Development of a more user understandable taxonomy

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INTRODUCTION

There are over a dozen different databases around the world listing assistive technologies and other devices to help address the needs of people experiencing disabilities [1-12]. The effectiveness of these databases however is directly impacted by the ability of users to effectively search the databases and find the proper solutions. The problem is that users are not necessarily familiar with the terminology used to categorize the databases.

This paper describes the efforts to address this problem with one of those databases, the Unified Listing, created by the Trace R&D Center at the University of Maryland, College Park, and Raising the Floor (both the International and US branches).

STATEMENT OF THE PROBLEM

The Unified Listing of Assistive ICT was created to help users and clinicians find appropriate assistive technologies associated with information and communication technologies. It is designed to be usable by users at all levels of expertise.

A few decades ago, the primary question of a search for an assistive technology might be “Is there a technology that will do x?” In 2020, the more appropriate question is, “Which of the many technologies available best meets the needs of a particular person?”

However, getting an overly long list of available assistive technologies would not be particularly useful. Given such a list, the typical user would be no more able to locate a specific product than they would be without it. However, getting an empty list because the right terms were not used in the search is equally useless. The identified challenge of the Unified listing is to provide a much shorter list, but a list that contains the items that are most likely to be appropriate to the needs of the individual – and allowing the user to be able to search successfully using their own terms.

APPROACH

In designing the data structure for the Unified Listing, we had to consider concepts that expand well beyond conventional database design. Specifically, we borrowed from experience in qualitative research design.

<u>Principles of Qualitative Research</u>

Qualitative research is a methodology for conducting exploratory research, where the research does not have a predefined research question beyond “what is out there?”. In general, the information collected through examination of records or interviews is grouped to identify “themes”, recurrent ideas in the mass of collected data.

A Priori Categorization

In A Priori categorization, the researcher/developer identifies the categories/themes before collecting the data, then places the data in the categories as it is collected. A Priori categorization assumes that the researcher knows the relevant areas of interest at the beginning.

In this process, the researcher/developer attempts to distill broad knowledge of the field being investigated to identify categories that exist, or that ought to exist. The resulting taxonomy will model the thinking processes of the person who is developing the data categories.

Emergent Themes

In Emergent Themes categorization, the researcher does not attempt to start with a structure for the data to be collected. Instead, as the information is gathered, it is placed into conceptual piles. For example, all computer access products might go in one category, while communication products might go in another. When a pile reaches an agreed upon size, its contents are examined. Are there, in fact, more than one kind of thing in this pile? Can we split it into two or more piles? This process continues until the data has been fully collected or until no new categories are found.

Emergent Themes categorization has an interesting feature in the logic of the categories. When the Apple II computer was shipping in the early 1980s, it included a number of demonstration games. One of these was "Animals," in which the computer would attempt to guess the animal the user was thinking of. The user might be thinking of a blue whale. The computer would guess, "Is it a canary?" The user would respond "No." When the user said that the animal was a blue whale, the computer would say, "Give me a question that would divide blue whales from canaries."

The user might respond with "Does it have feathers?" The computer would ask, "For a canary, what would the answer be?" And the user would respond "Yes."

So, for the next round, the user might think of a dog. The computer would ask, "Does it have feathers?" The user would say "No." The computer would ask, "Is it a blue whale?" At each incorrect guess, the user would be asked for a question that would divide the guess from the animal the user was thinking of.

If the user was very organized in his/her thinking, the resulting logic tree might resemble the Linnaeus System of Binomial Nomenclature. It is more likely that the result would be a tangled series of decisions that would robins and alligators more closely together than robins and sparrows. However, so long as the paths were followed carefully, both types of logic trees would lead to the same result.

This is an important point in taxonomy design. There may not be a uniquely correct taxonomic organization. So long as the system leads to the correct group, the taxonomy is acceptable.

Taxonomy Design

In taxonomic design, the end goal might be directed either towards categorization (filing) or retrieval.

Provide Unique Identification of objects

In a taxonomy designed for categorization, it is important that each group be uniquely different from other groups at the same level. When categorizing a product, it should fit into only a single group, so that ambiguity is minimized.

Assist in Locating a Technology

In a taxonomy designed for retrieval, the designer cannot assume that the person attempting to locate an item understands the principles of design of the taxonomy. If an object is categorized by a less than obvious characteristic, the naive user will not be able to use to successfully retrieve the desired object.

In such cases, it is more desirable that objects be placed in multiple categories that are "correct" categories but approached from different directions. Consider, for example, assistive technology that performs text to speech. Much of this technology was designed as aids for people with low-vision or blindness, and so might be categorized along with other accommodations for blindness. However, this technology is also useful for a person who has a learning disability affecting print translation to language. Such a person would be unlikely to search under blindness accommodations to find text to speech products, so they should also be categorized as accommodations for education, or for reading.

DEVELOPMENT

In the first attempt to develop a working taxonomy to assist users in finding appropriate assistive technology, the authors used an a priori approach. Based on decades of experience in the field of assistive technology and information collected from the Consumer Electronics Foundation, we created a taxonomy of more than a thousand end-categories and began to place assistive technologies in the appropriate locations.

After placing several hundred products in the taxonomy, we discovered two things. First, the taxonomy worked logically. Products could be placed into categories with little ambiguity. One potential use of this taxonomy would be to identify areas were development is most needed. If a developer wanted to begin working in the field of assistive technology, it would be fruitless to develop a new on-screen keyboard to complete with the more than 100 already available. Instead, developing a product to make spoken language more understandable in real-time (an empty category of the taxonomy) might result in a product without competitors. Second, while the taxonomy allowed fairly easy filing of new assistive technologies, it did not allow users outside the development team a high level of access in locating the technologies. Without a high level of familiarity with the field of assistive technology, users were generally unable to follow the logic tree.

Based on these findings, we abandoned the "logical" taxonomy, and begin developing assistive technologies based on emergent categories. We began with a small set of application-based categories. These included Computer Access and Use, Person to Person Communication, and Education.

As assistive technology products were imported into the Unified Listing, they were placed in these broad, high-level categories. When any category had more than about 25 products (our identified limit for user comfort), the products were examined to see if they might actually be more than one kind of thing. For example, products for "Computer Access and Use" might be related to information input, getting information out of the computer, using the computer to perform a task, or connecting the computer to other devices.

To augment this, we carried out a study of which terms a user might use to describe their problem or what they were looking for if they did not know AT terminology [13]. These terms were then paired with appropriate taxonomy terms. When an individual used one of these non-standard terms in a search the Unified Listing would provide a list of possible search terms that they can click on to find appropriate products. This feature can be found on both the classic and power searches.

RESULTS

The results of our taxonomic exploration can be seen at http://unifiedlisting.org/. The structure of the taxonomy can be seen most completely through the Power Search option, while the logic of the tree is explained through the Guided Shopping option.

The underlying taxonomy has over 650 branches and nodes containing over 2800 products. Because of the power of the branching tree structure, almost all of the products are accessible no more than 4 branches deep in the tree. In most cases, the number of products in a single group is less than 25 (a few nodes are still in the process of refinement to meet this ultimate goal).

Our user testing has shown that users at various levels of expertise are able to navigate the taxonomy through our interface to locate appropriate products.

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