

Digital Library Evaluation Made Simple with Nielsen's Design Heuristics: Design Compliance and Importance

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Abstract. Using Nielsen's well-established Heuristic Evaluation normally used for gathering *qualitative* feedback, this paper describes a user study conducted on the National Library Board's Digital Library (NLBDL) in Singapore to gather *quantitative* feedback on users' perceptions regarding compliance/violation of design heuristics implemented, and draw recommendations for design refinement.

1 The Study

For digital libraries (DLs) to realise their full potential, the design of a DL system needs to take into account the needs and preferences of users in the community. This is important as end-users are typically individuals who may not have particular skills in information retrieval, and are accessing library resources from their own desks, without support from a librarian. Hence, the design of DLs should be intuitive, flexible and easy to use, and usability evaluation plays an important role in DL design to ensure minimal effort by users using the system [5].

Previous studies [e.g. 5, etc.] on the National Library Board's Digital Library (NLBDL; <http://www.nlb.gov.sg/>) focused on conducting *detailed* and *time-consuming* usability inspection techniques such as Claims Analysis [2] to detect usability problems. In this paper, we describe a user study conducted on the NLBDL using Nielsen's well-established Heuristic Evaluation [4] to gather *quick, first-cut* feedback on users' perceptions regarding compliance/violation of design heuristics, and draw recommendations for design refinement. The objectives of this study were:

- **Objective 1.** To investigate users' perceptions of design heuristic compliance and/or violation when applied to NLBDL, and rank these heuristics in order of importance; and
- **Objective 2.** To identify common problems faced by users while using the NLBDL, and propose refinements to the design features and improve the usability of the NLBDL.

Target Respondents

Three main types of libraries come under the National Library Board (NLB): regional, community and children's libraries. For this study, we selected users of the NLBDL at

Jurong Regional Library (JRL), being the largest public library in Singapore, with a total floor space of 12,020 square metres. It has half a million collection of books, magazines, audio-visual materials, microfilms and newspapers, with an average visitorship of 200,000 per month.

Data Collection and Protocol

The survey was collected on 22 February 2006. Our target participants were those aged 15 years old and above, as they represented a generation of tech-savvy, internet-connected population according to the latest Infocomm Development Authority Annual Survey on Infocomm Usage in Households and Individuals for 2004 (<http://www.ida.gov.sg/idaweb/factfigure>; accessed 29 Jun 2007), and hence represented a pool of current and potential users of the NLBDL. To identify potential participants, we approached those who were using the multimedia terminals at the Jurong Regional Library or had used the NLBDL before.

Hourly announcement was made by the library staff inviting participation to the survey. A small token of appreciation was given to the participants. Participants took an average of fifteen minutes to complete the survey. A total of 100 took part in the survey.

2 Findings and Analyses

2.1 Profiles of Respondents

The sample population was divided almost equally with 44% males and 56% females. 64% of the participants were between 18-24 years old, and 36% were between 25-34 years old. Of the 100 participants, 63% were self-reported novice users, while 37% were intermediate users.

2.2 Degree of Compliance of Design Heuristics

Table 1 shows participants' comments in response to Question 1 on the degree in which H1 (visibility of system status) was well-implemented in NLBDL. We made the following assumptions: (i) responses marked "strongly disagree" (SD) and "disagree" (D) suggest negative comments/violation of the design heuristic; (ii) responses marked "neutral" (N, Column 5) were discarded; and (iii) responses marked "Agree" (A) and "strongly agree" (SA) suggest positive comments/compliance. Column 8 computes the Compliance Index (CI) by multiplying frequencies in Columns 3 and 4 with "-2" and "-1"; Column 5 with "0"; Columns 6 and 7 with "1" and "2". As an illustration in Table 1, total CI for HI is 62.5, with CI = 82 for sub-heuristic by statement H1i that NLBDL provides indication that an application was processing, CI=70 of indicator being appropriate, and CI=35 that the processing speed of the indicator was fast.

