Supporting gender-neutral digital library creation: a case study using the GenderMag toolkit

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Abstract. Software is assumed by its creators and maintainers to be gender-neutral: that is, that it is equally well suited for use by any user, regardless of gender. We investigate this assumption in the digital libraries context through analysis of a significant digital library construction and maintenance tool—the Greenstone Digital Librarian Interface (GLI)—using the GenderMag toolkit. GenderMag provides personas whose approaches to software use fall across the spectrum of gender-stereotypic actions and motivations. The personas are used as the basis for cognitive walkthroughs of the system under investigation, to uncover potential gender biases in system functionality and interface design. We uncover significant such biases in GLI.

1 Introduction

Digital library collections have many configuration options reflecting the diverse design decisions (appearance, structure, search features … etc.) made in sharing digital content. DL software systems have attempted to simplify these indexing, design and deployment options by providing dedicated interfaces to support online publishing. For example, the Greenstone digital library system [8] has a Greenstone Librarian Interface (GLI) [7] that abstracts underlying text indexing packages into a graphical interface.

Usability for digital libraries is often focussed on whether the published collection supports the needs of users seeking information. Evaluations of the creation interfaces are less common; one example study used questionnaires of students who had used GLI as part of their course [6]. There are a variety of usability techniques that can be applied to software; in this paper we focus on a recent variant of a well-established inspection method: the cognitive walkthrough.

Burnett et al. developed the GenderMag (Gender-Inclusiveness Magnifier) cognitive walkthrough method [1,2,3] to explore gender differences in software use and user experience. This topic is particularly relevant for DL users as a survey of the characteristics of the library and information science workforce (graduates of LIS programmes in North Carolina) reported they were "predominantly female" [4]. Further, a review of teaching practices in tertiary digital libraries courses found that the courses were sited largely in library and information science programmes (which generally have a large

This is the author's accepted version of an article published in Proceedings of the 18th International Conference on Asia-Pacific Digital Libraries (ICADL 2016). © Springer 2016. The final publication is available at link.springer.com.

https://doi.org/10.1007/978-3-319-49304-6_6

Cunningham, S.J., Hinze, A. and Nichols, D.M. (2016) Supporting gender-neutral digital library creation: a case study using the GenderMag toolkit. *Proceedings of the 18th International Conference on Asia-Pacific Digital Libraries (ICADL 2016)*. LNCS 10075. Springer. 45-50.

proportion of female students) and that Greenstone and GLI were frequently mandated or recommended for projects [5]. In this paper we outline the GenderMag approach and report on an initial evaluation of the GLI DL tool.

2 Background

GenderMag encapsulates the extensive body of research into gender differences in software use and problem-solving via the following five facets [1]:

- *Motivation:* whether the persona tends to use software in order to accomplish a task (typically a female characteristic) or whether the persona is primarily motivated by an enjoyment of technology use (typically male)
- *Self-efficacy*: a persona's level of confidence in their ability to use the software for a given task (typically female users have lower self-efficacy than males)
- *Risk aversion*: a persona's comfort with dealing with uncertainty and the possibility of error when using software (females tend to be more risk-averse)
- *Tinkering*: the degree to which a persona enjoys exploring the settings and functions of novel software (where males are more likely to engage in tinkering behavior than females)
- *Skills/knowledge*: while none of the personas have backgrounds in computer programming or formal IT experience, the male personas engage more strongly with technology in their leisure time (for example, updating and tailoring their mobiles and apps)

These facets are incorporated into a set of four personas derived from an extensive review of literature highlighting "statistically significant gender differences in the ways people tend to go about things" [2]: Abby, representing the statistically 'female' behaviors; Patricia and Patrick, whose behaviors are closer to female and male behaviors respectively; and Tim, representing the statistically 'male' behaviors. These personas are described in the conventional manner: each includes a photo, a brief backstory (hobbies, employment, age, etc.), and a discussion of the persona's facet-based behavior in an IT context (Abby's risk aversion, for example, is described as "She tries to perform tasks "the safe" (i.e., familiar) way, even if the less familiar features might promise a more direct solution"). The four personas share identical backstories in terms of a university degree in accounting, current employment as accountants, and knowing "how to think in terms of numbers".

