

# Contextual Inquiry - EkoBot

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It is common knowledge that responsible, working parents have busy lives. To stay on top of things, these parents need to stay organized with respect to time and space. They must organize their time since they have to negotiate every family member's schedules and allocate time for each task they need to do. They must also organize their space since they have to keep the house clean and make it easy to find belongings when they are in a rush. These organizational demands prevent parents from doing more desirable activities.

Our domestic robot system aims to decrease the time parents spend organizing the house. Parents could automate this robot to periodically pick up and store objects in their designated storage locations. The system allows the users to schedule cleaning, which enables them to remove this task from their daily planning. The parents can also order the robot to clean on demand through a web or phone interface. This interface provides detailed information regarding which rooms are messy and in need of cleaning. The robot can operate in two modes when requested to organize the house. The first mode simply reorganizes the items in the house to reflect a previously defined cleanly state. The second mode prompts the children to reorganize instead, allowing the parents to enforce the traits of discipline and independence on the children. The parents define where items in each room go. They do this using the interface before the robot actually performs the task, and the robot's job is to reorganize the items in the room to get them back to that state.

## 1 Contextual Inquiry Participants

We targeted working parents with young (13 or under) children for our inquiries. We expected these families to have the highest organizational demands due to the quantity of family members and degree of parental involvement required for that age range. We found these participants to be ideal for this system because they were likely to have a wide variety of frequent, menial chores that could potentially be automated by a robot. Observing these participants would enable us to decide which chores we should automate.

The families we observed had varying amounts of structure and different levels of maturity in their children. This gave us a more complete picture of the sorts of tasks working parents would need to perform as their children aged. We observed each participant family as they performed a variety of tasks in their homes (elaborated below). During these observations, we asked questions about their organization methods and chores, among other things.

Olivia and Elmo, our first parents, live in a 2-story house with three children ages 6, 5, and 4. We primarily talked with Olivia. She takes primary responsibility for organizing the family and home, while Elmo assists her at her request (he works most of the day). She also works at a daycare 7 hours per day and volunteers at her childrens' school. Olivia spends almost all of her time on these tasks, with occasional breaks where she is able to read.

She represents a highly organized parent who imposes structure on her family (the children are too young to self-organize, anyway). To stay organized, she keeps a physical “master calendar”, a pad of paper with daily to-dos, and a child-specific Google calendar that she prints out each month and puts on the fridge for the children. She takes most of the burden of maintaining this structure.

Mia and Wayne run a family with four kids. The mother works an at-home job which has hours matching the childrens’ school hours. The father works a regular work day away from the home, which lasts from 7:30 am until around 6:30 pm. All but one of the children are involved in after school activities. These activities typically occur 1-4 times per week and all requiring driving. Two kids are in the same school, while the others are in two different schools. We chose to interview this family since their children are older than our other interviewees and because they are much more loosely organized. Their children range in age from 13 to 6. Their house runs on many last minute preparations and ad hoc solutions. This will give us insight into the way a less regimented family manages to organize their time and space.

Sarah’s family has a much younger child - age 4. She lives in a house with her fiance, David, who also has a child of age 4. That makes this family a good choice for an interview since their kids are less able to take care of themselves at such a young age. They generally participate less in the running of the household, requiring the parents to do much of the organizing themselves. Sarah works from 6am to 2:30pm while her fiance works 8am to 6pm. The two parents take joint responsibility for all tasks, though David often does extra work to allow Sarah to attend online college courses. Due to their differing work hours and Sarah’s school responsibilities, their schedule could be considered hectic and they often get few hours of sleep. They have a generally well-organized space where there is only one location in the house for toys - the toy closet - and all toys must be there at the end of the day. They have no set system for organizing their time other than electronic calendars. Since the children are so young, they do not participate in the scheduling process.

