Augmented Reality and the Scenic Drive

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Abstract: We are interested in the general question of how to augment the viewed landscape with representations of its otherwise invisible aspects and using these to prompt visitors to reveal previously unidentified aspects of that same landscape. We take a participatory, grassroots perspective, where expert and local knowledge are made available, but emphasis lies in the collection of new or explanatory information from the broadest feasible range of participants. This paper proposes a process for capturing not just individual experience of place, but collective experience built upon the individual. Crowd-sourced imagery and sound "bites" populate an augmented reality (AR) environment and prompts visitors to the AR to consider and respond to those originating experiences with their own. We provide and project additional environmental data to prompt embellishments, corrections or additions. In our prototype, the goal is to locate as-yet-unidentified valued highway landscapes, but the general approach has application in numerous other settings where understanding collective grassroots experiences in the landscape is essential for its protection and preservation.

Keywords: Augmented reality, cultural landscape, social media, crowd-sourced data

1 Background

Driving for pleasure is a popular recreational activity in the United States. In response, many states have identified certain roadways as "scenic" or "historic" to attract visitors and raise revenue (PARSONS et al. 1998, FROMENT & DOMON 2006, MUCK 2006). An example is the Georgia Scenic Byways program which is based on "grassroots effort(s) … to identify, preserve, promote and protect treasured corridors throughout the state" (GDOT 2015). There are fifteen such corridors designated by the Georgia Department of Transportation (GDOT) (Figure 1a and 1b), but there has been no systematic description of the physical attributes that comprise a scenic landscape nor how such attributes would be identified and thus protected. GDOT's expertise or resources to devote to new discoveries is rather limited. Furthermore, there is the danger that any centralized statewide initiative would miss features of local significance such as abandoned farms and homesites, historic burial grounds or valued historic vistas − the landscape features to which local people are attached and thus might find worthy of protection. This paper presents a model "scenic highway detector" using social media and augmented reality mechanisms to (1) direct interested citizens to examine and identify road stretches for potential scenic highways and (2) record their support and criteria for such designation. We argue that the characteristics of valued scenic highways reside in the photographic records people make and the verbal expressions they use to describe them. We further argue that other, undesignated stretches bearing the same "affordances" (GIBSON 1977) could be candidates for state designation.

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2 Identifying Candidate Scenic Byways

To recognize and provide protection for scenic assets, scholars and United States federal land agencies have developed systematic ways of evaluating landscape scenic quality. The approaches have generally fallen into two categories. First, experts, often landscape architects, have developed ways of scoring landscapes based on evaluating the extent to which landscapes exhibit formal aesthetic principles based on analyses of their forms, lines, colors and textures, as well as other factors (USDI-BLM 1986, SMARDON & KARP 1993, USDA-FS 1995). Though extensively used, this method has been criticized for its failure to address the values of non-experts and to embrace the cultural values embedded in developed landscapes. Second, others have taken social science-oriented approaches, systematically capturing respondents' evaluations of typical scenes and using statistical methods to identify the physical characteristics of the landscape that elicit scenic evaluations (DANIEL & BOSTER 1976, SHAFER & BRUSH 1977, PARSONS et al. 1998). Regression models have been developed to estimate the effects of changes in the physical landscape on preferences. Either approach could be an avenue toward identifying previously unrecognized scenic corridors that might be eligible for Scenic Byway consideration; however, they are not "grassroots" and community-driven as required by the Georgia Scenic Byways program.

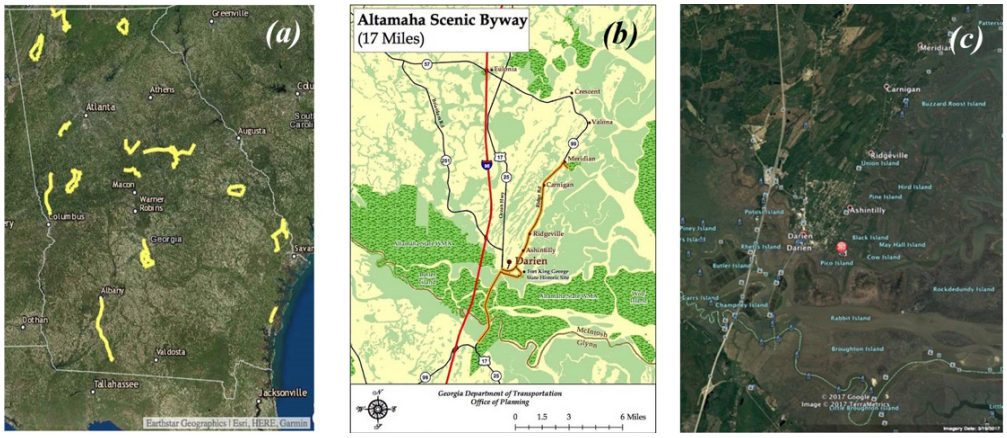

Fig. 1: (a) Fifteen corridors designated by the Georgia Department of Transportation as scenic byways, (b) the Altamaha Scenic and Historic Byway as a model for the study, and (c) a snapshot of Google Earth image locations

