

Usability of a metadata creation application for resource authors

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Abstract

This article analyzes resource authors' use of a metadata creation application at the National Institute for Environmental Health Sciences (NIEHS). Users' behavior was observed as they created metadata, and feedback about the application was solicited. Data analysis focused on usability—specifically task structure, duration, user perceptions and researcher observations. Developing a conceptual understanding of metadata and its use in retrieval was challenging for users. The study identifies particular interface elements (e.g., input fields) as well as element semantics and syntax that impact application usability and metadata creation. Implications for information architecture and interface design include the need to incorporate metadata into user-centered design processes and develop advanced applications that reduce the burden on authors.

1. Introduction

Metadata, defined as structured data that facilitates functions associated with a resource (e.g., resource discovery), plays a central role in modern information systems (Greenberg, 2003). Metadata's usefulness is matched by its complexity and problems. In particular, creating metadata on a large scale is a “daunting” challenge (Miller, 2002). While much research has focused on metadata schemas and interoperability, less

attention has been paid to the problem of creating metadata for extensive and growing digital collections.

The traditional creators of metadata, librarians and indexers, are professionals with specialized expertise. Many observers doubt that this mode of practice can scale to match the explosive growth of Web-based collections, leading to concern about a looming metadata “bottleneck” (Liddy, 2002). Moreover, the decentralized structure of the Web encourages content creation by individual resource authors (e.g., scientists, engineers, writers, or business specialists), and many organizations are instituting frameworks to support metadata creation by these authors (Onyancha, Keizer, & Katz, 2001).

Resource authors may be subject matter experts, but are unlikely to have specialized metadata creation expertise. Because of their inexperience in this area, providing system support for the creation process is especially important. Developing effective support for metadata creation by resource authors requires a thorough understanding of how resource authors create metadata, as well as analysis of the usability of specific metadata creation applications.

This article contributes to this understanding by providing a detailed analysis of authors' interactions with a metadata creation application for Web resources. The goals of this research were to:

- Investigate how interface design can influence task structure and performance of metadata creation;
- Investigate how interface design can influence resource authors' satisfaction with the metadata creation process;
- Draw implications for the design of metadata creation interfaces, processes and systems.

This research extends existing knowledge by studying resource authors in an organization, and integrating these observations with design principles. It addresses the absence of research on the usability of metadata creation applications, and provides an empirical basis for the design of future applications.

2. Literature review

Several researchers who have studied metadata creation in organizations (Blomberg, Suchman, & Trigg, 1996; Greenberg, Pattuelli, Parsia, & Robertson, 2001; Marshall, 1998; Quam, 2001; Trigg, Blomberg, & Suchman, 1999) have found that metadata creation is intimately connected to institutional processes and individual behaviors. They closely analyzed metadata creation in context, to better understand the

specific issues that metadata creators may face. The issues discovered include motivation, difficulty working with applications, and difficulty understanding the scope and use of metadata in retrieval.

Ethnographic studies with lawyers (Blomberg et al., 1996) and engineers (Trigg et al., 1999) illuminate these issues. Blomberg et al.'s (1996) analysis of document management practices in a law firm found that resource authors (in this case, attorneys), were reluctant to spend time adding metadata to documents. In fact, little metadata existed for attorneys' own informal filing. For more structured systems associated with litigation, where metadata was critical, the firm relied on a large centralized metadata creation team composed of "document analysts." The researchers closely observed the analysts' work, and found that their jobs contained a mix of data entry ("routine" work) and interpretive judgment ("knowledge" work). They argue that applications for metadata creation should automate the routine work as much as possible, freeing analysts to focus on intellectual tasks.

Metadata creation for a workgroup in a civil engineering department required "the participation of engineers [resource authors] on the project," due to their extensive local knowledge (Trigg et al., 1999, p. 339). Engineers were generally interested and helpful in providing metadata, though they had diverse views on the appropriate scope of metadata records—some thought a classification code combined with free-text searching of the underlying document was sufficient, while others supported extensive metadata. Like Blomberg et al., these researchers found that resource authors need application support during the metadata creation process. They also took a neutral position on the nature of this support, arguing for a system that "accommodates either view, not casting

any single perspective into stone through our design” (p. 347).