## **2 Contextual Inquiry Results**

### **2.1 Organizing Time and Space is a Priority**

All three of our interviewed families spend considerable energy organizing their time and stuff, with varying degrees of success. With kids, the parents must track innumerable activities such as sporting events, doctor’s visits, etc. If two working parents occupy the house, this organization becomes more difficult since they must coordinate their schedules jointly. Mia’s family, for instance, needs to coordinate the activity of four kids with two parents’ schedules. They occasionally miss important events due to scheduling conflicts. Sarah’s family encounters similar issues. Sarah begins work at 6am, which is quite different than her fiance, who begins at 8am. Because of their differing schedules, they need to perform hand-offs with watching the kids. Also, Sarah takes online college courses, forcing her to find space and time away from the kids so she can study. Olivia uses the most disciplined system

for organizing her time - she uses calendars and daily “to do” lists to track everything she must accomplish. She puts them on the fridge so the whole family stays synchronized.

They also spend considerable effort organizing their physical space. With so many objects in so many places, keeping track of them becomes quite challenging - necessitating the need for some sort of system. This means they set aside particular spaces for particular objects so they can be easily found. For example, Sarah’s family keeps all kids’ toys in one hallway closet. They allow the kids to keep the closet in any shape they want, but the toys must be put back there at the end of the day. Likewise, all clothing and school supplies belong in the closet and not elsewhere. Mia’s family uses many forms of organizing, including “cubby holes” belonging to each kid and drawers set aside for particular uses. Though they do not maintain strict discipline over their organization, it is nevertheless critical since it helps them work more efficiently while maintaining their hectic schedule. Olivia’s family uses a similar system.

## **2.2 Family Structure Reinforces Independence, Discipline**

These families structure their organization in a way that reinforces the childrens’ sense of independence and discipline. In all three cases, the families expect the children to contribute to the organization and arrangement of the space. By expecting the children to arrange their things according to the rules of the household’s organization, the children practice the virtues of hard work and discipline and gain an intuition for taking care of their own space instead of relying on their parents. In one case, the children also help organize scheduling and timing. In Mia’s household, the children play an active role in passing messages to the parents and scheduling - a collaborative effort. In Sarah’s family the experience is quite different - with children which are only four years of age, they are too young to help with organizing scheduling. Olivia requires her children to pick up after themselves every evening, which she says helps increase their independence.

## **2.3 Multitasking or Cutting Corners is a Necessity**

Given these families’ hectic schedules, multitasking becomes a norm. This can result in stress and missed details. For instance, Mia’s family juggles so many priorities that they occasionally miss Jaden’s Tai Kwon Do classes. Because they have so many things going on, they often deal with issues, like school forms, immediately before they are due. Sarah and her fiance often perform domestic tasks like cooking while attempting to watch the kids at the same time. This can be so taxing that they prefer to cut corners by buying food at the local supermarket instead. Olivia pointed out that some important tasks in her daily to-do notebook had gone unfinished for several months just because she didnt have enough time to complete them.

## 2.4 Free Time is at a Premium

When we ask the parents which tasks they would like to give up and what they would like to do in their spare time, we find some general regularities. The parents generally enjoy cooking, for instance, and would not want to give it up. On the other hand, it seems they would prefer to give up shopping and many cleaning tasks. In all cases, the parents have activities they would like to do and have either neglected them or “fit them in” because of their hectic schedules. Sarah, for instance, takes online college courses. Because she works so early, and because she performs so many domestic duties, she has to burn both ends of the candle to finish assigned homework. Wayne, who is Mia’s husband, begins exercising at 4am since this is the only time he has away from children and work long enough to fit it in. Olivia expressed a desire to have time to herself to take tennis lessons and to volunteer more at the school. With this consistent lack of time, it is clear that free time is at a premium for these parents.

## 3 Task Analysis

Our tasks focus on one of the most common issues we found during our contextual inquiry - organization. Since tools already exist to help with organizing one’s time, our tasks focus on organizing one’s space. The families commit considerable resources to organization, which becomes a time sink. Because they have such hectic schedules, this contributes to cutting corners and missing details, which increases stress. Since free time is such a premium for them, a domestic robot system could provide considerable value by assisting with organizing their space. However, since the organizing tasks provide an opportunity to instruct the families’ children, the system should either make suggestions to the children to clean up, to guide them in cleaning, to alert the parents to the dirty state of the house, or to provide some other supporting role that can help make things easier without taking away the childrens’ independence. However, since the children will not always be home, the robot should also be capable of cleaning on its own. This requires that the family teach the robot how the space is to be arranged - similar to teaching a maid about the layout of things in the house.