To identify gender-related usability issues with an application, one or more of the personas are used as the basis for a streamlined cognitive walkthrough (described in the context of an analysis of GLI in Section 3). The choice of persona—Abby, Patricia, Patrick, or Tim—provides the perspective of a user at that point on the spectrum of stereotypically gendered user behaviors. The GenderMag methodology has been evaluated in multiple case field studies in major technology organizations [1] and was found to be of practical utility to real-world software developers in identifying software interface and interaction gender-inclusiveness issues.

3 Methodology

We explored potential gender inclusiveness issues with the Greenstone Librarian Interface by performing a GenderMag-based cognitive walkthrough using the materials in the GenderMag Toolkit [2]. The tasks and their associated actions of the walkthrough were drawn from the GLI tutorial as representing a fundamental set of activities for a GLI user, together with the developer-recommended actions to accomplish those activities. Specifically, we chose the scenario involving the creation of a new Greenstone collection from a set of documents, with four sub-goals (the fifth was added by the present researchers):

- Sub-goal 1: Start a new collection (give the collection a name and description)
- Sub-goal 2: Add documents to a collection (where the documents are pre-existing HTML documents on the user's local drive)
- Sub-goal 3: Build the collection ('build' is Greenstone terminology for creating the index and interface to the collection)
- Sub-goal 4: View the extracted collection (from within GLI, examine the interface to the new collection)
- Sub-goal 5: Confirm that the collection construction was successful (exit GLI, then locate and open the new collection)

As we were primarily interested in teasing inclusiveness issues likely to have their strongest impact on female GLI users, we took the 'Abby' persona as our point of view in the walkthrough. Key characteristics of the Abby persona are: low self-confidence in performing computing tasks, risk aversion, and preferring step-by-step tutorials to tinkering with software [2]. The three authors comprised the walkthrough team, with one serving as facilitator, a second as recorder and all three serving as evaluators (as standard in the GenderMag methodology). We performed a GenderMag cognitive walkthrough by stepping through the sub-goals from the standpoint of Abby, noting each point at which she would likely diverge from the 'ideal' path of actions listed in the tutorial.
For each sub-goal, we considered the following two questions*: Will Abby have formed this sub-goal as a step to her overall goal*?; and *Why (considering Abby's Motivation and Strategies)*? For each action in a sub-goal, we considered the analysis questions in Table 1.

Table 1: GenderMag analysis questions for our scenario

Will Abby know what to do at this step?	If Abby did the right thing, will she know that she did the right thing and is making progress towards her goal?
Why? (considering Abby's Knowledge/ Skills, Motivations/Strategies, Self-efficacy and Tinkering	Why? (considering Abby's Self-efficacy and Attitudes Toward Risk)

