HF700: Foundations in Human Factors

Assignment Three: Prior Knowledge

Goal and Task Analysis:
The I-JAM MP3 Player

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November 6th, 2000

Introduction

The I-JAM MP3 Player (see Figure 1) is a small, portable device that allows users to play MP3 music files. Music can be obtained from a user's personal CD collection, or downloaded from Web sites. The I-JAM MP3 Player comes with a special disk drive (see Figure 2) and JAM Station™, an MP3 conversion software for installation on a user's computer. Songs are saved to a quarter-sized disk (see Figure 3) using the disk drive, and the disk is then inserted into the player. The I-JAM MP3 player also comes with a built-in FM radio.

Figure 1 – I-JAM MP3 Player

Figure 2 – JAM Station Disk Drive

Figure 3 – Disk

Using the I-JAM MP3 Player as the case study, this paper will analyze the product's usability with regard to prior knowledge and goal/task analysis.

Factor: Goal and Task Analysis

The cognitive perceptual factor of goal and task analysis is critical to the effective design of any system. It is an important tool for uncovering a user's prior knowledge and for discovering how that knowledge affects a user's expectations and interactions with a given system. Goal and task analysis encompasses many different areas, including users, tasks, and work environment, and involves learning about users through observation of their activities (Hackos and Redish, 7).

User Profiles/Personas

The first vital component of any goal and task analysis involves the creation of user profiles. User profiles give designers and programmers a more concrete sense of the people who will actually use the system, as well as how they might expect it to function. Cooper, who perhaps more accurately calls user profiles "personas", describes them as "hypothetical archetypes of actual users". Because personas are often based on interviews with real people, multiple personas are likely to be discovered during this phase of a goal and task analysis. However, the precise,

detailed descriptions of multiple individuals may help determine the feature/functionality scope for the system, and assist overwhelmed development teams in narrowing down the target audience. Ironically, it has been found that designing an interface for a primary persona (instead of trying to please all types of users) can result in more intuitive, useable, and pleasing systems for a wide variety of people (Cooper 124-126, 132).

Profiles/personas should include information on age, gender, education, training, motivation, goals, and so on (Shneiderman, 67). All of these areas provide invaluable data about a user's prior knowledge. For example, a younger persona may have certain expectations about a system's response time because s/he has only used systems produced during the past five years, while an older persona might be more patient and wait longer to see a result because almost anything is faster than what they use to work with. A persona who has been trained in the use of a particular system has some basic knowledge of that system, even if that training was given during a previous release. This information is stored in the persona's memory and helps them utilize the interface; a persona who is new to the system does not bring such information to the experience. Since research has shown that prior knowledge has a significant affect on learning experiences, user profiles/personas can help designers understand why users do not receive certain ideas and concepts in the way they may have been intended (Learning in Interactive Environments Page, Hackos and Redish, 15). Speaking with actual people to develop user profiles/personas provides important information that can be used to determine the prior knowledge a person brings with them and applies when interacting with a system (Hackos and Redish, 41; Shneiderman, 67-68). In other words, personas can help us develop a mental model inherent in the design of the system that is more compatible with that of the user (Hackos and Redish, 41).

Unfortunately, some designers equate the intentions, goals, and expectations of users with their own. Or, designers may mistakenly believe that they already "know" their users. However, users are continuously changing, growing, learning new skills, and adapting to existing technology (because they are real people, after all!). In other words, "you need to know where your particular users are in a continuum of knowledge and experience" (Hackos and Redish, 35). Failing to recognize this and include it as part of a goal and task analysis can make the most well intentioned interface design counterproductive.

Not surprisingly, personas can also help designers estimate the level of expertise or skill of a target audience (Cooper, 131). For our purposes, expertise can be loosely defined as the knowledge and experience a user has previously acquired with regard to a subject area or interface. The subject area or interface does not have to be exact; they can be areas or interfaces that are similar in nature to that of a given system. The amount of this knowledge and experience that a user can employ when using a system determines their level of expertise, which are generally categorized into novice/first-time/naïve users, occasional/perpetual novice/knowledgeable intermittent users, and expert/frequent/power users. Some characteristics of each expertise level are shown in the following table.