Even with this clear articulation of the importance of applications for metadata creation, research directly addressing application usability is limited. Two recent studies have addressed this topic. An online questionnaire administered to users of the Nordic DC metadata creation application revealed that they generally found the application sufficient for their tasks (Hansen, 2001). Open-ended comments indicated a number of specific problems with various parts of the interface design. However, the study took place in an uncontrolled setting, provided only a general view of the application’s overall usability, and relied too heavily on self-reported data (Nielsen, 2001) to be considered definitive. Greenberg, Crystal, Robertson, & Leadem (2003) analyzed two versions of a Web-based metadata creation application. They found that users were generally satisfied with the application, but a number of subtle usability problems linked to conceptual understanding and motivation were also apparent. They concluded that metadata creation is a complex process and recommended iterative, user-centered design to improve the usability of future applications.

A final issue uncovered by metadata researchers is that authors are concerned about others being able to find their documents later (Blomberg et al., 1996; Trigg et al., 1999). To support retrieval, metadata creators must understand how their metadata records will be used, and how to make their metadata helpful to users searching for their documents. In essence, this is a problem of intersubjectivity (Dourish, 2001), as resource authors attempt to communicate the content of their documents to potential users. The interviews with lawyers and engineers indicate that this can be a significant challenge for resource authors.

Overall, researchers have made progress in describing the nature and scope of metadata creation activity, and in identifying obstacles to widespread metadata creation by resource authors. Several studies also demonstrate that metadata creation is a complex process embedded in institutional practices. However, little attention has been given to the design and usability of applications which can help overcome these obstacles and effectively support users.

3. Procedures

Metadata creation was investigated at the National Institute for Environmental Health Sciences (NIEHS), a research institute of the National Institutes of Health. NIEHS is a scientific organization, and many of its scientists and research groups maintain Web pages. Six NIEHS authors (primarily scientists) who had authored the intellectual content of at least one Web resource (joint authorship was acceptable) were recruited. This sample size is not intended to yield definitive results, but models of usability testing (Nielsen & Landauer, 1993) suggest that testing with five users is sufficient to uncover most usability problems.

The study took place in the NIEHS Computer Training Laboratory. Each user session lasted approximately one hour. During the first half-hour users completed both a pre-test questionnaire and a metadata tutorial. The tutorial introduced the concept of metadata and explained the features of the NIEHS-Dublin Core metadata form. The form

enables the creation of metadata records in NIEHS-Dublin Core Schema (Robertson, Leadem, Dube & Greenberg, 2001).

During the second half-hour, users created metadata records using a Web application (Figure 1). Screen-capture software was used to record the authors' interactions with the application. Authors input metadata by entering text or selecting from lists of options. The completed metadata records are encoded with XML and saved as text files. After submitting their metadata, participants completed a post-test questionnaire.

[Insert Figure 1 here]

4. Results

Data analysis focused on task duration and task structure, and usability problems as reported by participants and noted by the researchers.

Task duration and task structure

The interaction logs (footnote 2) were analyzed to determine the duration and structure of the creation task. Each *task* was decomposed into *subtasks* and *events*. A task was defined as the process of creating a metadata record. A subtask was defined as the completion of a single field, such as *title*. An *event* was defined as a single user-

interface activity, such as requesting help, viewing a Web page, or copying and pasting data. Based on these definitions, each interaction log was analyzed to determine:

- Which subtasks the user completed;
- The order in which the user performed these subtasks;
- The events associated with each subtask;
- The total time required to complete each subtask.

Table 1 shows how long each user spent creating each record (note that all users but one created multiple records). Times varied widely, from a minimum of 3 minutes, 16 seconds to a maximum of 14 minutes, 29 seconds, with an average of 6 minutes, 34 seconds.

[Insert Table 1 here]

Table 2 and Figure 1 illustrate this analysis for a single user, providing a detailed view of user activity throughout the metadata creation process (note that time spent scrolling or engaged in other window management activities was not analyzed in detail and is recorded as “unanalyzed time.”) Most users proceeded similarly through the form. They consistently spent more time on intellectual fields such as *subject* and *relation*, as opposed to physical fields such as *author* (see Table 3). They varied widely in the amount of time they devoted to particular subtasks, and the events they completed for each subtask. For example, the time spent on the *audience* subtask ranged from 3 seconds to one minute, 27 seconds (and one user did not even complete this subtask).

