Walkthrough Research: Methodological Potentials for Head-mounted Cameras as Reflexive Tools in Museum Contexts

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Abstract
This study investigates the potential of head-mounted video cameras as a technique for understanding human experience in museums. Goals of the research are to avoid over-determination of experience, instead providing digital tools for reflection and understanding. The work uses a head-mounted video camera, an interview, and a set of simple image processing techniques to explore methods for understanding relationships between people, objects, and museum spaces.

Author Keywords
video; method; user experience; museums.

ACM Classification Keywords
H.5.1 Multimedia Information Systems: *Evaluation/methodology*

Introduction
Video technologies are proliferating in all aspects of social and cultural life. The use of video, the development of technologies such as Google Glass [1], and other increasingly commonplace miniaturized video technologies make the potential of body-mounted, first-person video capture both apparent and under-researched. Further, the analysis of 'video as data' and the sophistication of real-time image analysis tools open a host of future scenarios for linking visual

anthropological uses of digital video with the motivations and promise of digital humanities [2] and research into an increasingly "quantified self." [3]

The potential for head-mounted video capture in social research contexts (in ethnography and anthropology, for example), has been explored by researchers in visual-anthropology contexts as both a general method, and in specific, contextual applications. See Warren and Shroeder's discussion for an account of the shift toward image-based tools as a means of critically expanding anthropological discourse beyond text and speech [4]. In museum contexts, vom Lehn, Heath and Hindmarsh outline "interest[s] in confronting visitors with video recordings of their own conduct to elicit talk and discussion between them." It appears that "VideoTraces" [5] or "reflective video-techniques" [6] can be an important tool to engender talk with visitors and to have them reflect on their backgrounds and behavior, and also on exhibit properties and characteristics. While such tools are quite successful in generating discussion, many authors conclude that understanding of visitors' "conduct and interaction still needs to be explored." [7]

In the context of a trans-European research project about relationships between individual museum visitors and European cultural institutions [8], researchers at the Copenhagen Institute of Interaction Design (DK) and Newcastle University's International Centre for Cultural and Heritage Studies (UK) have developed experiments into the methodological potentials in digital design-ethnography. The work stems from an interest in understanding museum spaces and their resonances with peoples' real-time perspectives. Also revealed are the dynamics of how meaning is created, space is composed, and identity reflected through the exhibit. This research uses digital video and image analysis techniques to expand, challenge and invert the top-down ways that museums are traditionally conceived and analyzed. Museum visitor studies of spatial flow and behavior most often presuppose a static-frame omniscient perspective, surveillance-like tracking of visitors, and document formats which privilege the floor-plan as an adequate (and often sole) tool for understanding museum spaces. "Walkthrough" research approaches these issues from the bottom-up, as composed by visitors.

Our investigations invite visitors to make head-mounted-camera video documents of their own museum visits. These videos are then watched together with museums researcher, who prompts visitors' reflections on their museum visit. The video is also processed with image analysis techniques to develop metadata analytics, informing researchers of metadata of interest (intended also in a reflexive mode).

Elicitation Interviews

Visual anthropology, stemming from humanities and social science research, provides a model for treating video documents as reflexive "texts" against which to derive further "readings," or insights and knowledge. Intervening with video in this way, research productively sidesteps attempts at full-characterization or total-determination of situations and experience, either through implication or inference. This "thinking we know more than we really do," over-determination is often a pitfall of data and data-based knowledge pursuits in design-anthropology, as in computer science [9]. Instead, the ambiguity of what is known and unknown in the recording of a given situation or

museum visit is maintained, video recording serving only as an artifact to elicit response and stimulate recall. Henry and Fetters note that, "Variations of video elicitation interviews have been used in knowledge engineering, [10] interaction analysis, [11] anthropology, [12] and other social science disciplines.[13] Important here is that the participants are invited to create the video themselves, as a part of the research. The method also operates in the language of museum spaces, as visual artifact of a visual environment. [14]

These aspects of our research share inclinations with the quantified-self movement, in that they are geared toward data collection for self-reflection. During a subsequent interview, the video helps visitors recall their visit, the detail of the museum space, and their trajectory through it. Also, the footage serves to show visitors aspects of their behavior they are unaware of, revealing, often to themselves, how their itineraries and attentions shape their movement and engagements in the museum. As with quantified-self data-analytics and visualization, the intention is understanding what is outside the consciousness of people (see for example [15]).

Future prospects for ubiquitous imaging technologies in developing reflexive profiles of behavior and identity are numerous. (See, as further example [16].) Yet, it is important, while seeking accuracy, to design into video artifacts indications of ambiguity and dynamism, as well as accuracy. In so doing we avoid the reduction of experience to data, or treating the digital image as "fact." This is one reason to maintain use of commercially available, economical and simple head-mounted camera technologies, instead of more sophisticated technologies such as eye-trackers. As a more "accurate" technology, eye-tracking in the context museums may fall prey to the desire to interpret data as a "reflection of 'reality' in [a] straightforward sense." [17] Head-mounted cameras, by comparison, maintain a degree of ambiguity in both capture and presentation as the "view from the camera (viewed later during the interviews) gives no information about whether the participant is gazing, glancing or scanning, staring vacantly or using peripheral vision." [18]

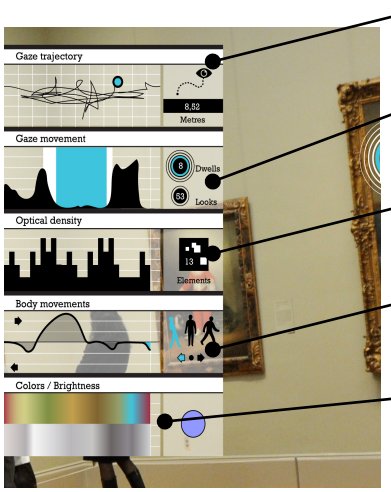

Figure 1. Rendered GUI of walkthrough outputs.

Image Processing & Analysis

Mackenzie and Kerr's work to investigate sporting experiences shares much in common with our walkthrough research. Their innovative use of head-mounted cameras in the context of sport research "focuses on video footage obtained from head-mounted cameras for use in stimulated recall during post-event

interviews." [18] For our walkthrough research we add a further analysis step to the captured video, via image-computational algorithms applied to the footage. The intent of this analysis is to provide further metadata to juxtapose with the qualitative interview techniques, as a way of digging further below the obvious or known aspects of the museum space and visit. *Figure 1.* illustrates the final interface components and discusses the data derived and rendered onto the video footage.

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