Working with Children and Props: Two Adolescence User Research Cases with Props

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ABSTRACT
Props have been used in all phases of user research, but their influences on collected data have not been thoroughly discussed. In this paper, three prop characteristics, likeness, visibility and tangibility, and configurability are identified from literature review based on different roles of props in user research: representation of physical entities, visualization and objectification of abstract entities, and reenactment of past events in user research. In this research, correlations between prop characteristics and generated design information are hypothesized. Two research projects, MonkeySmart! and Bike Interviews, are presented to exemplify research activities. Discussion of each project identifies (1) the types of information, either narrative or paradigmatic, generated with props, and useful for design practitioners, and (2) correlations between prop characteristics and the generated design information.

Author Keywords
Prop Characteristics, Behavioral Prototyping, Interviews, Design Research Methods, Adolescents Users

PROP ROLES AND PROP CHARACTERISTICS

The advantages and disadvantages of using props in user research have not been thoroughly examined. The exploratory questions for this research-in-progress include:

- What roles do props play in user research, and what prop characteristics are relevant to such roles?
- What differences can the prop characteristics cause in the different types of user responses we collect?

The human-centered design process is an iterative process of developing products or services to satisfy user needs. It consists of four phases: Examination, Interpretation, Projection, and Realization which will be repeated until the project team devises optimal solutions [10]. For the participatory activities in the Examination and Realization processes, props (any objects, activities or settings intentionally used in research activities provided by researchers or acquired from the participants' possessions) have been used (1) to represent physical entities, either in appearances and/or functionalities, (2) to visualize/objectify abstract entities which users can physically manipulate, and (3) to reenact past events or user actions. Such prop roles are shaped by three types of prop characteristics: likeness, visibility and tangibility, and configurability.

1. Likeness

Props are representations of physical entities, with an analogous relationship between them, either in their appearances and/or functionalities. For example, toy characters are iconic representation of mobile phone users [8], while a dictionary is a functional analogue of the searching feature in a digital library website in that both provide alphabetized information items [9].

2. Visibility and Tangibility

Props can visualize/objectify abstract entities, and users can physically manipulate them. The relationship between them may be isomorphic or metaphoric. For example, in the Landscape Game [1], the metaphor of space is used: a center of concentric circles represents the conceptual center of a user's office activities.

3. Configurability

When props are used to reenact past events or user actions, and this role requires the props to be configurable by participants. Participants moved around toy characters to show their usages of mobile gadgets [6]. Configurability allows users to create various meanings also. Johansson and Linde used a set of video cards showing fragmented narratives, and the participants were asked to arrange cards to make negotiated narratives. The open-ended nature of the cards allowed for the variety of stories [7].

RESEARCH WITH ADOLESCENT USERS AND PROPS

In this paper, the findings from two design projects with adolescents interacting with props are discussed in relation to relevant literature and theories.

User research tasks designed for adolescent subjects need consideration of the subjects' cognitive and social

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developmental stages. Farber et al. [4] found young participants (7–11 years old) had difficulties in certain types of tasks, such as working in a group, thinking of ideas, writing, and interacting with many objects even after one year of partnership between the participants and researchers. Consideration also needs to be given to the interview method and environment. Druin [3] proposes the Cooperative Inquiry method in which low-tech prototyping, observation, and note-taking are combined to have children as partners in design projects. Druin reported that children tend to perform or freeze in front of video cameras, and recommended that the researchers interact with children without taking notes to make children comfortable.

The author conducted two design projects with adolescents with props. The first research, MonkeySmart! shows the case of props used to represent unimplemented features for behavioral prototyping. The second, Bicycle Interviews, was a pilot study showing how varied degrees of likeness can alter user responses in a primary research activity (interviewing). These two projects exemplify the two types of research activities we need concerning the effective use of props: (1) behavioral prototyping types of research to identify the types of information and props useful for design practitioners, and (2) quantitative analysis to identify correlations between prop characteristics and Narrative/Paradigmatic types of information. The research aims to provide partial guidelines in designing and using the right kind of props.