[Insert Tables 2 and 3 here]

Users also employed quite different tactics to complete the various subtasks, sometimes relying heavily on browsing and copying-and-pasting, while at other times using primarily direct text entry. These differences may be due to user interface issues; see the analyst's observations, below, and the discussion section for more details.

A task flow diagram (see Figure 2) provides a visualization of the task structure for a particular user and task. The diagram illustrates how users backtrack and revise during their creation of a record.

[Insert Figure 2 here]

Usability problems

Feedback from participants and observations by the researchers revealed usability problems with the application. Interface design, and element semantics and syntax were found influence users' behavior. Developing a conceptual understanding of metadata records and their use in retrieval was found to be challenging for users.

Researcher observations { note: level III header }

User behaviors were also observed using the interaction logs. These observations provided insights into the interface design, element semantics, and syntax requirements of metadata creation applications.

Interface design and functionality influenced metadata creation. For example, one author requested help for the *source* element, but the popup window containing help text was hidden by the other open windows, and the user was unable to obtain help. As a result, he misinterpreted the field's semantics, and entered "Microsoft Word" as the *source* (*source* should refer to the original source document, such as a book or printed report). In another instance, the copy-and-paste function proved ineffective in the presence of a hidden hard return. Although the user highlighted two lines of text on a Web page, they were separated by a hard return, so the "copy" command did not collect the second line. Only the first line was pasted, resulting in an incomplete, confusing title. Another user was frustrated in multiple copy-and-paste attempts, due to his difficulty in highlighting text. Eventually he abandoned the copy-and-paste process and typed in the *title* by hand, making a typographical error in the process.

Element semantics also influenced metadata creation. One author was observed to exhibit confusion over the *geographic coverage* element. For many Web pages, it was unclear how relevant this element was. In addition, some users had difficulties with *date created*—unsure what to enter, they revised their input several times. It was surmised that providing metadata qualifiers (e.g. date created and date modified) would have helped users. Another example of a need for qualification occurred when another user interpreted the semantics of *author-contributor* to include staff roles (e.g., "Web assistance") in addition to staff names. The schema did not provide for this additional information.

Observations also indicated that users may be confused by the syntactical requirements of input fields. When entering an *alternate title*, one author input the

acronym ROC (Report on Carcinogens) as “R <new line> O <new line> C.” This user was apparently confused by the field’s instructions, which said to enter “one per line” (meaning one whole title per line, not one letter or word per line). A final example is a user who, when entering a *subject*, started with a comma-delimited format, then later switched to a one-per-line format, after realizing his mistake. The interface forced him to switch from his natural input style.

User perceptions and feedback {note: level III header}

After completing the metadata creation task, users were asked to complete a brief questionnaire. The questionnaire solicited their perceptions of various aspects of the NIEHS metadata application and of the metadata creation process as a whole. Six questions regarding satisfaction were anchored on a five-point scale, where “1” indicated “strong disagreement” and “5” indicated “strong agreement.” Tables 4 and 5 summarize the users’ responses. Generally, users appeared to be satisfied with the process and the usability of the application. They agreed that the application was easy to use (average score of 4.2 on the “ease of use” question and 4.7 on the “ease of creation” question).

[Insert Tables 4 and 5 here]

Open-ended responses and overall assessment of the data show that users also found the application easy to learn, the online help to be useful, and the terminology to be accessible. They generally, though not strongly, agreed that metadata is desirable (i.e.,

worth generating). These general perceptions are qualified by users' open-ended responses. These responses encompassed impressions of the application and thoughts for improving it. Comments from authors confirmed the strong influence of information design and help text on metadata creation behavior. Two authors noted that clear descriptions and examples were needed to understand the various metadata elements. However, since different authors often value different types of descriptions and examples, it can be difficult to provide appropriately universal information. For example, another author pointed out that it "wasn't obvious what some categories [for the *type* field] included, e.g., 'Text.'" Succinctly explaining the fields of a standardized schema such as Dublin Core to metadata novices appears to be a key challenge for designers.

Comments about the importance of providing helpful information to metadata creators also point toward the challenge of fostering resource authors' conceptual understanding of the metadata records they create. Several responses from authors further illustrate this point. "[F]or actual use a 'philosophic' overview should be provided to major NIEHS users," one author wrote. This is particularly important to help authors cope with intellectual fields such as *description* and *subject*. As another author observed, "I would want more information on what level of detail I should go into re: subject: e.g. my site has over 1000 keywords."

