Formative Analysis of Aging in Place:
Implications for the Design of Caregiver Robots

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SUMMARY

Many have conceptualized caregiver robots as consumer products and studied elders' perceived needs for and preferences about such products. For reviews, please see (Broadbent, Stafford, & MacDonald, 2009; Jones & Schmidlin, 2011). That approach, though, could create robots that cannot satisfy elders' actual caregiving needs.

Alternatively, one can conceptualize caregiver robots as workers in complex socio-technical systems. To do so, one would need a detailed account of the caregiving that takes place in elders' homes. Unfortunately, as noted in a National Research Council (2011) report, such a detailed account of caregiving does not exist.

Accordingly, we sought to develop such an account. There are many ways to analyze work (for a discussion of general approaches, see Vicente, 1999). They can be categorized into 3 general types: normative, descriptive, and formative approaches (Vicente, 1999). We adopted a formative approach because formative approaches are tailored to the analysis of complex socio-technical systems (Vicente, 1999). They capture work requirements without specifying how that work must be done or who must do it. For example, the constraint "must not lose track of time" captures a work requirement but allows the associated work to be accomplished in a number of different ways (e.g., by checking a clock, setting an alarm) and by a number of different entities (e.g., family member, caregiver robot).

To conduct our analysis, researchers observed caregiving in elders' homes, and interviewed caregivers about their work activities. Researchers then organized their findings into an Abstraction Hierarchy (AH; Vicente, 1999), that is, a detailed account of the aging in place socio-technical system.

Our primary aim was to create an AH that describes means-ends relations between the complex socio-technical caregiving system's overall objectives, work tasks, and physical resources. Such a description provides a detailed account of the caregiving work domain, and serves as the foundation for subsequent formative analyses of caregiving.

To create the AH, research team members completed 4 steps: 1) analyzing existing caregiving documentation, 2) observing caregiving and interviewing caregivers, 3) drafting and/or refining the AH, and 4) validating the AH. Steps 2 and 3 were iterative. This process is consistent with Naikar, Hopcraft, and Moylan's (2005) recommendations regarding formative analyses.

The AH made clear that caregiving for those who age in place is a complex and nuanced activity. More specifically, our analysis confirmed existing research regarding categories of caregiving tasks and revealed aspects of caregiving that have not been detailed so far. The existing literature indicates that caregivers assist older adults with self-maintenance activities of daily life (ADLs), such as eating, toileting, and dressing (Lawton, 1990), instrumental activities of daily life (IADLs), such as cooking, cleaning, and shopping (Lawton, 1990), and enhanced activities of daily life (EADLs), such as participating in social activities and pursuing hobbies (Rogers, et al., 1998). Our analysis confirmed those findings, and our AH provides a more detailed account of those tasks than was previously available. Our analysis also revealed aspects of caregiving for those who are aging in place that have not been detailed thus far in the research literature. For example, our AH contains a purpose-related function called Counseling, which concerns ensuring that the elder does not experience psychological distress. To perform this function, the caregiver must understand the elder's situation (e.g., a family conflict), use information about that situation (e.g., experience with relevant family members and/or past conflicts; the elders' past choices), and offer the elder advice about how to proceed (e.g., which family member's advice to follow).

The main implication of our AH for the design of caregiver robots is that such robots cannot be designed to perform purpose-related functions in a one-size-fits-all way; rather, caregiver robots must exhibit context-conditioned variability (Vicente, 1999). Our AH has many other important implications for the design of caregiver robots, which unfortunately cannot be detailed here due to space constraints.

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