Electronic Bulletin Board Distributed

Questionnaires for Exploratory Research

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James Miller, John Daly, Murray Wood, Andrew Brooks and Marc Roper

University of Strathclyde, Glasgow, Scotland, UK

Abstract

The use of electronic bulletin boards is increasing dramatically; they are now a significant source of opinion and experience-related commentary from a wide variety of people over a large range of topics. As such they are a major information resource and potentially suitable as a vehicle for questionnaire distribution. To date, there has been no formal discussion of this vehicle—a deficiency this paper attempts to address. It discusses the advantages and disadvantages of this medium, and compares it against other alternatives. We believe this comparison shows that the medium has a great deal to offer and a wide degree of applicability, especially within the area of exploratory research.

The main deficiency with the medium is that it potentially suffers from a large-scale self-selection bias. To investigate this, we have conducted a questionnaire study through this medium, and subsequently replicated it using a traditional mail distribution approach. We believe that this experiment provides evidence that, for populations without a sampling frame, the effect is of a similar magnitude for both bulletin board distributed and mail distributed surveys. We conclude that surveys using this new medium are valid given the above restriction.
1 Introduction

Electronic communication has undoubtedly made a great impact on the working and home environment; an increasingly familiar phenomenon are bulletin boards, such as the Usenet service[1]. Bulletin boards are collections of electronic newsgroups, where a newsgroup is a discussion group with a particular focus. Individuals can send electronic articles to and receive from these newsgroups, in general people only subscribe to newsgroups which discuss their particular interests. Individuals can subscribe to newsgroups for a single session or a longer commitment. Some newsgroups are moderated, while other have no control or limitation. These services allow disparate collections of people with a common interest to meet virtually and hold a conversation. A recent phenomenon, especially common within technical groups, is the posting of ‘fact finding’ questionnaires, attempting to elicit opinions and work experience. This process seems (on the surface) reasonable, even desirable, given the amount of technical theory without any quantifiable support and/or evidence. But are these questionnaires fatally flawed? We can find no literature on the methodological issues involved in using electronic newsgroups or bulletin boards to distribute questionnaires. In fact, those articles which contain reviews of distribution media, ignore bulletin boards as a potential alternative[2, 3]. The main aims of this paper, therefore, are:

1. To discuss the advantages and problems associated with using this medium.

2. Via a questionnaire study, to investigate the validity (with regard to population cross-section) of using this medium.

A questionnaire distributed via Usenet is undoubtedly designed for mass electronic circulation. The questionnaire author constructs the electronic questionnaire, together with a request for participation, a preamble and a return e-mail address. Armed with the topic and the questionnaire, the researcher can now post it to the set of newsgroups which they believe the target population may read. This selection of only a small proportion of
the newsgroups helps to define the target population in terms of the phenomenon under investigation. In fact, Usenet and other services support a wide range of interest groups and are hence able to support surveys on a myriad of topics. (Currently Usenet supports approximately 6000 different newsgroups, with new ones being created all the time.) The questionnaire author then simply awaits for respondents to return the completed questionnaire via e-mail. Fortunately this period will be relatively brief (assuming a willing audience), allowing them to quickly assimilate the replies and start the analysis.

This paper can be viewed as a complement to the excellent paper by Pratto and Rodman[4], who discuss the advantages and disadvantages of using Magazine-Distributed Questionnaires and is related to the work of Hiltz[5], Meadows[6] and Knapp[7] who have investigated computerisation of questionnaire distribution.

2 The advantages of a bulletin board distributed questionnaire study

Each distribution method has its strengths and weaknesses, therefore when conducting a survey it is vitally important to choose the most appropriate medium for the respective task. The main advantages of using a bulletin board distributed questionnaire are:

Targeting: Bulletin board distributed questionnaires provide very quick access to members of the target population, i.e., by making use of the vast number of existing electronic newsgroups it is possible to select the ones which have a large proportion of individuals who are part of the target population. In fact targeting is highly efficient using this method, as newsgroups are in general very focused and are unlikely to be read by anyone not interested in the topic. Also these newsgroups can provide access to specialised populations, which are often unavailable in other media. This again is due to the diversity of the topics under discussion within these groups.