5. Discussion

Metadata and information retrieval

It seems critical that metadata creators understand how their metadata is to be used and how it can aid resource discovery and retrieval. Several authors were generally optimistic about the use of metadata in retrieval. “Doing effective/targeted searches is important in being able to access information efficiently and effectively,” one noted. Metadata “should help finding information,” wrote another. A third author said simply that metadata could “improve search efficiency.” Although these answers illustrated that authors understood the value of metadata for retrieval, none of them identified specific metadata elements or search strategies. Further developing resource authors’ understanding of metadata usage in retrieval is a key issue.

One way that may improve the value of metadata to end users is to involve additional types of metadata creators (e.g., authors and professionals, etc.) in a collaborative creation process (e.g., Greenberg & Robertson, 2002). Several authors commented on the value of such collaboration. On the one hand, there was a strong feeling that authors “have subject matter expertise” and “best know the page and target audience.” A few argued such expertise was more valuable when augmented by additional perspectives. One author wrote that while “[authors] best know subject matter, [information architects] best know searching patterns,” and another said that “input should be sought for *all* appropriate resources [e.g. from authors, librarians, other users, etc.]” Additional perspectives will likely lead to richer metadata.

One advantage of incorporating these additional perspectives—particularly from specialists such as information architects and librarians—is that they can help to integrate metadata creation and information architecture. Authors were blunt in their criticism of

the existing information architecture, which they viewed as organization-centered, rather than user-centered. “They [NIEHS Web designers] need to meet a librarian,” wrote one author. “Organization of tools on home pages often done by people with no knowledge of how to categorize or classify data.” Another argued that “[the NIEHS Web site should be] organized by type of science rather than around NIEHS organizational structure.” Rich metadata can support more flexible, user-centered information architecture, but only if metadata creators are aware of and work to exploit this relationship.

Implications for information architecture and interface design

Metadata is of greatest value when it facilitates the functions for which it is intended (e.g. resource discovery and management, etc.) (Greenberg, 2003). Merely adding metadata to existing resources is insufficient; rather, metadata creation should be incorporated into the larger organizational processes of defining an architecture and “making order” (Levy, 1996). In other words, metadata should be integrated into a user-centered information architecture process. Resource authors can best contribute to these processes if they understand the value of metadata in information retrieval. Observations from the usability study indicate that this understanding can be difficult to achieve.

For example, users’ frequent backtracking and revising behavior suggested that they were learning and developing understanding of metadata even as they created it. Authors had difficulty understanding how certain fields with very general semantics can be used to represent specific, idiosyncratic resources. As Marshall (1998) argues, metadata standards face an unavoidable tradeoff. Ad hoc approaches are rich in local

detail and usefulness but sacrifice interoperability. Global standards promote interoperability, but forego opportunities for more sophisticated information access. At the same time, standardized, interoperable schemas may challenge users' conceptual understanding. As was observed at NIEHS, authors may struggle to apply their detailed local knowledge to global, generic, schemas. Resource authors need help understanding the level of detail appropriate to a particular schema in use in their organization.

A final implication deserving further attention is the close connection between interface design and metadata quality (Bruce & Hillman, 2004). Since resource authors generally lack experience in creating metadata, they will likely need support to help them create effective metadata. This support could take various forms, as identified by Crystal (2003). Applications that better integrate metadata gathering (e.g. automatic harvesting tools) and entry (e.g., authoring applications) could simplify authors' work and reduce the need to switch between different applications. "Problematic" (e.g., syntactically incorrect) metadata records could be flagged for review or annotation. Richer contextual cues, such as examples of metadata in use, could help motivate users and encourage them to develop more complete metadata records.

6. Conclusion

It is feasible for organizations to pursue metadata creation systems involving resource authors. Such systems hold great promise. Resource authors have the ability to contribute rich metadata based on their specialized knowledge of their content and audience. This might free organizations from the burden of maintaining a separate cataloging operation, while still generating the metadata necessary for flexible, user-centered information architectures.

Relying on resource authors makes the organization's metadata dependent upon the capabilities of those authors. The data indicate that user interfaces and application behavior strongly influence the quality of the metadata these users create. Effective, highly usable metadata creation applications should enable authors to create metadata valuable for retrieval. Future research should seek to develop such applications and test them within the context of organizational processes.