In the face of ever-present pressure for economic development and job creation, lack of mutual understanding about what is valuable and worthy of recognition leaves the future of scenic byways in Georgia vulnerable to unexpected and unwanted change and degradation in the landscapes they traverse. To address this potential loss, a strategic method is required that captures grassroots values as they would apply across any of Georgia's highways yet is defensible in explicitly responding to, and demonstrating, grassroots citizen input.

2.1 "Grassroots" Values in Scenic Assessment

Past processes to recognize scenic highways and byways have been successful, resulting in corridor designations that are, indeed, scenic (EVANS & WOOD 1980, CLAY & SMIDT 2004, MUCK 2006). Nevertheless, their recognition may have been biased toward "expert" knowledge and have under-valued the place-based knowledge of local stakeholders and citizens (SCHÖN 1995). Local stakeholders frequently believe that they lack the broad knowledge of the natural and cultural systems at play to fully participate in land planning processes (ORLAND & MURTHA 2015), although participation could lead to closer engagement with the design process, ownership of the outcomes, and future involvement in ensuring plans are implemented (PHILIPSON et al. 2012).

Inherent in the idea of a "grassroots effort" is the likelihood that the identification and evaluation of resources will not be systematic. Conversely, the identification of hitherto unrecognized resources and the establishment of more extensive and effective protections for treasured resources will not occur if their value is not recognized by the "grassroots" (GDED 2017). A key to addressing both issues lies in raising public awareness of the "treasured" and developing mechanisms by which the values this idea implies can be found in the landscape and brought to the appropriate forum for discussion and potential recognition.

2.2 Using an Existing Scenic Byway as a Model

The Altamaha Historic Scenic Byway is used as a model to investigate how other coastal Georgia highways could be identified for potential inclusion in the program. Seven miles of U.S. Highway 17 (crossing the Altamaha River from Glynn County into the City of Darien) and eight miles of GA Hwy 99 (from Darien to Meridian, GA) comprise the Altamaha Historic Scenic Byway (GDOT 2015). Sampled along the latter route range, Google Earth images varied extensively from iconic views of the coastal salt marshes to damaged and abandoned boats, from prominent community churches to the smallest church in the USA, and from favourite restaurants to historic landmarks (Figures 1c, 2). With the example of the Altamaha Historic Scenic Byway, each scene contributes to the overall value of the scenic byway. Some scenes are discrete locations such as churches and historic sites while others are less location-specific representative landscapes. Candidate scenic byways will comprise the same constituents; for each, our approach must be able to assign values that can be used to discriminate between more and less valuable aspects of the highway landscape.

2.3 Social Media Mechanisms

There has been a forty-year history of seeking methods to efficiently evaluate the individual experiences of people in the environment, cross-examining them in place without interrupting the experiences under investigation. To study visitor enjoyment of scenery and recreation, the technique of Visitor Employed Photography was introduced by CHEREM and TRAWEEK (1977), using disposable cameras to collect images of favorite locations during a recreation experience. Since visitors are often taking photographs for their own purposes, the activity is natural and unobtrusive yet captures environmental conditions in the moment they are being experienced (CHEREM & TRAWEEK 1977, CHENOWETH 1984, HULL & STEWART 1995). Photovoice (BEILIN 2005, GUELL & OGILVIE 2015, BALOMENOU & GARROD 2016) is a more recent qualitative method for community participatory documentation where photographic doc-

umentation is followed up by discussion to elicit narratives to explain the content or context of the image. Nevertheless, each of these techniques involves a deliberate and intrusive intervention − respondents are solicited, trained and motivated to participate in a prescribed protocol. Participation is structured and shaped in ways that help investigators identify significant relationships between place and response, but this in turn, may structure and shape the pattern of the response itself.

