping software that was not developed or supported for activities of making and following story lines. It has also been a challenge to find (or to create) archival media that can be digitized with usable meta-data (e.g., contextual information about location and time; see Cayzer, 2004). Our research continues to create archival collections with adequate spatial (and other) meta-data, and we are developing new infrastructure components for making and following story lines within the DSSL framework.

We must also anticipate and design for tensions or contradictions between accounts of city history in the *archives*, which gather information about city neighborhoods that might later be used to create public history, and *discoveries* that our study participants regularly make while making and following story lines in city neighborhoods. In this sense, the DSSL framework makes possible a generative and open-ended practice of "ground truthing" (Pickles, 1995; Taylor & Hall, 2013), in which learners make discoveries about under- or untold stories even as they carry information from official archives into city neighborhoods. This tension between what is "known" and what might be told is particularly relevant for communities that have experienced decades of both economic and historical neglect and oppression (e.g., the Jefferson Street neighborhood in the Music City, where the Silent March began on April 19, 1960).

While our focus in this article has been on public history, the DSSL framework also invites students and teachers to participate and learn about emerging practices of digital mapping and information management as a means to tell stories and contribute to public history. The

NCRT and HSJT teams of pre-service teachers in this study incorporated these practices into their coursework in ways that are increasingly called for by social studies educators (e.g., Alibrandi & Sarnoff, 2006). For example, as our students entered the library archives, they began gathering or curating media almost immediately, using their smart phones (without our explicit direction) to capture digital copies of photographs and text in exhibit panels (the library archives surround a beautifully designed Civil Rights Reading Room; see https://library.nashville.org/research/collection/civil-rights-room). Then as they began working with boxed material at tables in the archive (Activity 1) their phones became "contextualization devices" when they used search engines to dig deeper into narrative elements they intended to carry into city neighborhoods. Finally, while using their own moving bodies to index (or geo-tag) archival media onto places in city neighborhoods, their phones served multiple purposes in the activity—as an authoring tool while on the move (i.e., the LiveTrekker blogging functions), as an aid to wayfinding (e.g., they found places they planned to make or follow, but also recovered from getting lost), and as a digital player for interactive maps, photographs, and audio (i.e., oral history segments and protest songs). As suggested in our review of the growing literature on neo-geography and informational rights to the city (e.g., Graham, 2010), the prospective social studies educators we studied learned about map-based story telling by integrating new practices of digital mapping (e.g., geo-tagging different forms of digital media to places and paths in the city) with their own, existing practices of personal curation and wayfinding (e.g., boyd, 2015; Shapiro & Hall, 2018).

We offer the DSSL framework as a terrain in which many types of learning on the move might be designed. In the design study reported in this article, we focused on bridging archival media from a public library into city neighborhoods described by these media, to explore relations between racial discrimination, civil rights activism, and protest or "issue" songs used to help organize social movements and protests. There is still much to be done and learned in this thematic area of public history. However, we also believe that DSSL-driven practices of curating archival media and using location-aware devices to make and follow story lines can be extended or generalized to different archival collections, different topics in social studies teaching, and different landscapes or regions in human geography. Working with community partners in the Music City has provided rich material for developing story lines in relation to the intertwined public history of American Roots music and a particular period in the Civil Rights Movement.

However, the DSSL framework may be much more general and usable in cities, rural or less densely populated regions, or even within theme or nature areas conceptualized as parks (e.g., the 34 North 118 West Project, see: http://34n118w.net/34N/ or writing and music commissioned for Missorts in Bristol, UK, see: https://www.missorts.com/). We believe the DSSL framework provides a way of learning about public history by making, sharing, and following map-based story lines that could be readily appropriated and re-used by others (i.e., it can be generalized by scaling out; see Hall & Jurow, 2015; Penuel, 2014).