Cost: The monetary cost of such a survey is exceptionally low, an advantage when performing exploratory research with limited financial support. This type of survey usu-
ally works on a quid pro quo basis: the individual is asked to respond, and, in turn, is promised access to the survey results (usually posted to the corresponding newsgroups).

**Access:** Bulletin board distributed questionnaires have the ability to obtain a substantial amount of quantitative data: popular electronic newsgroups are read by thousands of individuals from all over the world.

**Speed:** The speed of turn-around from beginning the survey to collecting the data is quick, i.e., once the questionnaire has been completed, all that is required is posting it to the appropriate newsgroups (responses can be returned within a matter of hours). This is also an advantage for planning future research with deadlines, e.g., subject based experiments require advanced laboratory bookings, subject recruitment, and so on, and such surveys can quickly help to focus hypotheses for testing.

**Support for Alternative Forms of Questionnaires:** The medium also supports ‘complex questionnaires’, via the use of graphics, hypertext and hypermedia techniques, a questionnaire can be constructed which gives explanations of complex issues, both textually and pictorially. In fact, the potential exists to moderate many of the traditional defects of ‘remote non-personalised’ media. Questionnaires can be constructed which allow respondents, for example, to click on the question and then be presented with a clarification dialogue. Questionnaires constructed in HTML (HyperText Markup Language) and distributed via Usenet and the World Wide Web, open up a myriad of alternatives of style and presentation techniques using text, audio, images and animation. Using modern facilities these more complex questionnaires are relatively easy to construct and undoubtedly offer many possible advantages.

**Ease of Use:** All the responses received will be computerised. This can itself offer several advantages notably (i) a reduction in the time to edit the data into a statistical analysis package, e.g., SPSS and (ii) a reduction in the numbers of errors introduced when transcribing the data to the appropriate format.

**Reposting:** A researcher can re-post their questionnaire or send a follow-up message with a few key strokes. These follow-up techniques are important in increasing the
response rate.

3 The disadvantages of using bulletin board distributed questionnaires

Obviously as well as having advantages, any medium must have disadvantages:

**Self-selection:** A questionnaire posted to electronic newsgroups will be distributed to a ‘biased’ population: only those who subscribe to the newsgroup can read the questionnaire. Furthermore, respondents to the questionnaire are self-selected from the total population for their motivation and interest to respond. Also, techniques such as personalised reminders\cite{8}, often used in mail based surveys, which help to alleviate the self-selection problem, are not available using this medium due to the anonymous nature of the subscribers. Having said this, it should be noted that many potential target populations, available via electronic newsgroups \(^1\) have no available sampling frame for the target, and investigative research on potential topics is limited. This medium is not unique in suffering from this bias, in fact, every medium suffers to a greater or lesser degree, for example see Hawkins\cite{9} for a discussion of self-selection biases associated with other approaches. Potentially the problems faced using this electronic medium are more severe than those using more traditional means. This will be addressed further later in Section 6.

**Ability to ask open questions:** The ability to ask open questions is still as restricted as in mail based questionnaires because such questions require typing. Open questions require probing of the answers given and as with mail based surveys cannot be easily performed. Having said this, we found a significant number of respondents were willing to edit the questionnaire to supply extended or additional open-answers.

**Confidentiality:** This approach is not inherently confidential, potentially this is a massive problem depending on the phenomenon under investigation. Fortunately respondents

\(^1\)e.g. specialised technical groups, specialised interest groups (ranging from sports to politics to medical concerns) and anarchic, chaotic groups (such as anecdote and joke swapping)
dents can supply anonymous contributions, either by using an anonymous e-mail service or by ‘instructing’ their local e-mail service to suppress their names. E-mail services are not normally configured to allow this, but they run very few checks on who is posting what, and it is not difficult to find ways to circumvent the normal e-mail procedures. Having said this, it does require someone with some knowledge of e-mail operations, hence we recommend that appropriate instructions and guidance be provided with any questionnaire about how to achieve an anonymous reply.