Although these findings contribute to understanding of interface design for metadata creation, the sample was limited in size and focused on a single organization. Other resource authors working in different types of organizations may have different approaches to metadata creation, or different responses to metadata creation applications. This research does not generalize directly to such situations, and additional work in different contexts is clearly warranted. Additional types of data, particularly qualitative process data such as verbal protocols, would be helpful in confirming and elaborating the observed behavior.

Still, this research provides an important first step toward breaking the metadata “bottleneck” by facilitating widespread metadata creation. In particular, resource authors are a largely untapped source of quality metadata—but they are generally not skilled or motivated enough to create metadata without software support. Highly usable metadata creation applications are needed to make metadata creation by resource authors a reality. By taking a user-centered perspective on metadata creation, this research provides a foundation for future empirical studies and for the design of metadata creation applications. Progress in this area may yet overcome the “daunting” challenge of metadata creation, and break the metadata bottleneck.

References

- Blomberg, J., Suchman, L., & Trigg, R. H. (1996). Reflections on a work-oriented design project. *Human-Computer Interaction, 11*, 237 -265.
- Bruce, T. R., & Hillmann, D. I. (2004). The continuum of metadata quality: defining, expressing, exploiting. In D. I. Hillmann & E. L. Westbrook (Eds.), *Metadata in Practice*. Chicago, IL: ALA.
- Crystal, A. (2003). Interface design for metadata creation. In G. Cockton & P. Korhonen (Eds.), *CHI '03 extended abstracts on human factors in computing systems* (pp. 1038 - 1039). Fort Lauderdale, FL: ACM Press.
- Dourish, P. (2001). *Where the action is: The foundations of embodied interaction*. Cambridge, MA: MIT Press.
- Greenberg, J. (2003). Metadata and the World Wide Web. In A. Kent (Ed.), *Encyclopedia of Library and Information Science* (pp. 1876 - 1888). New York: Marcel Dekker.
- Greenberg, J. and Robertson, D. W. (2002, October 13 - 17). Semantic Web construction: an inquiry of authors' views on collaborative metadata generation. In *Proceedings of the International Conference on Dublin Core and Metadata for e-Communities: Supporting Diversity and Convergence*. (pp. 45-52). Florence, Italy: Firenze University Press.
- Greenberg, J., Crystal, A., Robertson, W. D., & Leadem, E. (2003, September 28 - October 3). Iterative design of metadata creation tools for resource authors. In

- Sutton, S. Greenberg, J., & Tennis, J. (Eds.), *2003 Dublin Core Conference: Supporting Communities of Discourse and Practice—Metadata Research & Applications*. Syracuse, NY: Information Institute of Syracuse.
- Greenberg, J., Pattuelli, M. C., Parsia, B., & Robertson, W. D. (2001). Author-generated Dublin Core metadata for Web resources: a baseline study in an organization. *Journal of Digital Information*, 2(2). Retrieved December 2nd, 2003, from <http://jodi.ecs.soton.ac.uk/Articles/v02/i02/Greenberg/>.
- Hansen, P. (2001). Evaluation and design issues of Nordic DC metadata creation tool. In K. Oyama & H. Gotoda (Eds.), *Proceedings of the International Conference on Dublin Core and Metadata Applications 2001*. Tokyo, Japan: National Institute of Informatics.
- Levy, D. M. (1996). Cataloging in the digital order. In *Proceedings of the Second Annual Conference on the Theory and Practice of Digital Libraries*. Austin, TX: ACM Press. Retrieved July 14th, 2004, from: <http://csdl.tamu.edu/DL95/papers/levy/levy.html>.
- Liddy, E. (2002, November 18 - 21). *Automatic metadata generation & evaluation*. Paper presented at the 65th ASIST Annual Meeting, Philadelphia, PA, November 18-21, 2002. Retrieved December 2nd, 2003, from <http://cnlp.org/presentations/slides/MetaData.ASIST.2002.ppt>
- Marshall, C. C. (1998). Making metadata: A study of metadata creation for a mixed physical-digital collection. In I. Witten, R. Akscyn & I. Frank M. Shipman (Eds.), *Proceedings of the third ACM conference on digital libraries* (pp. 162 - 171). Pittsburgh, PA: ACM Press.