The first project, a behavioral prototyping project, can identify (a) the types of information directly useful for design practitioners, and (b) the kinds of props useful to collect such information. If a designer is working on a bicycle project for kids with new GPS features, s/he may collect different types of information. Users can draw sketches of GPS devices they want, and the collected sketches are paradigmatic types of information. Or users can give potential usages of the GPS feature in narrative format. Narrative and paradigmatic types are two common types of information we can collect from user research directly useful for design practitioners. The researcher may provide props to collect either type of information. In deciding the kinds of props, s/he will consider prop roles and varied degrees of characteristics. For example, a realistic three-dimensional model of a bicycle (high degrees of likeness) or just a printed word label "bicycle" (low degrees of likeness) can be used.

The second project entails quantitative analysis of research data to identify correlations between prop characteristics and narrative/paradigmatic types of information, e.g., using a prop with high degrees of likeness is more effective in collecting paradigmatic information than the one with lower degrees of likeness. The second project, Bike Interviews, is an example of this type of research.

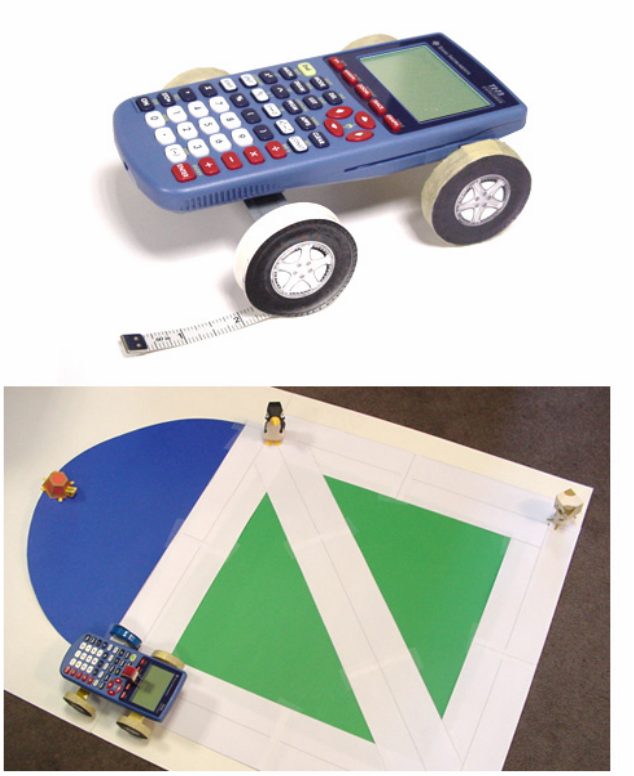

Figure 1. A car-shaped calculator prototype, a map, and animal props for MonkeySmart!

TWO DESIGN RESEARCH PROJECTS WITH PROPS

Props in Behavioral Prototyping: Engaging Users in Concept Development

The first research shows the case of behavioral prototyping with narrative and props. The author conducted a project entitled MonkeySmart! in which new concepts of graphing calculators for a middle school curriculum, especially 6th grade measurement/geometry lessons, are explored. Props involved in this project and their roles are as follows: a map and paper models of animals (visualization/objectification of abstract concepts), a wheel-attached calculator (representation of unimplemented features), and printed images of calculators with or without additional objects (representation of physical entities). The collected information includes students' drawings of calculators with new features (paradigmatic type), and short stories about them (narrative type).