### 3.1 Easy task - Scheduling a nightly organization routine

In this task the participants must schedule a nightly organizing routine for the robot. This task occurs frequently across all of the families we observed. The kids regularly return from school and leave their clothes and toys strewn about the house. This means a quick arrangement of the space must be done each evening so the house is clean the next day. By scheduling the robot to organize the house each evening, the parents can get assistance doing this. The kids’ typical clean-up time is 7:30pm, so a parent schedules the robot to organize during that time. Since this is mostly a problem on weeknights, the parent selects for this to run on weeknights. The total clean up time should be no longer than 30 minutes. To clean up for the coming week, the parent also schedules it to run for an hour at 7:00pm

on Sunday evening. Since the children will be home during these times, they should do the organizing themselves and the robot should only play a supporting role.

### **3.2 Medium task - Preparing the house for a dinner party**

Our parents often find themselves on the run from one place to another, making it occasionally impossible to clean the house when it needs to be. This task represents that challenge. In this task, the parents intend to throw a dinner party in the evening, but they do not have time to clean the house in the morning before they leave. They need to run to the market to pick up some items for the party immediately beforehand, making cleaning the place themselves impossible. The kids will not be home this evening, so they cannot simply call the kids to ask them to do the cleaning. The parents will use a remote interface to request information about which rooms are dirty and need cleaning. Once they receive this information, they will command the robot to clean any dirty rooms to return them to a cleanly state. Since the kids will not be home, the robot will do the cleaning itself instead of suggesting it to the children. The party starts at 8pm, but the robot should be finished with cleaning by 7pm so they have time to set up without the robot in the way.

### **3.3 Hard task - Teaching the robot to clean the living room**

Since different families organize things differently, the interface must provide a way for users to teach the robot how to clean a particular space. The families we observed tend to have particular spaces for particular classes of objects. In this task the parents will define the robot's policy for cleaning the living room, which specifies the mapping between objects and the place where they would be if the room were clean. This task plays a similar role to explaining the layout of a space to a maid. The room has many toys, school supplies, eating utensils, and books strewn throughout it. The toys belong in a toy chest which is located in the childrens' bedroom, school supplies belong in the closet in the childrens' room, the eating utensils belong in a particular drawer in the kitchen, and books belong on the book shelf.



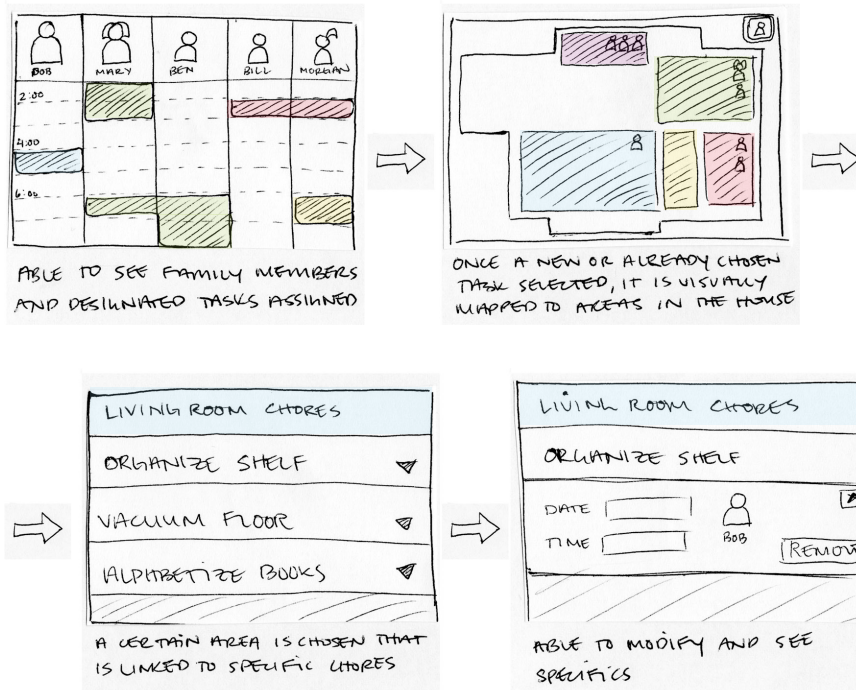


Figure 2: Coordinating the family's chores and use of the robot





Figure 3: Scheduling task frequency and date