- Miller, E. (2002). The Semantic Web. In E. G. Toms (Ed.), *Proceedings of the 65th ASIST Annual Meeting* (pp. 495 - 496). Philadelphia, PA.
- Nielsen, J. (2001, August 5, 2001). *First rule of usability? don't listen to users*. Retrieved 2001, 2003, from <http://www.useit.com/alertbox/20010805.html>.
- Nielsen, J., & Landauer, T. K. (1993). A mathematical model of the finding of usability problems. In *Proceedings of INTERCHI 93* (pp. 206 - 213). New York: ACM Press.
- Onyancha, I., Keizer, J., & Katz, S. (2001). A Dublin Core application profile in the agricultural domain. In *Proceedings of the International Conference on Dublin Core and Metadata Applications 2001* (pp. 185-192). Tokyo, Japan: National Institute of Informatics.
- Quam, E. (2001). Informing and evaluating a metadata initiative: Usability and metadata studies in Minnesota's Foundations project. *Government Information Quarterly*, 18, 181 - 194.
- Robertson, W. D., Leadem, E., Dube, J., & Greenberg, J. (2001). Design and Implementation of the National Institute of Environmental Health Sciences Dublin Core Metadata Schema. In *Proceedings of the International Conference on Dublin Core and Metadata Applications 2001* (pp. 193 - 199). Tokyo, Japan: National Institute of Informatics.
- Trigg, R. H., Blomberg, J., & Suchman, L. (1999). Moving document collections online: The evolution of a shared repository. In S. Bødker, M. Kyng & K. Schmidt (Eds.), *Proceedings of the Sixth European Conference on Computer Supported*

Cooperative Work (pp. 331 - 350). Copenhagen, Denmark: Kluwer Academic Publishers.

Tables

User #	R e c o r d #	T i m e (m i n u t e s : s e c o n d s)
1	1	1 1 : 0 0
1	2	4 : 3 0
2	1	8 : 0 0
2	2	6 : 2 5
3	1	4 : 0 0

			(
			*
)
3	2		3
			:
			0
			0
3	3		4
			:
			1
			5
4	1		1
			5
			:
			0
			0
4	2		7
			:
			1
			5
6	1		5
			:
			2
			0
			(
			*
			*
)

Table 1. Time (seconds) per user/task.

(*) interaction log was missing the first few seconds of this task.

(**) interaction log was missing approximately the first minute of this task.

User #1 – Task #1

<i>S</i>	<i>E</i>
U	W
R	P
T	T
F	C
D	H
D	C
D	CKD
A	C
T	C
T	T
A	H
S	V
D	H
T	E
S	H
R	H
D	E

Unanalyzed

Table 2. Detailed task structure for a single user and task.

Key:

- Code** **Event**
- CKD* **Checked**
- CP* **Copy and paste**
- ED* **Editing or erasing**
- H* **View online help**
- T(ED)* **Type (entry)**
- VS* **View (HTML) source**
- WP* **View/browse Web page**

Event	Time (% of total time)
relation	23.1
subject	18.5
Author	14.7
URL	9.6
description	9.3
date modified	5.8

Table 3. Most time-consuming tasks (as proportion of total time).

Question	Mean response
Working with the application was easy.	4.2
Learning the application was quick.	4.7
The online help was useful.	4.2
The terminology was understandable.	4.3

Table 4. User perceptions of the application.

Question	Mean response
Creating metadata was easy	4.7
Metadata should be added to Web pages.	4.0