We also offer our use of the Interaction Geography Slicer (IGS) in this article as a powerful and generalizable way to organize multiple forms of data (e.g., location, movement, transcripts of conversation, geo-tagged digital media, and audio and video data) in order to study and support designs for learning on the move. We used the IGS to make sense of this data, at multiple scales and from different perspectives, for the purpose of understanding how learners made and followed story lines at a walking scale. More generally, we believe the IGS can be extended to and support more traditional forms of interaction and conversation analysis by providing new ways to select, visualize, and make sense of large sets of data including multi-perspective audio and video data, media indexed to places, and transcripts of talk-in-interaction. Integrative analysis of these kinds of data is increasingly needed in education and learning sciences research, as personal or wearable digital recorders can be placed on moving people and objects, and used selectively to capture interactive configurations of people and things on the move. We believe that exploratory data analysis tools like the IGS will be necessary if we wish to understand learning on the move at multiple levels of analysis.

Who speaks for Music City neighborhoods?

We conclude this paper by considering our own positionality in relation to the historical material used in our studies and the people living in communities that have become topics in our research and teaching. Most (not all) members of our research team and lab are White, and all of us are college-educated, middle or upper middle-class persons. We more closely resemble the business owners refusing to let Black patrons sit down in Music City restaurants during the 1950s than we do the students and community leaders protesting these deeply-ingrained practices of racial segregation and discrimination. While faculty at our university were involved in the historical

movements documented in story lines made and followed by our students, and we would hope we also would have lent our time and bodies to this work, we and our students are not part of Nashville's African American community.

The analysis and data reported in this article come from early work to develop, enact, and study the DSSL teaching framework described above. We chose Music City neighborhoods, which had been isolated and damaged by urban renewal projects between 1950 and 1970, after doing ethnographic field studies of how city planners interacted with residents and property owners in the historic Jefferson Street neighborhood of Nashville (Taylor & Hall, 2013; Taylor, this issue). This neighborhood was the site of the 1960 bombing and starting point of the Silent March explored by makers and takers of the story line analyzed in earlier sections of this article. As we learned about the history of this neighborhood, we sought out and developed dense partnerships with archivists at the Nashville Public Library and with community organizations in the Jefferson Street neighborhood. These partnerships have been crucial (Bang & Vossoughi, 2016; Melendez, Radinsky, Vossoughi, Marin, Bang, et al., 2018) for our own learning about the public history of Nashville, much of it either difficult to find or not available in public archives. As this work has continued, stories told by neighborhood residents have become part of our archival materials, and we have collaborated with the city library and community partners to make these available as digital media that can be used by schools, community residents, and visitors to the Music City (e.g., for a story line in which residents describe how urban renewal damaged the cultural heritage of the Jefferson Street neighborhood see: https://slam.app.vanderbilt.edu/digital-spatial-story-lines/a-walk-down-jefferson-street-with-jesse-boyce-and-lorenzo-washington-2015/).

Who speaks for Music City neighborhoods like Jefferson Street is an open question. Our stance has been to act as respectful partners and listen to residents' efforts to tell the intertwined story of music, social activism, and civil rights in the city. In doing this work, we try to create and share public assets that can be used by residents in the Jefferson Street neighborhood. We are keenly aware that our affiliation with an elite private university has an uncertain relation to the communities and neighborhoods reflected in the DSSL framework and activity structure (Houston, 2012), as well as in the story lines that are created and shared in this activity. We are committed to making historical media and digital storytelling tools available to community residents, as well as to high school students and teachers in an arts-based magnet school that

serves families in the neighborhood (in an ongoing partnership that refines the DSSL framework in classroom research). Our current research also develops these materials and practices within the setting of a community-based museum and recording studio in the Jefferson Street neighborhood. Our still-developing answer to the question of who speaks for Music City neighborhoods seeks out and privileges the stories of community residents, our partners in research, and community elders who wish to leave a durable record of their stories about life in the neighborhood. While we are not members of the Jefferson Street community, we have sought to make ourselves "fit" to do this work (Harding, 1993) by developing relations of trust with neighborhood residents, listening attentively to their criticism of historical processes of development, and working towards what they desire regarding the future of their neighborhoods as one of our central research problems.

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