

Chapter 7

How Knowing Who, Where and When Can Change Health Care Delivery

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ABSTRACT

Everything that happens to a person during their lifetime happens in the context of place, and the movements made by the person through and within that place. Persons begin life with a birthplace; they remember exactly where they were when they first laid eyes on their true love, the street address of their first home, etc. New research suggests that changes in movement patterns which occur in home and public spaces may be significant indicators of declining mental and physical health. In this chapter the authors discuss efforts to measure natural human movement, present a novel technique that uses a referential grid system to study the relationship of movement to health changes. The authors then present several syndromes whose understanding may be increased by a more thorough analysis of movement. They conclude with a discussion of how location aware technologies can play a role in identifying problems and solutions in the design of living spaces for the elderly.

DOI: 10.4018/978-1-60960-469-1.ch007

INTRODUCTION: THE POTENTIAL OF ACTIVE LOCATION AWARE TECHNOLOGY IN HEALTH CARE

Locomotion is elemental to the definition of what it is to be human and to our understanding of what constitutes proper health. Disorders such as Parkinson's disease and other neurological maladies which restrict mobility are among the most feared of disorders because they cause such dire limitations in a person's activities. While a person in the later stages of a movement limiting disease may clearly evidence the disorder, the disorders may begin slowly and reveal themselves in subtle changes in movements which may not be apparent to the afflicted.

The main argument of the present chapter is that current location aware technology can be used to detect subtle changes in movement patterns in everyday living situations as well as in formal assessments of gait and balance. The information so obtained can be used as an aid to diagnosis of movement disorders as well as a way of monitoring the effectiveness of interventions for them.

In this chapter we present information on emerging location aware technologies that show promise for detecting some forms of dementia. We then present several disorders whose early detection and diagnosis may be aided by location aware technologies. Finally we present to the reader a framework in which location aware technologies can augment existing care environments both in the home and in formal settings.

BACKGROUND

In Asia in 2000 fully 6% and in Europe 15.5% of the population was older than 65 years of age, percentages that are projected to grow at an accelerating rate (US Centers for Disease Control, 2003). The US fares a bit better than Europe at 12.4% due to sustained immigration of younger persons and their families. The swelling health-

care budget has forced governments to consider innovative technological approaches to mitigate rising healthcare costs. One innovation under study is to implement "smart house" technologies in the homes of persons who may be at risk of developing expensive chronic disorders or suffering the effects of their sequelae (Pavel et al., 2007). This strategy includes monitoring and evaluating behavioral changes (Harvey, Zhou, Keller, Rantz, & He, 2009) including the early detection of potentially expensive or lethal disorders, the delineation of high fall risk areas in the home through the study of resident traffic patterns (Wang, Skubic, & Zhu, 2009), or detecting falls and injuries rapidly and summoning prompt assistance in order to minimize recovery costs (Hamill, Young, Boger, & Mihailidis, 2009). In each case the intent is to improve care through improved surveillance and significantly reduce the likelihood that the resident will transit into an expensive formal care environment before it is absolutely necessary. A considerable body of mental and physical health evidence supports the practice of maintaining persons in their own homes vs. transferring them to formal care settings where they may be cut off from their social support networks (Mihailidis, Cockburn, et al. 2008; Demiris, Rantz, et al. 2004; Sixsmith 2000; Ni Scanail, Carew, et al. 2006).

CHAPTER FOCUS: SPACE—THE CONTEXT FOR LIFE'S MOVEMENTS, MEMORIES AND GOALS

In our investigations we employ the movement ecology paradigm as the theoretical framework for studying human path tortuosity (the degree to which an elder's movement path deviates from a straight line) in dementia; it is a transactional analysis that links three features of an individual—their internal state, their navigational capacity and their motion capacity—with features of their external environment (Nathan et al., 2008 p. 10954). Each

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