

Project #3: Evaluate an Information Retrieval System

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Step 2. ANALYSIS OF NORMAN'S CONCEPTS

Affordance

J. J. Gibson defines affordance as an “actionable property between the world and an actor” (Norman, 1999, p. 39). Affordances give the user the opportunity for an action and suggest how a user can interact with an object (Norman, 1988, p. 9). Norman (1999) separates affordances into two categories: perceived and physical. Perceived affordances are actions that the user perceives to be possible. Physical affordances do not always have an effect, such as clicking a mouse button with the cursor on an unclickable area of the screen. They both guide the user and provide clues as to how the object can be used. Perceived affordances are critical to design because “affordances are of little use if they are not visible to the users.” (p. 41)

Constraint

There are three types of behavioral constraints: physical, logical, and cultural. Physical constraints restrict the physical abilities of an object; Norman gives the example of a cursor that you cannot physically move outside the screen (Norman, 1999, p. 40). Logical constraints rely on the user's reasoning to determine the alternatives (p. 40). They also rely on good conceptual models and making the design model visible to the user to guide behavior. When the design model is visible and the conceptual model is good, the user understands what actions are required (p. 40). Lastly, cultural constraints “are conventions shared by a cultural group” (pp. 40-41). Cultural constraints are arbitrary, but conventions that evolve out of cultural constraints and are not arbitrary (p. 41).

The concepts of affordances and constraints are helpful to individuals who study information seeking because they inform the information professional on important

design choices. Perceived affordances and cultural constraints are the most important aspects to consider when designing an object. If an object has an affordance that the user cannot perceive, then the affordance is essentially nonexistent. Cultural constraints are, according to Norman, “slow to be adopted and slow to go away” (Norman, 1999, p. 41). If a designer decides to design a checkbox that looks like a radio button, the cultural constraint or convention of the user would indicate that only one choice can be made. This relates to affordances as well; the affordance of selecting multiple choices would be imperceptible to the user. When designing for usability, the designer must take all aspects of a user into account.

Mapping

Mapping as defined by Norman is “a technical term meaning the relationship between two things” (Norman, 1999, p. 23). This term describes how two entities interact. He emphasizes visibility, stating that “visibility indicates the mapping between intended actions and actual operations. Visibility indicates crucial distinctions...” (p. 8). Here we learn from this concept how the user can utilize their viewing ability to decipher and to ultimately make the appropriate decisions to reach their desired goal.

Natural mapping

According to Norman, natural mapping, which takes “... advantage of physical analogies and cultural standards, leads to immediate understanding” (Norman, 1999, p. 23). He goes on to state, “Some natural mappings are cultural or biological, as in the universal standard that a rising level represents more, a diminishing level, less” (p. 23). From this concept we learn about the impact of culture on design, which aids the user in identifying items quickly and understanding of how things work naturally. Norman

discusses how a “designer gets it right” (p. 25) when inquiring with a tour bus driver about the controls in the vehicle. The driver replies, “Each control is just where it ought to be. There is no difficulty.” “A good principle, that controls are where they ought to be. One function, one control. Harder to do, of course, than to say, but essentially this is the principle of natural mappings: the relationship between controls and actions should be apparent to the user” (p.25). Norman’s focus is on how the driver’s experience relates to where the controls are located. We learn from this example that when designers consider logic and proximity in the context of the environment, a practical design can be the end result.

The concepts of mapping and natural mapping are helpful to individuals who study information seeking since they provide a basic guide or template. Information professionals and students can then use this basic guide or template to more effectively aid information seekers in achieving their information goals. Information retrieval systems and services should be designed with natural mapping. Users should be able to easily navigate information systems and services through immediate understanding.

Conceptual and mental models

Norman (1988) defines a conceptual model as a user's mental simulation of how an object will work (p. 12). Users obtain clues as to how an object works when the parts are visible and the implications are clear (p. 12). “A good conceptual model allows users to predict the effects of their actions” (p. 13).

In *Affordance, Conventions and Design* (1999) Norman states that “the most important part of a successful design is the underlying conceptual model” (p. 39). A designer creates a conceptual model of a system or device through a process of

development. The functionalities of the system are conveyed to the user through the system image, or the visible part of the device. The user constructs a mental model through interaction with the system or device. He or she “interprets its perceived actions and its physical structure” (Norman, 1988, p. 17). If the system image is clear and consistent, and provides useful feedback, the user experience is positive. Conversely, if the system image is a poor representation of the design model, the user’s conceptual model will not match that of the designer. The user will be confused and unable to use the system effectively.