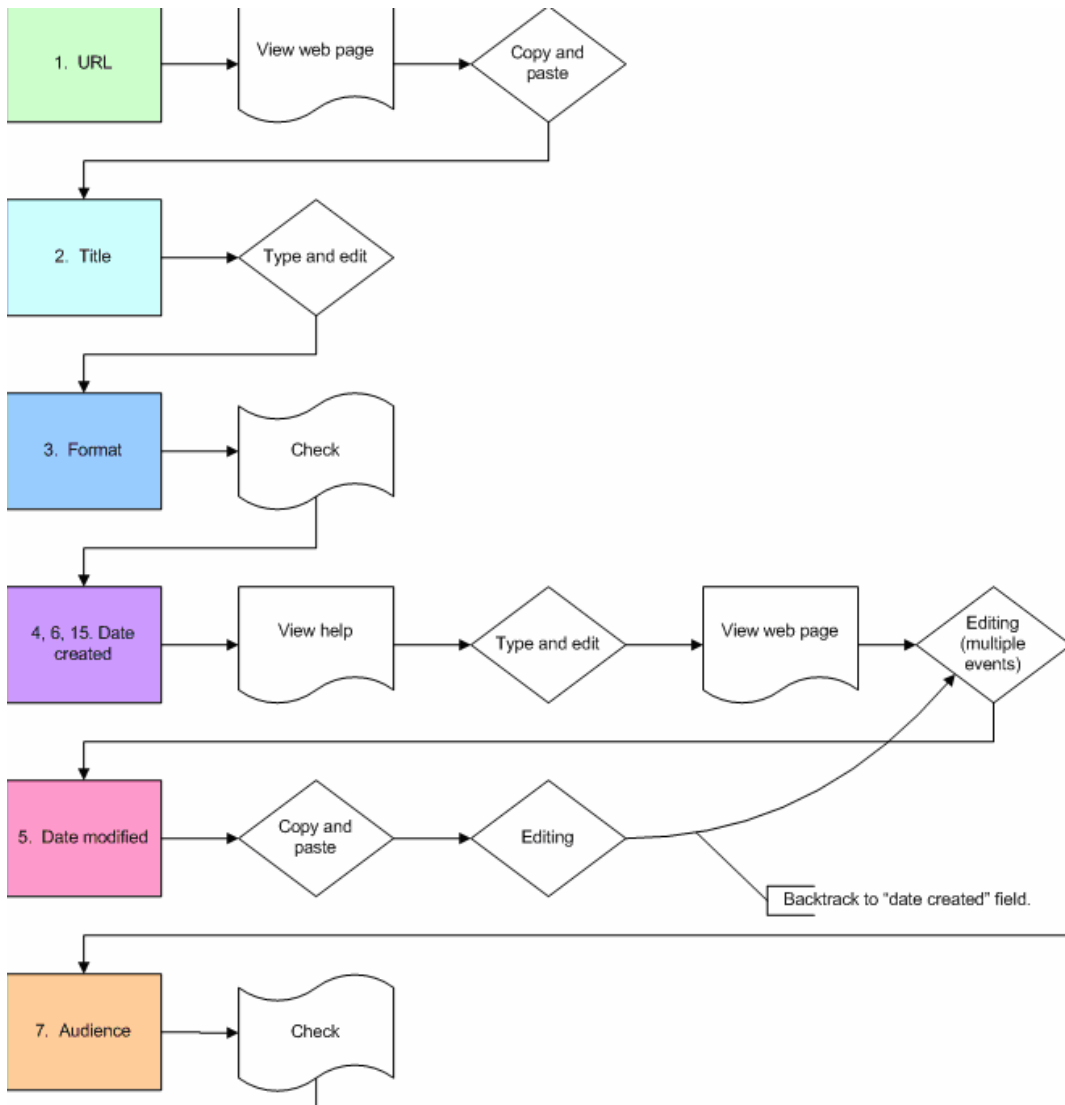
Table 5. User perceptions of the metadata creation process.

Figures

{ Please note: no better quality is available for Figure 1, as it is a screen capture }

Document's URL: <input type="text"/>		
Title <input type="text"/>	Document's Language English <input type="button" value="v"/> Format text/html <input type="button" value="v"/>	
Author/Contributor(s) (<i>last name comma first name</i> ; one author per line) <input type="text"/>	Date Created (YYYY-MM-DD, or YYYY-MM, or YYYY, or decade, e.g., 1980s) <input type="text"/> Date Modified (as above) <input type="text"/>	
Subject(s) (one key word or phrase per line) <input type="text"/>	Audience (ctrl-click to select more than one) General Public <input type="button" value="v"/> Researchers NIEHS Employees Teachers Students Kids <input type="button" value="v"/>	Type (ctrl-click to select more than one) Text <input type="button" value="v"/> Sound Software Service Interactive Resource Image <input type="button" value="v"/>
Alternative Title(s) (one per line) <input type="text"/>	NIEHS Project or Event Number: <input type="text"/> Other ID (e.g. ISBN) <input type="text"/>	
Geographic Coverage (e.g., town, county, state, and/or country for which this resource most <i>narrowly</i> applies) <input type="text"/>	Time Coverage (e.g., <i>time span</i> 1999-2001, <i>era</i> Vietnam War or 19th century, or a <i>specific date</i>) <input type="text"/>	Description (enter text) <input type="text"/>
Related URL(s) (one per line) <input type="text"/>	Original Source(s) (one per line) <input type="text"/>	

Figure 1. Screenshot the of the input form.