4 Comparison with other distribution media

Obviously there exist other factors which are important in weighing up the various merits of each of the survey methods. Frey’s paper[10] on telephone surveys lists a total of 21 factors he considers to be of varying importance when choosing a medium. He then proceeds to compare: postal, face-to-face and telephone surveys against these criteria. Pratto and Rodman[4] have subsequently extended this table to include magazine distributed surveys. Based on our conducted survey, we have extended their table to include electronic newsgroup distribution (Table 1). Some caution should be used when interpreting this table, as our experience in conducting this survey may not be typical. We would welcome responses from other individuals carrying out similar work about their experiences, and hope to update the table once we have collected further evidence. Having said this, we believe that it is clear, from Table 1 and the previous discussion, that bulletin board distribution compares favourably with other media in a great number of situations, especially where exploratory research is being undertaken.

5 The Usenet study

For our study, we were interested in professional computer scientists and their attitudes to new programming practices, especially their experiences in using object-oriented software
<table>
<thead>
<tr>
<th>Factors</th>
<th>Mail</th>
<th>Face-to-Face</th>
<th>Telephone</th>
<th>Magazine</th>
<th>Bulletin Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Personnel Reqs.</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Implementation Time</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Sample Coverage</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Response rate: General public</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Refusal rate</td>
<td>U</td>
<td>3</td>
<td>3</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Nonaccessible</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Obtain response from an elite</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Respondent within home</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Interviewer control</td>
<td>n/a</td>
<td>3</td>
<td>1</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Item nonresponse</td>
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<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Questionnaire length impact</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>Confidentiality</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1*</td>
</tr>
<tr>
<td>Ability to seek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socially undesirable responses</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ability to probe</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Ability to clarify</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Ability to ask:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-ended questions</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Sensitive questions</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Complex questions</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Use of Visuals</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Avoid opportunity for</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondents to consult</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 1: Key: 1 = major advantage, 2 = minor advantage, 3 = minor disadvantage, 4 = major disadvantage, U = unknown, * assuming correspondents have the capability or are provided with the capability to send anonymous e-mail.
construction. Again we found no empirical data available on the beliefs and experiences of actual professional programmers - what are they finding difficult and what benefits are they seeing? These and other similar questions are often the basis of large research programs, even though these programs often ignore canvassing the actual practitioners. The results of the survey are presented in [11].

We selected the following Usenet newsgroups as defining our target population (object-oriented partitioners): comp.databases, comp.lang.clos, comp.lang.c++, comp.lang.eiffel, comp.lang.objective-c, comp.lang.smalltalk, comp.object, comp.software-eng, and comp.sys.next.programmer. These newsgroups have an average monthly traffic of 3500 articles, read by thousands of people, and hence we are confident that the questionnaire reached a sizable cross-section of the target population. As with the majority of mass distribution questionnaires, we attempted to create interest in completing the questionnaire by offering to post the questionnaire results back to the selected newsgroups. We also followed up our original posting with a re-posting to all the relevant newsgroups five working days later. From these postings we managed to amass 167 responses within seven working days. Appendix A contains the questionnaire.

We estimate that the re-posting contributed about 30 percent of this figure. Obviously follow-up techniques, such as re-posting, are unavailable if the researcher chooses to distribute the questionnaire in a magazine or journal and hence bulletin board distribution is more akin to postal distribution in this respect.

6 The problem of self-selection

There exists the possibility that work undertaken in this medium is flawed because it suffers from a large-scale bias introduced by the self-selection phenomenon. In an effort to estimate the potential impact of this effect, we decided to repeat the survey using a different medium which was known to have a reasonable tolerance to this effect and subsequently compare the obtained results from these two media. If self-selection was a
significant problem we would expect the results of the two studies to diverge.