Fig. 2: Google Earth images along the Altamaha Historic Scenic Byway

Volunteered independently, social media such as internet-shared photographs, blog posts, and Twitter tweets are potentially rich sources for evaluation of place unaffected by researcher influence which, if accompanied by geolocations, could assist in the identification of potential scenic highway corridors. In particular, researchers regard photo-sharing services as rich sources of Volunteered Geographic Information that could serve for route identification (ALIVAND & HOCHMAIR 2013, DUNKEL 2015) or identification of valued viewsheds or scenic regions (BERBÉS-BLÁZQUEZ 2012, GARCÍA-PALOMARES, GUTIÉRREZ & MÍNGUEZ 2015, SALMOND, TADAKI & DICKSON 2017). Imagery from a photo-sharing service is free of possible impediments of an experimental intervention but also generally lacks explicit information as to why the photograph was taken.

At first glance, photographs adjacent to a scenic highway accessed via Google Earth Pro® appear too eclectic to derive generalizable insights into what constitutes valued scenery (Figures 1c, 2). However, the photovoice literature views this variety as a benefit and has used the photographs collected to discern a broad range of values in the landscape. Numerous researchers have explored sense of place and symbols of well-being in rural landscapes (BEILIN 2005 & RAMÍREZ et al. 2011, BERBÉS-BLÁZQUEZ 2012, GUELL & OGILVIE 2015, MARTINEZ PASTUR et al. 2016). Others have explored the more explicit cultural landscape of urban settings (MAHMOOD et al. 2012, RICHARDS & FRIESS 2015, LIU et al. 2016). The research concludes that the use of crowdsourced data allows for the identification of spatial patterns of cultural ecosystem service preferences and their association with landscape settings (MUCK 2006, MATTHEWS 2011, BERBÉS-BLÁZQUEZ 2012, MARTINEZ PASTUR et al. 2016, NIEUWOUDT et al. 2016). We build on this to propose a delivery and data gathering mechanism that brings the richness of unseen or unrecognized cultural and natural ecosystem

services to the attention of a passing motorist and prompts them to share their own insights in order to enrich the collective body of knowledge on the highway.

3 Augmented Reality for Representing the Highway Landscape

Our prototype tool, LANDSCAPERECON (for Android only at time of writing), uses the concept of *geofences* within an AR environment to trigger prompts about cultural/ecological/scenic benefits. A geofence is a virtual threshold located via spatial coordinates that trigger a response in a mobile device when it enters or leaves an area. One version of our application uses map-target based AR to deliver visual and audio augmentation to smartphone users scanning a static map or landscape model in a community location such as city hall or post office (Figure 3a) (MORRISON et al. 2011). A second, mobile, version delivers imagery and audio narratives to automobile passengers, and audio cues only to drivers, again via their location-enabled smartphones (Figures 3b, 3c) (BLATTNER, SUMIKAWA & GREENBERG 1989, VAZQUEZ-ALVAREZ et al. 2012).

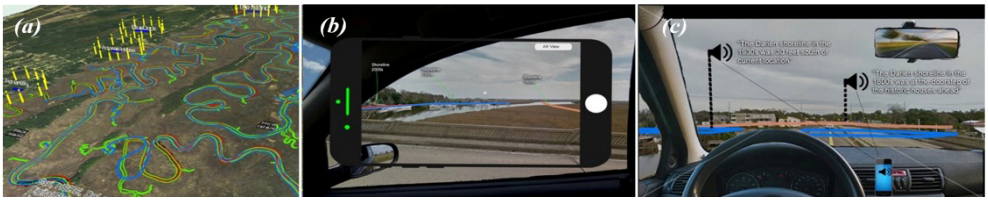

Fig. 3: (a) a map target-based AR, (b) passenger audiovisual AR, and (c) driver audio cues AR

Use of the Google Services® application programming interface (*API*) allows the creation of a geofence located via the GPS of a smartphone or tablet, or approximated using surrounding WIFI locations when GPS is not enabled. Google Services and the ARCore® development kit enable the augmented reality portion of the application (the visual component) to exist in the same application as the geofence portion (the auditory). User information (location, type of device, language, time spent using application features, etc.) can be monitored using Google Analytics.