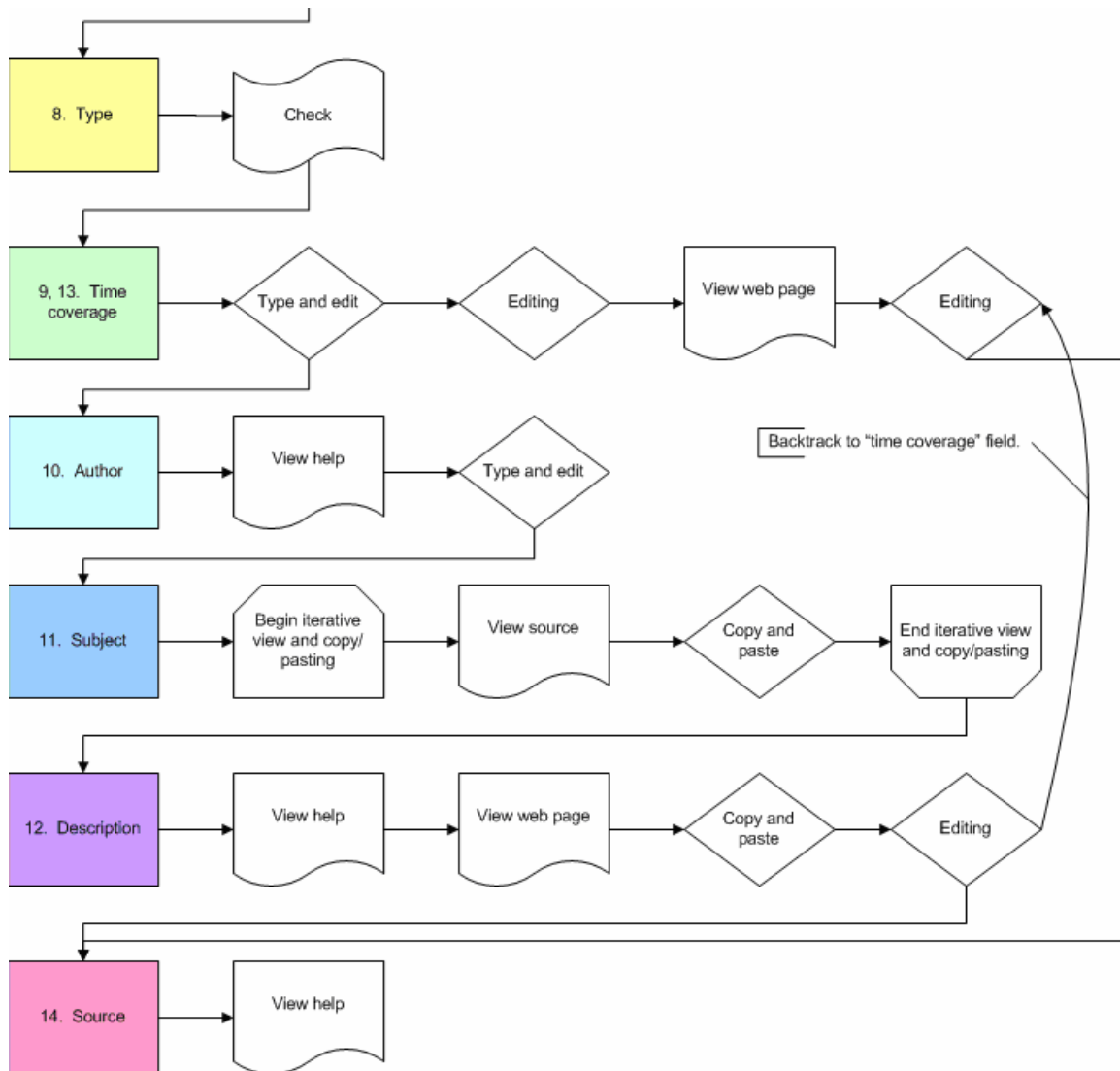


Figure 2. Task flow diagram (user #1, task #1).