Novice	Occasional	Expert
• May be anxious about the new experience and afraid to make errors. • Typically have a limited number of prior experiences to draw upon, which can be used as a bridge to learning new systems. • Require more explanations and definitions of concepts and terms, as well as frequent and informative feedback/reinforcement.	• Fairly confident but may make occasional errors. • Have a moderate number of prior experiences to draw upon, which can be used to "rediscover" how to accomplish goals or execute particular tasks. • Require functionality that prevents critical mistakes from free exploration/trial-and-error behavior.	• Confident that they have the ability to perform; activity is often automatic and errors are self-corrected. • Typically have a large number of prior experiences to draw upon, which can be used to quickly adapt to new situations. • Require a system that offers quick response time, flexibility, and short-cut/macro features.

(Shneiderman, 68-69; Prior Capabilities, Knowledge, and Experience Page)

An interface designer can leverage prior knowledge for any user expertise level (novice, occasional, expert). For occasional users and experts, the design can work to their advantage by triggering previously stored information and/or reducing the amount cognitive effort needed to accomplish a goal or individual task; for the novice, the design can introduce new concepts in a way that leverages previous experience in similar areas, making learning easier and the system less intimidating. In sum, a user's prior knowledge and experience, which together determine their level of expertise, affect how they learn and use the systems we produce (Hackos and Redish, 25).

Goals, Tasks and Task Flow

Insight into people's goals (desired end states) can improve the likelihood that an interface will be more in line with a user's expectations (Cooper, 150). If a goal is defined as the result state a persona seeks to achieve, a task is a "procedure the user must go through to achieve this state." Once a persona's goals are known, one can examine the individual tasks and subtasks necessary for these goals to be accomplished. Subtasks can be further divided into actions, which are often considered to require little (if any) conscious thought on the part of the user (Task Analysis Page). It is not surprising then, that Fitts' third and final phase of skill acquisition (which can be used to categorize an expert user) is described as a phase where "procedures [are] progressively more automatic and less subject to cognitive control" (Proctor, 255). Since tasks and subtasks require cognitive effort to complete and can negatively impact efficiency, it is wise to minimize these as much as possible and to increase the number of true actions that are performed.

Hierarchical Task Analysis (HTA) and Cognitive Task Analysis (CTA) are probably the most relevant types of task analysis where prior knowledge is concerned. HTA is fairly self-explanatory: activities are broken down into their components and arranged into a typical hierarchy (or flow) of execution. To be most helpful, this flow will be established from information (such as goals) about a persona and how she currently performs similar activities with other systems. Uncovering the importance, sequence, and frequency with which a persona performs tasks provides human factors specialists with insight into the persona's mental model. Conveniently, CTA assumes that there are

two models: the task model inherent in the design of a system and the mental task model that is present in the user's mind. When these two models are compatible with one another, usability of the device or system is increased (Task Analysis Page). It has even been shown that expert users of a system are those individuals whose mental models correspond to particular tasks more adequately than those of novices (Proctor, 261). Therefore, discovering the persona's mental model using goal and task analysis provides human factors specialists with the information they require to build the appropriate system task model and increase the effectiveness of a system design.

Application of Concepts: Evaluation of the I-JAM MP3 Player

This section describes how the principles of goal and task analysis can be applied to the I-JAM MP3 Player interface. It describes user profiles/personas and task flows that can be used to evaluate the usability and overall effectiveness of the system, and provides suggestions for improvement where necessary.

User Profile/Personas

This author expects that the primary persona for the I-JAM MP3 Player, whom we will name "Sarah" (following Cooper's process), is someone with a medium to high level of prior knowledge in this subject area/technology. In other words, she is a younger person (approximately 25 years old) who regularly listens to the radio and uses electronic devices that play CDs. Although Sarah does not typically use advanced features, she can play songs in an order that is to her liking with no assistance. Additionally, Sarah has successfully installed software on her personal computer using the typical wizard-like installation programs, and understands how to copy files from one location to another. Sarah has also been known to download MP3s from the Internet so she can play them on her computer. Sarah is now interested in learning how she can use the I-JAM MP3 Player to take those songs with her – specifically, she would like to take this music with her to the gym where she works out. She thinks listening to music would help her pass the time more quickly by taking her mind off the workout. Sarah is likely to try to use the I-JAM MP3 Player without reading a user manual the first time, and may try to figure out what all the controls do before seeking assistance. She will probably just pop the installation disk into her computer and follow any on-screen directions for the JAM Station™ software. Sarah expects that the music she listens to on the I-JAM MP3 Player will be similar to when she listens to it on her computer, though she realizes that portable gadgets probably cannot produce the same level of sound quality.