It is helpful for individuals who study information seeking to understand the idea of conceptual or mental models. Users employ information retrieval systems to access the information they require. Interactions between users and information retrieval systems can be mediated by information professionals. In order to support users, information professionals need to understand how patrons use these systems. Information professionals should help users develop good conceptual models for effective use of information retrieval systems. Services and systems should be chosen and/or designed with clear and consistent visual clues that allow users to mentally simulate how they work.

The paradox of technology

Norman discusses the paradox of technology in his chapter entitled *The Psychopathology of Everyday Things* (1988). “Technology offers the potential to make life easier and more enjoyable; each new technology provides increased benefits. At the same time, added complexities arise to increase our difficulty and frustration” (pp. 29-30). This idea describes the tension emerging from the increased functionality of new

devices and systems. More functionality does not always lead to a positive user experience. The device or system becomes more difficult to learn and users are often bewildered. A fabulous array of new operations and tools may be utterly useless if they are unclear and difficult to access.

The paradox of technology is a useful concept for individuals who study information seeking. When mediating the interaction between users and information retrieval systems, information professionals should bear in mind that the functionality of these systems can be overwhelming to users. Users who are confronted with information retrieval systems for the first time may need support and guidance. In designing services and/or choosing systems, more is not necessarily better. Clarity and usability are essential.

Step 3. EVALUATION OF 4 FEATURES OF REFWORKS “CREATE A BIBLIOGRAPHY” FUNCTION

Feature 1: Selecting references

Affordances

RefWorks affords the ability to create a bibliography from all the references on the page, all in the list, or only selected references. The affordances are both physical and perceived. The user perceives that she can select references because of the checkboxes next to each reference (**Figure 1**). The user physically selects the reference by clicking on the checkbox. RefWorks also affords the user the ability to select one or more references. Once the references are selected, and the user clicks on “Create a Bibliography,” the user is afforded the choice between “Selected,” “Page,” or “All in List” (**Figure 2**). This affordance is represented by the radio buttons next to each choice.

Constraints

The constraints in selecting references are physical, logical, and cultural. Physically, the user can select from only “Selected,” “Page,” or “All in List,” and she can only select one choice because of the use of radio buttons (**Figure 2**). This constraint relies on the user’s conceptual models of radio buttons. The user would logically only want to choose one of these options. The user is also physically constrained in how she can select each reference; she must click the checkbox in order to select the reference (**Figure 1**). This physical constraint relies on the user’s conceptual model of checkboxes. Checkboxes and radio buttons are conventions that are culturally accepted. Users immediately perceive the necessity to make a choice.

Mapping & Natural Mapping

The natural mapping design in this feature can be seen in the following ways: (1) The ability to select articles manually by checking the box conveniently located to the left of the article (**Figure 1**). The proximity of the checkbox aids the user in making the connection that if the checkbox is selected the article will be included in an action. This design allows the user to efficiently read the identifying factors of the articles and then decide on selecting the checkbox. (2) The location of the “References to Include From All References” (or “References to Include From Last Imported”) menu radio buttons is significant (**Figure 2**). It is the first menu item listed in the “Create a bibliography from a list of references” popup window. It is a logical first step in the “Create a bibliography” process. The user selects one of the radio buttons in order to indicate the number of articles to include in the process of creating a bibliography (**Figure 3**). The three radio buttons are organized by the number of articles in ascending order, which is a further example of natural mapping.

Conceptual model

Selecting references in RefWorks is designed with a good conceptual model that provides visual clues and clear feedback. Three clickable radio buttons make it clear that users must choose whether to include all references in the list, all references on the page, or only the selected references (**Figure 2**). Further clues are provided by the total amount of references for each choice in parenthesis. Users can predict how many references will appear in the bibliography by looking at the number in parentheses. If a user chooses the "Selected" option, the desired references must be chosen in advance. Building on cultural conventions, the designer assumes that users will have had previous experience working with interfaces that allow the selection of specific items. Through previous experiences, users understand that items are selected in order to work with them further. Visible boxes (**Figure 1**) and buttons (**Figure 3**) indicate to users that the box or button has the ability to be clicked. The system provides the user with clear feedback: when the box is clicked a visible check mark appears in the box, and when a radio button is clicked it turns blue. Users are able to predict that selected items will appear in the bibliography. The user develops a good conceptual model through interaction with the system. User experience is positive because the system image is clear and consistent.