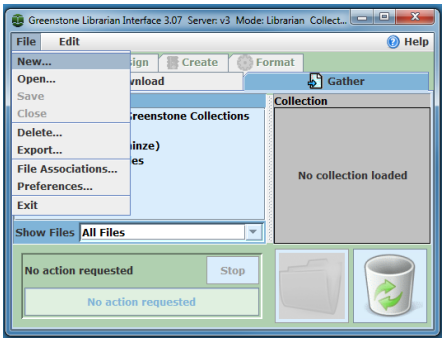

Figure 1: Starting a new collection

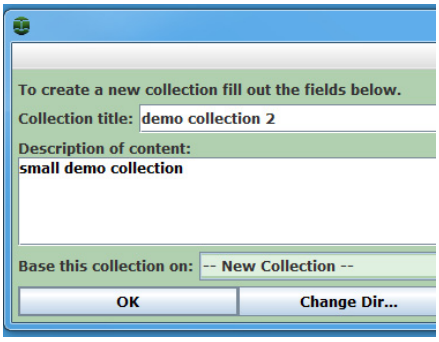

Figure 2: Naming & description

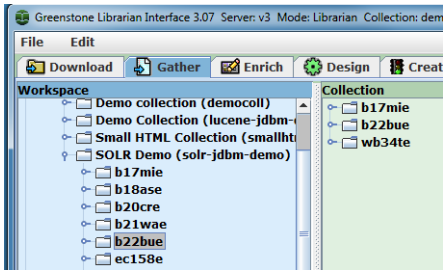

Figure 3: Gather documents

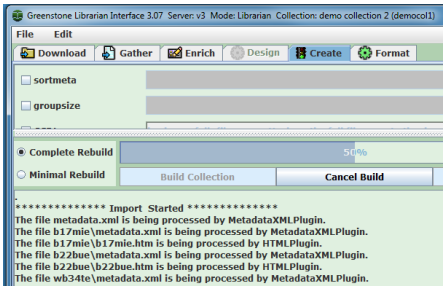

Figure 4: Building a collection

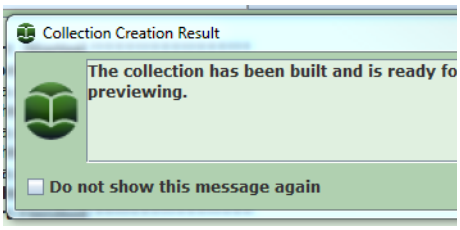

Figure 5: Collection result

We briefly describe the tutorial tasks through a series of screenshots: Step 1: The process of creating a new collection is started by selecting "New…" in the File menu (see Figure 1). The second step (un-named pop-up window, see Figure 2) captures the collection title and description. The third step is to gather documents into the collection (via the "Gather tab", see Figure 3) by drag and drop. Fourth, the collection is built (see Figure 4). At completion, the librarian is informed of the built collection (see pop-up in Figure 5).

4 Results

We present an overview of the significant gender-focused problems identified by our cognitive walkthrough. Note that a GenderMag analysis will identify both issues

surrounding gender inclusivity (that is, problems associated with persona facet values) as well as general usability problems. In the discussion below, we focus on the former.

Three closely related issues became apparent as we stepped through the scenario: confusion over whether the computer or the person is the actor, a focus on artefacts over process, and a lack of feedback as to the effects of a user's actions.

Actor confusion: While it is Abby's goal to build a DL collection, as soon as she turns to the software, most tasks are presented *not* from her point of view but instead with a focus on the actions of computer. For example, the activity of "building" the collection is a task that the software performs (see Figures 4 and 5). Some of the screen designs are ambiguous at best, such as the gathering of documents into the collection (see Figure 3), in which the interface merely shows the objects rather than referring to the process (see discussion below). Similarly, while the on-screen instructions Step 2 (Figure 2) refers to creating the new collection, from the interaction it becomes apparent that this, in fact, refers to the software process that will commence *after* Abby entered some information. This ongoing ambiguity over who is in control of the interaction—Abby or the software—is likely to be particularly stressful for a low self-efficacy user like Abby. Further, none of the on-screen instructions or labels seem to directly consider Abby, as a digital librarian, to be managing and leading the process but rather assign her to the role of assisting the software. As a consequence, users like Abby may feel marginalized—counter productive for an application designed with information professionals as one of the target user groups.