Because Sarah has frequent exposure to and experience with modern music players and can perform simple installation and file manipulation activities on her computer, she can be categorized as an expert user. Therefore, the I-JAM MP3 Player's interface should take advantage of the background knowledge Sarah has to make common functions as automatic as possible. Also, the interface should build on Sarah's knowledge to help her quickly and easily learn more advanced functions that she might come to appreciate. This is quite a feasible task, given the research that has shown how "'old' knowledge plays an important role in the acquisition of 'new' knowledge" (Assessment of Prior Knowledge Page).

Task Flow

Sarah's main goal is to take her mind off her workout by listening to music. The following are examples of related goals that Sarah might have for using the I-JAM MP3 Player:

- Listen to her favorite MP3s.
- Listen to her favorite radio station.

Each of these goals can be divided into a number of tasks, subtasks, and/or actions that Sarah must perform in order to produce the desired outcome. For example, if the goal is to listen to her MP3s, Sarah would:

1. Insert a previously recorded I-JAM disk into the player.
2. Turn on the I-JAM Player.
3. Play the tracks on the disk, in a desired order.
4. Optionally, adjust the volume, bass, treble, etc.

Sarah should be able to complete each of these tasks with relatively little difficulty, given her prior knowledge with operating CD players and radios.

Suggestions for Improvement

When a persona like Sarah presses the light gray button with the text PWR beneath it, the I-JAM MP3 Player scrolls the text HELLO across the display screen, followed by the text MP3 MODE, MPEG PLAY. Automatically, the device begins to play the first track on the disk. The interface correctly assumes Sarah's primary goal and condenses what could require multiple steps (power on, select mode, select first track, etc.) into a single action. However, pressing the PWR button again causes the display area to illuminate, when one might expect the device to shut off. Although the button also shows a black image of a sun (✳) to indicate this lighting feature, it is not automatically clear what action one would take to differentiate between these two responses. The user guide indicates that when "pressed and released" the power switch will "provide five seconds of back light illumination". However, even the instructions do not indicate how one would turn the power off! (You actually have to hold the button in for a slightly longer period of time.)

As it turns out, most buttons on the I-JAM MP3 Player produce one, two, or sometimes even three possible responses. This is most likely due to the space limitation for the interface. Another such example is the gray directional buttons (<<, >> printed on the button itself [used to move between tracks or radio stations]; v, ^ printed above the same buttons [used to adjust volume, bass, or treble]). It is unclear whether even the expert user would intuitively know that the VOL button can be quickly pressed once to put the device into volume adjustment mode, held down for a slightly longer period for bass adjustment mode, and quickly pressed once again for treble adjustment mode.

Despite these small hurdles, a persona like Sarah can probably operate the I-JAM MP3 Player with little difficulty. Once she realizes that different durations cause the buttons to execute different functions, these types of tasks will most likely become less confusing. However, this may take some time, and it may require Sarah to flip through the user guide. Additionally, given the environment in which Sarah desires to use the device, it may be difficult (while

running on a treadmill for example) to be sure she is pressing the button for the correct length of time. Due to the miniscule size of the buttons, it is also quite possible that Sarah might not even be pushing the correct button!

Although the I-JAM MP3 Player is so small and shaped perfectly to fit into a person's hand, it is not entirely in line with Sarah's goals. While (after a few tries) Sarah may be able to use the device flawlessly when she is sitting on her couch, the environment in which she wants to use the device makes it more difficult. It is this author's opinion that enlarging the size of the buttons on the device (which is entirely feasible) would alleviate many of these issues. Further, some indication that there are multiple types of button presses would be helpful. This could probably be done in a number of ways, but the design that comes to mind is one from the author's automobile. If one presses the power window control in the down direction, the window slowly goes down as long as the button is held. However, if one presses it a bit harder, the button seems to lock (this difference can be felt [tactile feedback]) and the window will go all the way down without requiring the button to be held. Such subtle cues could be used to alert Sarah to the state of the device, significantly improve its usability in the target environment, and would allow the I-JAM MP3 Player to build on its already fairly intuitive design to be even more "persona friendly".

Conclusion

Performing a goal and task analysis is a wonderful way to determine whether a given interface will meet the expectations of its target users. By researching information about specific users (personas) and identifying their ultimate goals (task flows) for a given system, human factors specialists can use this information to create an interface that is in line with a user's prior knowledge (no matter how much that may be). Ideally, the goal and task analysis should be performed at the beginning stages of a project, but as we have seen here, it can also be used to help identify weaknesses in a system. Interface designers should work to educate the rest of the project team about this process (pointing out some misconceptions) and incorporate this process into the development cycle. In the end, it will help everyone involved – especially the users.

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