Paradox of technology

Although RefWorks presents users with several options for selecting references to include in a bibliography, the choices are clear and visible. Users are not overwhelmed by too many possibilities. The operations are useful because they are clear and easy to access.



Figure 1. Check boxes used for selecting references.



Figure 2. Three choices of references to include.



Figure 3. Radio buttons used for selecting references.

Feature 2: Selecting output style

Affordances

RefWorks affords the user several choices of output style for her bibliography. This affordance, represented through the dropdown menu (**Figure 6**), is both perceived

and physical. The selection affordance is perceived because of the up and down arrows on the right of the box, which is a conceptual model that relies on users' prior knowledge and experiences (**Figure 4**). The user physically selects an output style by clicking on the box, placing the cursor over the desired style, and clicking again.

Constraints

RefWorks constrains the user's choices by providing only those styles listed in the dropdown menu (**Figure 6**). The user is physically constrained to selecting only one style and to choosing from only those styles presented. (The user can add styles through the "Manage Output Styles" interface.) The constraint is logical to users, who would likely only need to choose one style. If the user required a style other than the default option, she would logically deduce that the desired style could be found by clicking on the textbox.

Mapping & Natural Mapping

In the "Create a bibliography from a list of references" popup window, the "Output Style" options menu is the second item listed. It appears after the selection of references (**Figure 2**). This reflects the logical order in the process of creating a bibliography: the user would first select the references, then decide how they should be formatted. The user can view the menu options (**Figure 5**) by clicking on the arrows, which are located just to the left of the "Preview" button. The menu options for output style can be seen in **Figure 6**. The proximity of the "Preview" button may provide clues to the user that once they choose an output style, they can then select the "Preview" button to view their output style selected option.

Conceptual model

In order to generate a bibliography in RefWorks, the user is prompted to choose an output style in a popup window. The design provides visual clues that help the user learn how to operate this tool. The system image presents the user with a textbox that displays one output style (**Figure 4**). At the right of the textbox are up and down arrows, indicating the ability to go up or down. The designer relies on cultural experiences of the user. Users are generally aware that up and down arrows indicate a list of choices. Clicking anywhere on the textbox reveals a list of output styles from which to choose (**Figure 6**). When the cursor is placed on a style, it becomes highlighted, and when the user clicks on a style, the menu disappears and the selected style appears in the textbox. The system image is clear and the feedback is good. By interacting with the system, the user learns how to select an output style.

Paradox of technology

The system design assumes that users of RefWorks are familiar with publication styles, are writing a scholarly paper, and have a clear idea of which style they need. Although the design makes it easy to select an output style, users who are unfamiliar with these styles or who do not have clear instructions as to which style to use may be confused with the choices, what they represent, how they differ, and which to choose. This may lead to frustration and a poor user experience.

A screenshot of a user interface element. On the left, the text "Select an Output Style" is displayed in a brown font. To its right is a light gray rectangular box containing the text "APA 6th - American Psychological Association, 6th Editi" followed by a small black downward-pointing arrow icon.

Figure 4. Textbox displaying output style.

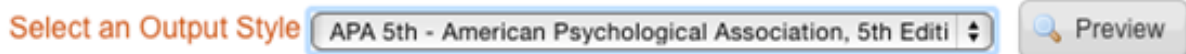
A screenshot of a user interface element. On the left, the text "Select an Output Style" is displayed in a brown font. To its right is a light gray rectangular box containing the text "APA 5th - American Psychological Association, 5th Editi" followed by a small black downward-pointing arrow icon. To the right of this box is a separate light gray button with rounded corners, containing a magnifying glass icon and the word "Preview" in a gray font.

Figure 5. Output style selection and preview button.