For our replication we decided to use mail distributed questionnaires. Apart from the lower self-selection bias in this media, this format allowed us to use a paper-based version of the existing electronic questionnaire. In fact very little alteration to the electronic questionnaire was required for the mail study. This obviously helps minimise any effects from non-media variables.

400 questionnaires were posted to randomly selected members of a mailing list (consisting of 2000 contacts). All members of the list had in the past expressed interest in the object-oriented technology products of a specific software company. Unfortunately, nothing can be said about how representative recipients of the questionnaire were, but we are confident that the vast majority were members of our target population. Having said this, the list does contain a wide variety of organisations and the ‘interested’ persons have a wide variety of positions and job titles within these organisations.

In response to our mail shot, we received 119 completed questionnaires, yielding a 30 percent response rate. Many authors (e.g. see [12]) remark that a response rate of 20-30 percent is considered to be adequate. Hence, we regard our response rate as a confirmation of the validity of the mail based survey. Further, on inspection of the returns we found only a small minority of questionnaires with incomplete questions; again we consider this to be a validation of the mail based survey and the questionnaire design in general.

It is worth noting some other differences in the potential sampling populations between the mail based and the bulletin board based surveys. These differences can lead to problems depending on the type of survey. As stated above, the response rate for the mail based questionnaire was of the order of 30 percent. On the other hand, the response rate for the bulletin board version is extremely difficult, if not impossible to estimate. Also factors such as geographical distribution, demographic groupings, etc. which can be partially controlled in a mail based approach, can become major sources of variability and bias. Another related point of concern is with respect to the topic of our study. The questionnaire is aimed at computer professionals, and begs the question: would a
less computer literate cross-section of the population provide the same response rate? It would certainly be interesting to replicate this experiment with a non-computer oriented study.

7 Comparison of the two surveys

A Chi-square test was performed on each question variable to check for answer differences between Usenet respondents and mailing list respondents. Table 2 presents the results of each test where any result indicated as significant is at the $\rho = 0.05$ level or better. The significant result achieved for respondent position (Q.1(a)) demonstrates that in this survey different media have targeted different cross-sections of the population. Although we are unable to predict whether either sample is representative of the population, the likelihood is that neither sample is representative. The significant differences achieved for capacity used, experience, and language familiarity are not independent of this fact and are therefore easily explainable: because two different groups of people were questioned it is understandable that differences exist (i) in the capacity the respondents use the programming paradigm, (ii) in respondents’ Object-Oriented experience, and (iii) in respondents’ familiarity with Object-Oriented languages (although capacity used and experience are not significant under the Bonferroni correction method discussed below).