Users' mental models of calculator interaction, math curriculum in which the calculators will be used, and other sources of influence such as peer group interaction were critical in this project. Through the literature review and class observations, the author generated the concept of '*the attached metaphor*', a series of devices that users can attach to a calculator to get external data input, for example temperature, luminosity, or acoustic wave for further calculation. The devices are suggested to be designed after other objects, such as an ear-shaped device for collecting

acoustic wave, to metaphorically denote their functions. The first author developed one prototype of such a device with *the attached metaphor*, by adding four wheels to a calculator making it a car that can measure distance. The measuring function was prototyped by attaching a tape measure as one of the wheels to simulate the function of distance-measuring, as well as turning the machine into a fun toy, so the product concept was efficiently communicated between the researcher and students. Students enjoyed the calculator greatly, and did not need extra instructions to use it.

To understand users' responses to the attached metaphor, and to generate more instances of metaphor for other devices, a classroom activity, MonkeySmart!, was conducted with 28 6th graders for two hours in a Chicago public school. The activity had two parts: first, there was a math quiz with narrative structure, a story of an auditory challenged monkey who needs to visit his friends' places by driving a car (the calculator with wheels). This monkey was supposed to measure distances of paths on a map, and to calculate the distances of other paths based on the data and geometry formula. In this story, however, he did not know how to use the calculator, so the students needed to help him by showing the right sequences of pressing keys on paper strips. They had to write down keys because the monkey could not hear. The second part was a survey of composing a short story about objects-attached calculators, and adding a new object around another calculator image. Later, the survey was repeated with another group of 12 students.

Contextualization of Research Activities & User Responses

The props and the narrative structure of MonkeySmart! set a plausible context for the research activities. The story of a monkey visiting places set a sensible context of calculating distance. The story of the auditory challenged monkey successfully required students to write down every trial on paper strips. It was an easier way to record their traces of thinking -- their unsuccessful trials resulted from wrong mental models of the calculator interface, and subsequent attempts to correct them -- compared to video recording of verbal utterances.

The representational props facilitated generation of both paradigmatic information (students' drawings of calculators with new features), and narrative information (short stories about them). In the survey part of the research, the first 28 students added a range of objects around the given calculator images, from living organisms (trees, flowers, animals, insects…) to man-made artifacts (robots, desks, wristwatches…). Their stories of possible use of the calculators go beyond the current use of them. This shows that they not only perceived the calculator as functioning machinery; they were able to extend their thinking to the metaphorical level of function the author expected to see. The other 12 children did not draw anything. Instead, they added verbal comments strictly confined to the functional extension level, such as adding TV, radio, a game, a robot, and globes to the calculator.

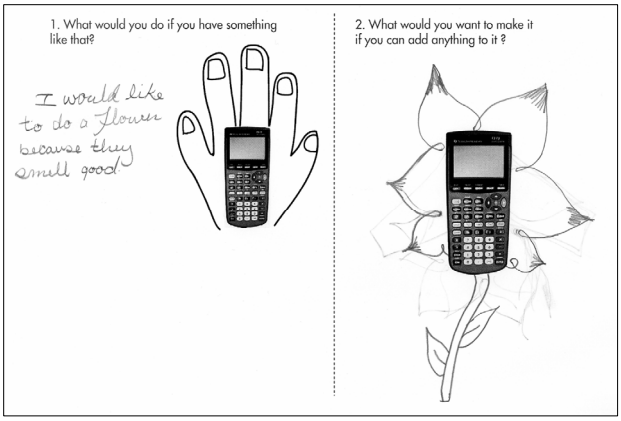

Figure 2. A story and an object added by children around the calculator.

Props in Interviews: User Narratives and Props with High and Low Degrees of Likeness

In Bike Interviews, a pilot study was conducted to compare collected narratives with an low degrees of likeness prop (the word label 'bicycle') and a high degrees of likeness prop (a scale model of a bicycle). In the same Chicago public school, two interviews within a week were conducted with six adolescents, two girls and four boys between 10 and 12 years old. In each of the two interviews, the participants were asked to perform two identical tasks: sharing two bike-related stories and drawings of bicycles.