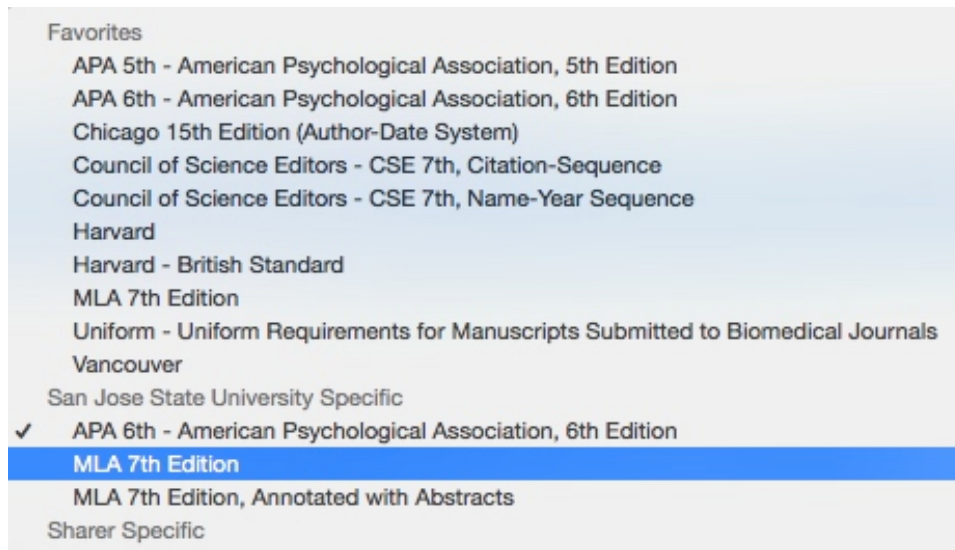


Figure 6. Dropdown menu with list of output styles.

Feature 3: Preview the output style

Affordances

RefWorks affords a preview of the output style, which the user perceives through the “Preview” button (**Figure 7**). Once the user has physically clicked “Preview,” she is also afforded the ability to choose the reference type from an additional dropdown menu (**Figure 8**). The up and down arrows are visual cues by which the user perceives the possibility of selecting a reference type.

Constraints

The user is physically constrained to viewing only one publication style at a time in the “Preview” operation. The user can only preview one output style at a time based on the one chosen in the dropdown menu (**Figure 5**). She can also only select one reference type at a time (**Figure 8**). These constraints are logically deduced by the user. The user is further constrained by the reference type choices that RefWorks presents in the menu (**Figure 10**). The up and down arrows used to make selections in the “Preview” tool are

cultural constraints used by the system to indicate to a user that only one option from a list may be chosen. The user is also constrained to previewing only the sample reference. The system does not allow the user to preview her own references.

Mapping & Natural Mapping

The design of the “Preview” operation employs natural mapping. The location of the “Preview” button is significant. The proximity of the “Preview” button to the “Output Style” menu may provide clues to the user that these two items are connected or related. This can be seen in **Figure 5**. The user can also gain clues from the symbol on the “Preview” button. The magnifying glass included on the “Preview” button often symbolizes viewing in many programs/systems (**Figure 7**). The user can assume that they would have the ability to preview the bibliography format selected in the “Output Style” menu. This also provides the user with the opportunity to view multiple output styles prior to moving on to the final steps in the creation of a bibliography. The system is designed with consideration for the user’s natural sequence of thought and work process when creating a bibliography.

Conceptual model

The preview feature of RefWorks provides the user with obvious visual clues and feedback. The “Preview” button is located to the right of the output style, indicating what the user will preview (**Figure 5**). The magnifying glass icon builds on cultural experience (**Figure 7**). The designer assumes that through previous experiences users understand that a magnifying glass offers a closer look. The user receives visual feedback when the cursor is placed over the “Preview” button and the button becomes shaded. When the button is clicked, a popup window displays a preview of the output style. Up and down

arrows in the "Reference Type" textbox builds on cultural experience to indicate the possibility of selecting a reference type (**Figure 8**). The system image is clear and consistent. Through interaction with the system, the user develops a mental model that is similar to that of the designer.

Paradox of technology

Unless the user is very comfortable with publications styles and knows exactly what the resulting bibliography should look like, the preview feature will be of little help (**Figure 10**). The long list of reference types can be overwhelming (**Figure 9**). In order to select a reference type, users will need to remember which type of references they have in their folder. The sample that is previewed may bear little resemblance to the user's references. The user may therefore have difficulty picturing his or her references in the selected style. Even by previewing the various styles, differences are subtle and may appear nonsensical to a casual user. Although the preview feature is clear and easy to access, it may be frustrating and confusing to some users.