Although statistically significant relationships have been discovered through the Chi-square test, this significance does not indicate the strength of the relationship; a significant result only means that the relationship in the population is unlikely to be zero [13]. It is, therefore, desirable to have a measure of the strength of the relationship (i.e., have an index of the degree of correlation). For this reason Cramér’s $\phi$ was calculated, a linear index which converts the Chi-square $X^2$ value to a correlation coefficient (interpreted as a Pearson $r$ correlation coefficient) indicating the strength of the relationship between two different variables. The index is on the scale of 0 to 1 where the larger the value of $\phi$, the stronger the relationship between the two variables. Note that the largest value,
<table>
<thead>
<tr>
<th>Description</th>
<th>Question</th>
<th>Degrees of freedom</th>
<th>Test result ( (X^2) )</th>
<th>Significant?</th>
<th>Cramér’s ( \phi )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Q. 1(a)</td>
<td>4</td>
<td>44.08</td>
<td>Yes</td>
<td>0.40</td>
</tr>
<tr>
<td>Capacity used</td>
<td>Q. 1(b)</td>
<td>3</td>
<td>8.46  ( \text{Yes} )†</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Object-oriented experience</td>
<td>Q. 2(a)</td>
<td>3</td>
<td>12.28</td>
<td>Yes†</td>
<td>0.21</td>
</tr>
<tr>
<td>Language familiarity</td>
<td>Q. 3</td>
<td>5</td>
<td>50.86</td>
<td>Yes</td>
<td>0.34</td>
</tr>
<tr>
<td>Typical method size</td>
<td>Q. 4(a)</td>
<td>3</td>
<td>2.59  No</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Method size range</td>
<td>Q. 4(b)</td>
<td>4</td>
<td>7.81  No</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>Depth of class hierarchy</td>
<td>Q. 5</td>
<td>3</td>
<td>4.37  No</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Inheritance caused difficulty</td>
<td>Q. 7</td>
<td>4</td>
<td>2.00  No</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Problems caused by naming</td>
<td>Q. 8</td>
<td>4</td>
<td>4.87  No</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Use of local class libraries</td>
<td>Q. 9</td>
<td>4</td>
<td>8.63  No</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>Ease of analysis and design</td>
<td>Q. 10(a)</td>
<td>2</td>
<td>10.53</td>
<td>Yes†</td>
<td>0.20</td>
</tr>
<tr>
<td>Programmer productivity</td>
<td>Q. 10(b)</td>
<td>2</td>
<td>5.68  No</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Software reuse</td>
<td>Q. 10(c)</td>
<td>2</td>
<td>0.77  No</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Ease of maintenance</td>
<td>Q. 10(d)</td>
<td>2</td>
<td>1.49  No</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Multiple inheritance useful</td>
<td>Q. 11</td>
<td>4</td>
<td>5.88  No</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>SP maintenance problems</td>
<td>Q. 12</td>
<td>4</td>
<td>2.42  No</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>OO maintenance problems</td>
<td>Q. 13</td>
<td>4</td>
<td>4.36  No</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>OO more maintainable than SP</td>
<td>Q. 14</td>
<td>4</td>
<td>6.25 No</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>C++ as a de facto standard</td>
<td>Q. 15</td>
<td>2</td>
<td>2.62  No</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>C++ allows hybrid programming</td>
<td>Q. 16</td>
<td>3</td>
<td>3.01  No</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>C++ Friend function</td>
<td>Q. 17</td>
<td>4</td>
<td>3.31  No</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Use operator overloading</td>
<td>Q. 18(a)</td>
<td>4</td>
<td>2.01  No</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Overload operators as</td>
<td>Q. 18(b)</td>
<td>3</td>
<td>4.43  No</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Use of templates</td>
<td>Q. 19</td>
<td>4</td>
<td>2.94  No</td>
<td>0.13</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Two-tailed Chi-square test results between each variable and the two media, see Appendix A for the full questionnaire. †- see text for explanation.
achieved for position ($\phi = 0.40$), only represents a weak to moderate relationship between the medium used and the position the respondent held. Consequently, given that (i) the questions tested, with one exception (Q.10(a)), provide no significant difference of opinion between the two sets of respondents and (ii) the calculated indexes for these questions are indicators of no more than weak relationships, we can have increased confidence that the self-selection problem discussed in the previous section has not biased the results of this survey.