Four kinds of difference were predicted regarding interview data collected with these two contrasting props: (a) the total number of utterances, (b) the ratio between narrative and paradigmatic types of utterances following Bruner [2], and (c) the number of bicycle parts present in the children's drawings, and (d) the frequency of gestures relevant to their stories during the interviews. It was proposed that participants may be reminded of features of a bicycle by a prop with higher degrees of likeness; as a result, they may describe more features in paradigmatic types of utterances. It was also proposed that their visualization of bicycles may be more realistic than schematic with literal props.

The interview data were coded and compared with t-test procedure. The results indicated that there is not a significant difference between the two sets of verbal interview data in terms of either the total numbers of utterances, or narrative/paradigmatic utterance ratios. The analysis of the drawing data revealed, however, that significantly more parts were included in the second group of drawings created with the scale model of bicycle, and overall, the second drawings were more realistic in the way parts were connected. All participants were observed to refer to the model while drawing, but all claimed that their drawings were either their own bicycles or imaginary ones. Regarding gestures, the author could not collect any data to compare because the participants barely made gestures in

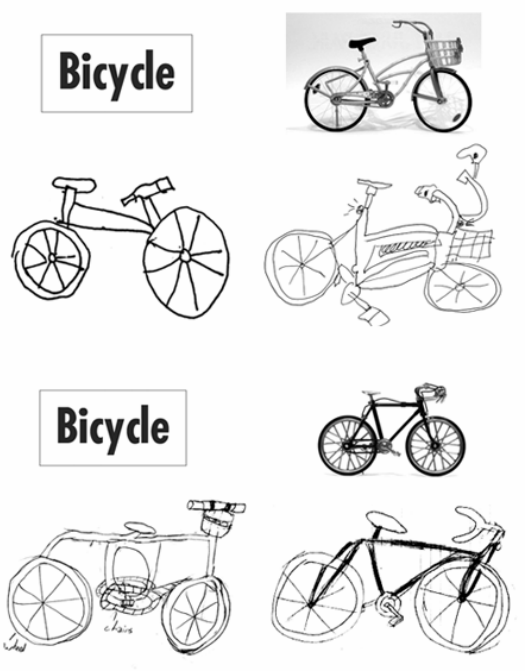

Figure 3. Four bicycle drawings from 2 participants drawn with different props.

any of the interviews. Only one participant actively touched and played with the model bicycle. It may be meaningful that this participant is the only person who switched from an episodic story (how he got a bicycle) to a feature-related story (adding a light to it later). In addition, his drawing became remarkably realistic with the literal prop.

High degrees of likeness and descriptive information

High degrees of likeness may influence the descriptive nature of information. Participants' drawings became similar to the given props. We should also keep in mind that having more details does not necessarily mean getting closer to their own bicycles, even though most participants claimed they described their real bicycles.

If design researchers need to know the realistic features of things and events by drawing, realistic props may lead to better recall and thus better results as supported by some psychology research literatures [5, 12]. However, as O'Callaghan showed, realistic props may suggest something else that was not there for real, and young participants are most vulnerable to suggestion [11].

DISCUSSION OF FINDINGS

In these two cases of user research, props are observed to facilitate design information generation by representing physical entities. This representational role of props contextualized research activities and user responses, and assisted users' recalling of features.

However, the findings from the Bike Interviews have some limitations. First, the number of participants was too small to draw any substantial conclusion. Second, the author did not have enough time to build rapport with participants before the interviews, and as a result, they sat for the interviews in a rather passive, albeit very cooperative, manner. Third, the physical environment of the interviews (the small desks and a rather big bicycle model) did not encourage grabbing the bicycle and moving it along.

In further research, behavioral prototyping and quantitative analysis of research data will be expanded with more participants. In the quantitative analysis of research data, two types of information, narrative and paradigmatic, and three prop characteristics will be cross-examined. The Bike Interviews will be expanded as one part of the research, with more consideration of configurability derived from props' physical attributes, as it will partly influence the qualities of reenacted experiences.

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