Artefact vs process: Most of the tasks that need to be carried out are not presented as processes but rather with a focus on the artefact or object. This lack of process or workflow support is particularly problematic for Abby, who heavily favors software that guides her work with a wizard, step-by-step prompts, or other explicit representation of the expected series of actions. For example, the creation process has to be started by selecting "File" and "New…"; while these standard labels would be reassuring to Abby (as she prefers to use features that she is 'already familiar and comfortable with' [2]), these labels are not particularly helpful in this instance (Abby wishes to create a new collection, not a new file). The interface for the gathering process (in which the documents for the new collection are identified; see Figure 3) does not refer to or guide the activity. It merely shows a workspace (left) and files in the collection (right), which is initially empty for a new collection. The librarian's activity shown in Figure 2 is not named (no window title). Overall, this reinforces the impression that the librarian is not the actor and their process of creating the collection is not the focus of the software, but rather the emphasis lies on the artefacts.

Lack of feedback: Abby has low self-confidence / self-efficacy in learning new applications and tends to blame herself rather than the software when software does not work as expected. When problems occur, she tends to avoid using those features in favor of work-arounds—or perhaps avoid using the software at all. The GLI interface gives very little feedback to users as they progress through the digital library creation process; we noted at most sub-goals that there was no dialog box or other message to inform Abby that the correct actions had been taken, and that the final dialog box indicating that a collection has been successfully created (Figure 5) includes the option "Do

not show this message again" (the ticking of which would eliminate any future indication of successful collection creation / re-creation). Further, there was no indication given at the end of the process of how to locate the new collection once Abby exited GLI. This constant state of uncertainty over the effects of her actions would be a powerful disincentive to future use of GLI for Abby.

5 Conclusions

Our analysis of the GLI interface uncovered three significant usability issues. These issues affect all potential users but would be particularly problematic for Abby, the GenderMag persona who exhibits the strongest statistically 'female' software use characteristics. Given the strongly female skew of the library and information science profession [4]—a major target user group for Greenstone and GLI—these issues could be a significant barrier to Greenstone uptake.

Additionally, we found the GenderMag methodology to provide a powerful tool for exploring the affective aspects of these usability issues on potential (female) users. By basing the cognitive walkthrough on a persona, the potential emotional impact of interface / interaction issues is magnified and made explicit—allowing the researchers to better differentiate between minor and major problems with the GLI software.

References

1. Burnett, M., Peters, A., Hill, C., Elarief, N.: Finding gender-inclusiveness software issues with GenderMag: a field investigation. In *Proceedings of CHI'16*. ACM. 2586-2598 (2016).
2. Burnett, M., Stumpf, S., Beckwith, L., Peters, A.: *The GenderMag Kit: How to Use the GenderMag Method to Find Inclusiveness Issues through a Gender Lens*, EUSES Consortium (2015) http://eusesconsortium.org/gender
3. Burnett, M., Stumpf, S., Macbeth, J., Makri, S., Beckwith, L., Kwan, I., Peters, A., Jernigan, J.: GenderMag: A method for evaluating software's gender inclusiveness, *Interacting with Computers*. (to appear) doi:10.1093/iwc/iwv046
4. Morgan, J.C., Farrar, B., Owens, I.: Documenting diversity among working LIS graduates. *Library Trends* 58(2), 192-214 (2009)
5. Pomerantz, J., Abbas, J., Mostafa, J.: Teaching digital library concepts using digital library applications. International Journal on Digital Libraries, 10(1), 1-13 (2009)
6. Tramullas, J., Sánchez-Casabón, A-I., Garrido-Picazo, P.: An Evaluation based on the Digital Library user: An Experience with Greenstone Software, *Procedia - Social and Behavioral Sciences*, Volume 73, 167-174 (2013)
7. Witten, I.H.: Creating and customizing digital library collections with the Greenstone Librarian Interface. *Proceedings of International Symposium on Digital Libraries and Knowledge Communities in Networked Information Society (DLKC'04)*, University of Tsukuba, Tokyo. 97-104. (2004)
8. Witten, I.H., Bainbridge, D., Nichols, D.M.: *How to Build a Digital Library*, Second Edition. Morgan Kaufmann, San Francisco, USA, 2nd edn. (2010)