Figure 7. Preview button with magnifying glass icon.

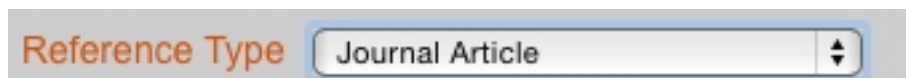


Figure 8. Reference type selection.

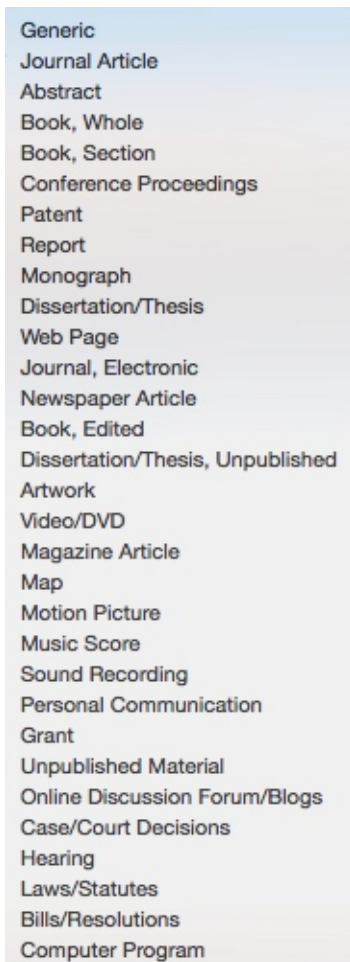


Figure 9. List of reference types.

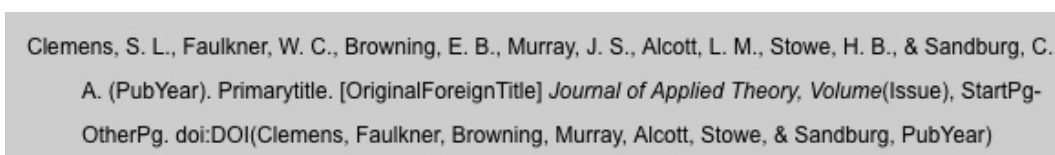


Figure 10. Sample reference preview.

Feature 4: Bibliography- creating the document

Affordances

The last step in the bibliography process is to create and download an electronic file of the bibliography. RefWorks affords the user this ability, which is represented by the “Create Bibliography” button (**Figure 11**). The user perceives the tool by observing

the button. Physically clicking on this button causes a popup window to appear, which guides the user through the process of generating an electronic file. Once the user has selected a series of options, the “Create Bibliography” button appears again at the bottom right of the screen. This is a visual cue that once the necessary selections have been made, the user may complete the process by clicking the “Create Bibliography.” The bibliography should automatically download, but if it does not, RefWorks affords a second chance to download it. It also affords emailing the bibliography to the user’s email address (**Figure 12**).

Constraints

RefWorks does not generate an electronic file the first time “Create Bibliography” button is clicked. Before the operation can be completed, a popup window appears. Popup windows are cultural constraints in which users understand that a process must be followed before the final result can be achieved. The system will only generate an electronic file of a bibliography after the user has selected the references, the output style, and the file type within the popup window. This is logical to users, who assume they will have control over the references to be included and the style and format in which they will be presented. An electronic file is created only when the “Create Bibliography” button is physically clicked the second time.

Mapping & Natural Mapping

The RefWorks tool that allows a user to generate an electronic file of a bibliography employs natural mapping by taking advantage of “physical analogies and cultural standards” (Norman, 1999 p. 23). One physical analogy is the use of up and down arrows, indicating choices above or below. The system uses the cultural standard of

following a process from top to bottom and left to right. After the user selects the “Create Bibliography” button at the top of the main RefWorks screen, it is logical for the “Create a bibliography from a list of references” popup window to appear. Users may expect the opportunity to make choices regarding the content, style, and format of their bibliography. The three menu options within the popup window, along with their order, make sense from a process point of view. The user would first select the number of articles to create a bibliography from the “References to Include From All References” or “References to Include From Last Imported” (**Figure 2**) options. They would then proceed to the “Select an Output Style” menu, making a selection and then choosing whether or not to “Preview” the bibliography format. After the user decides on the output style, they would then move on to the “Select a File Type” menu, which is the final menu option, signifying to the user that the final steps in the process are approaching. The location of the “Create Bibliography” button at the bottom of the popup window screen indicates that this is the final step. The symbol on the “Create Bibliography” button also offers visual clues. The pencil and paper is a standard cultural symbol for composing or creating (for example, when creating a text message or email on an iPhone a somewhat similar image exists). In this case the ultimate goal is to create a bibliography.

