Reliability of Heuristic Evaluation during Usability Analysis

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Abstract

Scientific reliability --- the degree to which a research method produces stable and consistent results --- represents a major linchpin of tenable scientific research. A number of different studies support the conclusion that usability testing of software interfaces lacks scientific reliability (Jacobsen et al., 1998; Jordan, 2017). The present report augments this conclusion with findings that heuristic evaluation, the second major pillar of usability analysis, also lacks reliability. We conclude that a key priority of “usability science” should be to initiate a systematic program of inquiry to investigate the degree to which this term has meaning.

Objective

Analyze the reliability of heuristic rankings of different design features attributed to selected social networking sites.

Background

A number of different studies support the conclusion that usability testing of software lacks scientific reliability. As stated by Jacobbsenn et. al. [2] “Both selection of usability problems and selection of the most severe problems are subject to considerable individual variability”.

Factors that affect the probability that a problem will be detected by usability test:

- Number of problems contained in a given interface
- Difficulty in detecting a given problem
- Number of users recruited to test the usability of interface

This study extends prior research on usability testing by exploring the reliability of heuristic evaluation, the second scientific pillar of usability analysis.

Method

Student teams enrolled in a human-centered design course were tasked with usability analysis of selected social networking sites, using a perceptual survey. Both team members, and members of recruited survey groups, used the survey to numerically rate the quality of a series of heuristics relevant to different design features of the sites.

These heuristic quality rating data then were analyzed using correlation analysis and Krippendorff's alpha (K-alpha) to assess the reliability of the results, based on evaluation of the variance in team versus survey group member ratings for each heuristic.

Results

I. Correlation Analysis

Table 1 summarizes quality rating results for a series of different heuristics for four different social networking sites. Average Team and Survey Member Ratings are based on 1-5 Likert rating scales. Figure 1 is a scatter plot of the paired average heuristic quality ratings by team members vs. survey group members. The regression line (DOF = 23; r = 0.37) is statistically non-significant.

Table 1. Heuristic Evaluation Based on Quality Ratings of Selected Heuristics

Site	Gender Numbers		Age Range	Heuristic	Avg. Team Member Ratings	Avg. Survey Group Ratings
	M	F				
Facebook	17	19	15-88	Layout	4.0	3.7
				Ease of Navigation	4.2	3.8
				Content	4.0	3.3
				Site Privacy/ Security	3.5	3.5
				Visual Design	4.2	3.6
				Functionality	4.3	4.4
				Interactivity	4.1	4.5
				Overall Quality	2.7	4.1
YouTube	4	4	Avg 24	Ease of Navigation	4.3	4.6
				Content	5.0	3.2
				Functionality	4.3	4.6
				Interactivity	3.3	3.2
				Overall Quality	3.3	3.2
Instagram	44	20	18-73	Ease of Navigation	3.4	4.0
				Content	3.4	3.8
				Readability	4.6	4.6
				Visual Design	3.4	4.0
				Functionality	4.2	4.1
				Interactivity	4.1	4.3
				Ease of Use	4.0	3.9
				Provides Feedback	3.3	4.6
Snapchat	11	8	19-60	Overall Quality	3.4	4.1
				Ease of Navigation	1.0	2.6
				Content	3.6	3.1
				Visual Design	4.5	3.1
				Overall Quality	3.3	3.5

Figure 1. Scatter plot of paired average heuristic quality ratings

Table 1. Individual site data and combined data K-alpha

Site	Number of Rating Groups	Number of Heuristics	K-alpha
Facebook	7	11	0.03
YouTube	2	4	0.33
Instagram	9	11	0.10
Snapchat	4	7	0.03
Combined	22	12	0.12

Results (continued)

II. Krippendorff's Alpha

Table 1 lists K-alpha values for each social networking site, based on inter-rater (group) agreement on quality ratings for each heuristic, plus the value calculated for all rating pairs combined. All K-alpha values are well under 0.8, associated with low inter-rater reliability [17].

The finding from these two analytical approaches shows that heuristic evaluation by independent groups of raters lacks reliability.

Conclusion & Discussion

The analysis in this report raises the following major questions and conclusions:

1. Does a lack of reliability in ratings of heuristic quality represent a reasonable, or even desirable, expectation?
2. What is an acceptable level of variability in judgments of heuristic quality for a given interface design?
3. Given that prior research on usability testing, coupled with the evaluation of heuristic quality ratings presented in this report, both point to a lack of reliability in these empirical pillars of usability analysis, a reasonable conclusion is that the scientific validity of usability analysis is open to question.

Given the latter conclusion, a key priority of “usability science” should be to initiate a systematic program of inquiry to investigate the degree to which this term has meaning.

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Method

Student teams enrolled in a human-centered design course carried our usability analysis of selected social networking sites, using a perceptual survey. For this purpose, team members and recruited survey group members numerically rated the quality of a series of heuristics applicable to the design of these sites.

The heuristic data then were analyzed using correlation analysis and Krippendorff’s alpha. Reliability of the results was ascertained by evaluating the variance in ratings by team versus survey group members for each heuristic.

Results

I. Correlation Analysis

Table 1 summarizes quality rating results for a series of different heuristics for four different social networking sites. Average Team and Survey Member Ratings are based on 1-5 Likert rating scales. Figure 1 is a scatter plot of the paired average heuristic quality ratings by team members vs. survey group members from Table 1. The regression (DOF = 23, and $r = 0.37$) is statistically non-significant.

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