The exception was a statistical difference of opinion about the ease of Object-Oriented Analysis and Object-Oriented Design (Q.10(a)). The complete data set was examined in an attempt to explain the difference. A second Chi-square test was performed including only those respondents who chose either the ‘yes’ or ‘no’ category (to eliminate the ‘don’t know’ respondents as the reason for the difference). A significant result was still obtained, $p < 0.05$ (two-tailed, $df = 1, X^2 = 5.94$). Further examination of the data set revealed that the significance was caused by the number of respondents who replied ‘no’ to the question: only 11 (7.2%) respondents in the electronic group compared to 16 (17.2%) in the mail group. The questionnaires for these respondents were then examined for similarities which might explain why they answered ‘no’, e.g., were they relatively inexperienced object-oriented users? Cross checking across all the other variables in Table 2, however, did not reveal any common ground and left us unable to provide any explanation based on the data. One possible reason may be because when conducting multiple comparisons, the probability of committing a Type I error (falsely rejecting a null hypothesis) increases with the number of tests. Courtney and Gustafson [14] state, “although the probability of a Type I error is fixed at $\alpha = 0.05$ for each individual test, the probability of falsely rejecting at least one of those tests is significantly larger than 0.05.” Given that 24 statistical tests were applied, therefore, the probability that our significant result for Q.10(a) was achieved by chance is quite high. If the answer to any question is independent of all other answers then this probability is calculated as $P(x \geq 1) = 1 - (1 - 0.05)^{24} = 0.71$. Although some question dependence does exist within the questionnaire, this figure provides a rough
estimate of just how large this probability is. The most frequently advocated method of reducing this inflated Type I error probability is through the Bonferroni correction method [15]. This simple procedure involves dividing the $\alpha$ level desired for statistical significance (in this case $\alpha = 0.05$) by the number of statistical tests conducted. Thus, through application of this method, a significant relationship will be achieved only if the $p$ value is less than $\alpha = 0.0021$. As a consequence, statistical significance only remains for position and language familiarity; the other relationships indicated as statistically significant in Table 2 with a † do not achieve the required $p$ value to be classed as significant under the Bonferroni method.

To conclude we should reiterate that, although it is likely that neither medium has provided sample representativeness for our survey, the opinions expressed in the questionnaires did not show any significant difference across the media used under the Bonferroni correction method. Further, the strength of the relationship between the response to an arbitrary question and the medium used could, at most, only be described as moderate. Also, mail based questionnaires are known to suffer from the self-selection problem within acceptable limits and our results show little difference between the two media. We conclude that the problem of self-selection within the bulletin board distributed component of this survey appears to be of a similar order to the mail distributed component, and hence we have confidence that this effect has not negated the results of this survey. Furthermore, we regard this as initial evidence, suggesting that bulletin board distributed questionnaires are not fatally flawed due to the self-selection problem, although this study requires repeated external replication to allow us to draw any generalisable conclusions. We recommend that the merits of using electronic distributed questionnaire, either in association with mail based questionnaires or on their own, should not be underestimated.
8 Conclusions

As the way people communicate continues to evolve, then the opportunities for new and exciting mediums for survey distribution evolve. The downside of this is that unless each new medium is carefully assessed and evaluated, then we run the risk of producing large bodies of work which are fatally flawed. Distribution by electronic bulletin boards fits this bill. Although we are currently seeing an ever increasing number of questionnaires distributed by this medium (e.g. see [16]), no formal consideration of the medium has taken place to date. This paper seeks to remedy this deficiency.

The advantages of using this new medium are many, with the chief advantages being that the medium provides us with very cheap and immediate access to large populations, and that these populations are well defined in terms of a particular phenomenon. Also, new forms of questionnaires are relatively easy to construct, given advances in hypermedia technology and responses to the questionnaire can start arriving in a matter of hours and certainly should be completed within a few days. In fact the whole process, from questionnaire hypothesis to final statistical analysis can be achieved in a matter of weeks.

The main drawback with this medium, is the potential bias introduced by the self-selection phenomenon. In our experiment we have been able to show that this bias is probably not as serious as one might have feared, although further external replications are required to allow generalisation of these results. We conclude that electronic bulletin boards are a useful addition to the current range of distribution media, provided these four conditions are true: (1) the target population of the survey can be expressed as one or more newsgroups within the bulletin board; (2) there is no sampling frame for the target population; (3) a sizable number of people read the relevant newsgroup(s) and (4) research knowledge about the topic under investigation is limited or nonexistent.
References


A Questionnaire on object-oriented systems

Section 1 - Your Background with Object-Oriented Technology

Base your answers to the questions in Section 1 on experience with object-oriented technology. CIRCLE the category which most accurately describes your answer. Please feel free, however, to articulate information which you regard as relevant at the end of each question.