Conceptual model

Placing the cursor over "Create Bibliography" causes the button to become highlighted. Building on cultural experiences, the highlighting is a visual clue that an operation may be performed. The system image also provides a pencil and paper icon to guide the user, a cultural standard that represents the creation of a document (**Figure 11**). The user deduces from the system image that a bibliography may be created by clicking

the button. An initial click on "Create Bibliography" causes a popup window to appear. This feedback tells the user that the operation is not yet complete. After a series of selections are made in the popup window, the "Create Bibliography" button appears again. When the "Create Bibliography" button at the bottom of the popup window is clicked, the system provides the user with feedback that the operation is in progress by displaying a blue popup window at the bottom right of the screen that says "Processing." When the process is complete, the window turns green and reads "Completed" (**Figure 12**). Unfortunately, the feedback windows are very small. The user then receives a file download prompt. The document can be saved and downloaded. (For some inexplicable reason the default name of the file is the user's email address along with the suffix "-RefList.") Alternatively, the user can request the file to be emailed. The conceptual model for creating a bibliography builds on cultural experiences related to creating, downloading and saving files. Through interaction with the system, the user is able to develop a mental model for creating a bibliography in RefWorks.

Paradox of technology

Using RefWorks tools, generating a document containing a bibliography is achieved with relative ease. However, a close inspection of the bibliography reveals many errors, such as missing information, incorrectly italicized and bolded text, missing punctuation, missing capitals, and incorrect format (**Figures 13 and 14**). Users become confused as to how the errors occurred and mistrustful of the system. References in a bibliography generated by RefWorks must be double checked and corrected, leaving the user to question whether the function was worth using to begin with. The opportunities

offered by the system increase its complexity, and do not necessarily lead to a positive user experience.



Figure 11. Create Bibliography button.



Bibliography Complete. If you do not receive a file download prompt [click here](#) or if you'd like the file emailed to you [click here](#).

Figure 12. Small feedback window.

CannCasciato, D. (2011). *Ethical considerations in classification practice: A case study using creationism and intelligent design* doi:10.1080/01639374.2011.589221

Figure 13. Reference with errors (incorrect italics, no journal title).

Coolidge, K. K. (2005). "Baseless hysteria": The controversy between the department of justice and the american library association over the USA PATRIOT act. *Law Library Journal*, 97(1), 7-29. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=lih&AN=16219305&site=ehost-live>

Figure 14. Reference with errors (missing capitals).

Conclusion

Based on an analysis of four features of the “Create a Bibliography” function, RefWorks is an effective information retrieval system for users experienced in scholarly writing. Less experienced users may encounter difficulties. Norman’s concepts of

affordance, constraint, mapping, natural mapping, conceptual and mental models, and the paradox of technology can be used as a framework with which to analyze the RefWorks user experience.

Affordances are suggested by clear clues that guide the user's interaction with the RefWorks system. Physical, logical and cultural constraints help the user by defining the limits of RefWorks operations.

The natural mapping of the RefWorks design takes advantage of physical analogies and cultural conventions, resulting in an immediate understanding of how to interact with the system. Proximity and logic play major roles in demonstrating the relationship between the RefWorks controls and their actions.

The conceptual model of RefWorks is presented to the user by a clear system image with useful visual clues and clear feedback. Users are able to mentally simulate how the system will work, and to predict the effect of their actions. Through interaction with the system, the user develops a mental model that matches that of the designer.

When evaluating RefWorks from the point of view of Norman's paradox of technology, it becomes apparent that the user experience is variable. Users with previous experience in scholarly writing and extensive knowledge of publication styles will have a more positive experience than casual users, who may be confused by too many options that they do not understand. Casual users and beginners may therefore benefit from the mediation of an information professional. Additionally, users must not rely on RefWorks to create an accurate bibliography. Due to the tendency for errors to appear in bibliographies generated by RefWorks, users would be well advised to refer to an authoritative publication style manual when proofreading their bibliography.

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