Chapter 3

Horses for Courses: Designing a GPS Tracking Data Collection

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ABSTRACT

During the last decade, GPS tracking has become a key technology for data collection. In this chapter, the authors develop a practice-ready guideline for how to design and conduct GPS tracking investigations. They do so by first developing a V-model for GPS tracking, which describes the different phases of a GPS tracking data collection and the choices that have to be made in each phase. Thereafter, the authors show how this model can be applied in practice in a case study. The V-model is the first model that systematically combines methodological insights from the literature on GPS tracking and practical experiences from a number of GPS tracking projects into a practical guideline. Researchers can use this model as a starting point when designing a GPS tracking data collection. The authors hope that the model can constitute a first step towards the development of best practice.

INTRODUCTION

During the last 20 years, GPS tracking has become a key technology for data collection, and this has led to significant advances within a number of academic fields. GPS tracking has, for example, caused a revival of the old “time-space” geography (Shoval, 2008; Shoval et al., 2014); it has produced new knowledge about travel behavior (Armoogum et al., 2014; Schuessler & Axhausen, 2009), and it has given architects and planners new insights into how people use urban spaces (Christensen et al., 2011; Gong et al., 2012; Nold, 2009), just to mention a few examples. In this literature, a growing issue has been how to design and conduct GPS tracking data collections. Some publications deal with this issue from a surveying perspective (i.e., California Department of Transportation,
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2012; Geodetic Survey Division, 1992; Rydlund & Densmore, 2012). Other publications focus more on the use of GPS tracking within the transportation field, and some of these have manuals for how to use GPS tracking (Bachu et al., 2001; Marca, 2002; Mintsis et al., 2004; Imran et al., 2006; Lee-Gosselin et al., 2006; Stopher & Greaves, 2007; Auld et al., 2009; Bohde & Maat, 2009; Cools et al., 2009). Armoogum, et al., (2014) categorized the challenges relating to GPS tracking according to three dimensions: technology; data collection methodology and analysis.

Despite these publications, there is no consensus in the literature about how to design and conduct a GPS tracking study. In this chapter, we therefore aim to create clearly structured guidelines with specific steps describing what the researcher shall do in each step. These guidelines will synthesize insights from the existing literature, and our own experience from several GPS tracking investigations. There are two rationalities for this. First, to provide a tool which researchers, unfamiliar with GPS tracking, can use and thereby prosper from the experiences already available. The second reason is that we have come to a definition of best practice, considering the state of the art in GPS-based surveys, with hundreds of GPS tracking investigations being conducted. We hope that by providing a review of the literature and exchanging our experiences, we may provide a starting point for a discussion of what this best practice is. Our model, which takes all phases of the tracking investigation into consideration, is meant to be such a starting point.

The structure of the chapter is as follows. Section 2 presents our model for GPS tracking data collection. Sections 3 to 7 discuss the different phases of the model in detail, and section 8 presents a case study in which the model was used. Through practical examples, it shows how the issues we face as researchers in each phase of the model may be addressed. Finally, section 9 presents the conclusion.

A V-MODEL FOR DESIGNING A GPS TRACKING STUDY

To conceptualize our review of the literature and experiences into a model for GPS tracking, we chose the classic V-model for software development as our starting point. The V-model was originally developed by Rook (1986). As shown in Figure 1, it has been discussed in numerous publications and developed further by, for example, Mathur & Malik (2010). The V-model provides a clear differentiation between design, coding and test. The left-hand side of the V constitutes the design phase; the bottom the coding phase and the right-hand side the test phase. Many scholars regard the distribution of GPS devices, the tracking, and the collection of GPS devices as the main components of a GPS study. However, these activities, like the coding in a software development project, are only parts of a complete GPS tracking study. If we only focus on this, we forget many important tasks before and after the actually tracking. For example, too little effort in the phase before the actual tracking may endanger the motivation of the respondents in the recruitment phase.

The consequence of unmotivated respondents is typically that they forget the device more often than motivated respondents, or simply ignore to carry the device altogether, which in turn means that data capture rates will fall. Similarly, if the analysis coming after the actual tracking is not taken into consideration, there is the risk that the intended analyses are not possible with the captured data. An example is map-matching analysis, which often requires certain logging frequencies to be useful. If not considered before in depth, one might risk having collected the data with too low frequencies, which in turn makes the data useless for map matching.

Let us, therefore, turn the V-model for software development into a V-model for GPS tracking. On the left side of the V, the “Requirement Specification” box is replaced by “Study Objec-