3.1 Creating Geo-located Narratives

LANDSCAPERECON delivers narratives and images appropriate to a vehicle's location. As vehicle drivers and passengers move along a highway, the tool delivers aural cues already assembled from crowdsourced photos and narratives. Creating a narrative for one of the cultural/historical/popular destinations − reasons for its selection/identification as a place of value − appears relatively easy to do based on available descriptions. Destinations identified via crowdsourced imagery have discrete geographic locations and can therefore readily be made available as cues for a location-sensitive delivery system. Locating representative highway landscapes is less straight-forward as the locations are more diffused and are likely to be under-sampled by virtue of the challenge of taking photographs while in motion – impos-

sible for the driver and highly constrained for a passenger. A potential solution is to use GIS-based indicators, according to the characteristics of known photo-locations, to develop an ecological richness or scenic beauty "surface" (BISHOP & HULSE 1994, RAMÍREZ et al. 2011, GARCÍA-PALOMARES, GUTIÉRREZ & MÍNGUEZ 2015, MARTÍN et al. 2016), the high spots of which then constitute the locational cues for the evaluation system. A similar process is used to add non-visible features such as locations valued for their ecological or archaeological/historical characteristics. There are limitations set by the geo-location technology, especially in more remote locations with poor mobile communication coverage (ZIELSTRA & HOCHMAIR 2013). One of the future goals of this project will be to ascertain the significance of these effects (FIGUEROA-ALFARO & TANG 2016). For more diffuse imagery, personal and emotional attachments to landscape resources that constitute sense-of-place may be less obvious. We used interviews and survey responses from a post-Hurricane Matthew study that collected attitudes and anticipated behaviors, principally toward climate-related migration, but the study also included questions regarding attachment and reasons for living on the Georgia coast that were the basis for the embedded LANDSCAPERECON narratives (ORLAND & WELCH-DEVINE 2017).

3.2 Evaluating the Passing Landscape

Our initial conception of an evaluation approach used location-aware devices (i. e. personal smartphones) to represent the landscape and capture a narrative of the drive along the candidate highway. At geofence locations determined either by prior crowdsourced knowledge of a cultural/historical/popular feature or by prior GIS-based designation as a scenic or ecological "hotspot," the user is asked to comment on their surroundings and provide either additional information or an evaluation of their surroundings. Drivers respond vocally and their input is recorded and tagged with its geolocation. Passengers may take their own photograph, augmenting the crowdsourced photo resource and providing a more comprehensive evaluation (Figure 4). Users may also choose to provide unprompted input at any time, again with all responses geolocated. At the end of a journey, a record of evaluations can be downloaded and added to a resource database.

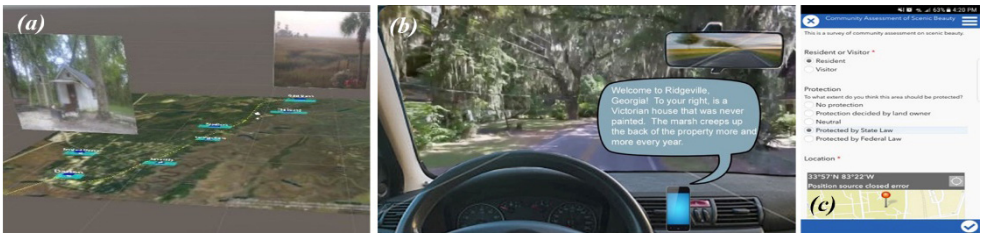

Fig. 4: (a) smartphone interface, (b) location-triggered in-car audio, and (c) geo-located feedback

Geolocated verbal responses or photographs taken by vehicle passengers can be uploaded to a publicly-accessible database of cultural, ecological, and scenic resources. The evaluative scripts that result may form the basis for an application to the Georgia Department of Transportation for Scenic Byway status.

4 Discussion and Conclusion

A prototype Augmented Reality tool, LANDSCAPERECON (Figures 3, 4) has been created and is under continuing development to enable increased resident and visitor engagement with the landscape, and the ability to actively and visibly participate in its evaluation, conservation and protection. Key considerations are whether the tool will be valuable and used. While we have not ventured into field-testing of these issues, we are aware of the necessity to engage users, to minimize both physical and conceptual barriers, to aid adoption and deliver a meaningful and authentic experience that elicits useful behaviors (i. e., increases the body of knowledge with respect to the target location). There is an emerging science of engagement with virtual environments that will inform our progress (AHN et al. 2015, SMITH 2015).

Photovoice and Visitor Employed Photography (and more recently, Panoramio/Google Earth) have a forty-year history as a means of evaluating the individual experiences of people in the immediacy of an environmental experience. CHENOWETH (1984) used the powerful connection of place and experience as important evidence in favor of protecting valued recreational landscapes and experiences on the Lower Wisconsin River. Here, we propose that the method can be taken further, capturing not just individual experience of place but also collective experience built upon the individual. We capture the richness of experience gathered by crowdsourced photography and then invite other people to consider and respond to those originating experiences with their own. In this case, the goal is to enable the identification of as-yet-unidentified scenic landscapes, but the general approach has application in numerous other settings (e. g. Landscape Character assessments in Europe) where collective grassroots experience of landscape is essential for its protection and preservation.

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