1. (a) What is your current position?
   - Student
   - Academic
   - Software Engineer
   - Project Manager
   - Other - please specify:

   (b) In what capacity do you use object-oriented technology?
   - Teaching
   - Programming
   - Analysis and design
   - Other - please specify:

2. (a) How long have you used object-oriented technology?
   - < 1 year
   - 1 - 2 years
   - 3 - 4 years
   - > 4 years

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(b) How often do you use object-oriented technology (e.g., every day, once a week, etc)?

3. Which object-oriented language(s) are you most familiar with? (you may circle more than one category)
   - C++
   - Objective-C
   - Eiffel
   - Smalltalk
   - CLOS
   - Other - please specify:

4. A method is typically how many executable lines of code?
   - 1 - 4 lines
   - 5 - 10 lines
   - 11 - 20 lines
   - > 20 lines

   Your range of smallest to largest is:

5. How deep would your inheritance hierarchy be before you became uncomfortable with it?
   - 1 level
   - 2 - 3 levels
   - 4 - 6 levels
   - > 6 levels
   - No problem with depth

6. What causes you the most difficulty when trying to understand an object-oriented program?
   Please specify:

7. Has inheritance caused difficulty when trying to understand an object-oriented program?
   (please circle the appropriate number)
   - Never
   - Always
   - 1
   - 2
   - 3
   - 4
   - 5

8. Overloading requires consistent use of method names within a system. Have you experienced any problems with consistent naming in this manner (i.e., methods did not maintain semantic consistency)?
   (please circle the appropriate number)
   - Never
   - Always
   - 1
   - 2
   - 3
   - 4
   - 5

9. Have you made use of class libraries that are local to your company/academic institution (i.e., designed and implemented by your company/institution)?
   (please circle the appropriate number)
   - Never
   - Always
   - 1
   - 2
   - 3
   - 4
   - 5

Section 2 - Opinionated Object-Oriented Questions
10. Do you believe that the object-oriented paradigm is more beneficial than other paradigms in terms of ...
   Ease of analysis and design: Yes
   No
   Don’t know

   Programmer Productivity: Yes
   No
   Don’t know

   Software Reuse: Yes
   No
   Don’t know

   Ease of Maintenance: Yes
   No
   Don’t know?

Any other reasons? - please specify:

11. Is multiple inheritance useful? (please circle the appropriate number)
   Never   Always
   1  2  3  4  5

12. Do you think that continual maintenance of structured programs, i.e., non object-oriented programs, leads to unmaintainability? (please circle the appropriate number)
   Never   Always
   1  2  3  4  5

13. Do you think that continual maintenance of object-oriented programs leads to unmaintainability? (please circle the appropriate number)
   Never   Always
   1  2  3  4  5

14. Do you think that object-oriented code is more maintainable than structured code?
   (please circle the appropriate number)
   Never   Always
   1  2  3  4  5

Please answer questions 15 to 19 only if you have knowledge of C++ or strong opinions on the subject in question.

15. C++ appears to have become the de facto standard object-oriented language for industry.
   Do you regard this as
   Bad
   Good
   Indifferent
   Don’t know, or
Disagree with statement, please say why:

16. C++ allows a mixture of object-oriented programming and structured programming. Do you see this mixture of paradigms as an
   Advantage, please say why:

   Disadvantage, please say why:

   Don’t know?

17. When maintaining a C++ program would you make use of the FRIEND function rather than redesign your inheritance hierarchy and thus maintain object-orientedness?
   (please circle the appropriate number)
   Never      Always
   1  2  3  4  5

18. (a) How often do you make use of operator overloading?
   (please circle the appropriate number)
   Never      Always
   1  2  3  4  5

   (b) Do you overload operators as
       Member functions, please say why:

       Non-member functions, please say why:

       Both of the above, please say why:

       Not Applicable?

19. How often do you make use of templates?
   (please circle the appropriate number)
   Never      Always
   1  2  3  4  5

Comments and points you would care to elaborate on:

Thanks for your time.