Similarly, the compliance indices of the rest of 9 heuristics were computed in this manner. Table 2 shows the total compliance indices of the 10 heuristics in decreasing order. Overall, the NLBDL interface design was found by the participants to adhere to most of Nielsen's ten heuristics. Of the ten heuristics, 6 heuristics (H1, H2, H3, H4, H6, H7) were found to be highly rated by the respondents (CI>60).

Weak compliance/violation of the heuristics was perceived in H5, H8, H9 and H10. H5 and H9 were rated with a compliance index of 47, implying more could be done in NLBDL to make error prevention and correction, and help to recognize, diagnose and recover from errors more explicit.

It seems that NLBDL might not be providing sufficient help and documentation. Congruent to findings from [3] that novice users were confused and overwhelmed as they were unfamiliar with the library web pages, novice participants in our study could also be frustrated and confused by the lack of help and documentation. They felt overwhelmed when faced with a new system. Therefore, NLB should look into improving their help and documentation feature. This could be due to the fact that the NLBDL users prefer online help as the customer service counter in JRL is located far from the multimedia terminals. Ambiguous representations of interface elements such as icons, toolbars, dialogues, and cursors can become a barrier to users' experience of effective navigation of the system.

To reduce such mismatch between users' mental models and design implementation, an effective interface design should provide clear and visible help and documentation, as suggested by Nielsen's heuristics H10.

Table 1. Participants' Feedback on H1 (Visibility of system status)

HI	Visibility of system status	SD	D	N	A	SA	CI
i.	NLB's Digital Library provide an indicator (e.g. an hourglass icon or a status bar indicator which shows system is running, etc) that an application is processing	0	1	24	67	8	82
ii.	Indicator given is appropriate	0	2	32	60	6	70
iii.	Processing speed of indicator is fast	2	10	43	41	4	35
Total Compliance Index							62.5

Table 2. Total Compliance Indices of the 10 Heuristics (Decreasing Order)

No	Nielsen's Heuristics	Compliance Index (CI)
H2	Match between system and the real world	88.5
H6	Recognition rather than recall	80.7
H4	Consistency and standards	77.0
H3	User control and freedom	75.8
H7	Flexibility and efficiency of use	64.5
H1	Visibility of system status	62.5
H8	Aesthetic and minimalist design	57.0
H10	Help and documentation provided by the NLBDL	54.0
H5	Error prevention and correction	47.0
H9	Help the users in recognizing, diagnosing and recovering from errors	47.0

2.3 Importance of Heuristics

Table 3 tabulates the “importance index (II)” computed from participants’ ratings for each of the ten heuristics. Similar to CI, II is computed by multiplying frequencies of “strongly disagree” and “disagree” with “-2” and “-1” respectively; “neutral” with “0”; “agree” and “strongly agree” with “1” and “2” respectively. As in CI, the range of the II lies between -200 and 200.

The top three heuristics with the highest II were H7 (II=112), H3 (II=110), and H5 (II=102) suggesting that flexibility and user control are important in ensuring positive user experience. This seems to concur with Borgman (2003) who advocates that minimum criteria for usability are that systems should be easy to learn, flexible, adaptable and efficient for the task [1]. On the other hand, respondents rated H6 (II=62) and H8 (II=54) the least important.

3 Discussion and Conclusion

This paper describes a *quantitative* usability technique complementing Nielsen’s well-established Heuristic Evaluation normally used for gathering *qualitative* feedback. With 100 participants, we were able to gather *useful, quantitative* comments regarding compliance/violation of design heuristics implemented on NLBDL, and draw recommendations for design refinement.

This is pilot study using a heuristic-inspired survey instrument. Future research could significantly expand the sample size, lengthen the survey period, and obtain responses from participants from more diverse backgrounds.

Acknowledgements

We would like to thank the National Library Board for allowing us to conduct a survey, and special thanks to the staff at Jurong Regional Library for their support and hospitality. This project is supported by NTU’s AcRF grant (RG8/03).

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