An Empirical Study of End-User Behaviour in Spreadsheet Debugging

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Extended Abstract

Very little is known about the process by which end-user developers audit and debug spreadsheets. Any research pertaining to the development of spreadsheet debugging methodologies or automated spreadsheet auditing tools would benefit from information on how people actually perform the debugging process in practice. This paper describes our current ongoing experiment designed to record and analyse the behaviour of industry professionals in the debugging of spreadsheets. The results of this experiment will enhance our understanding of software debugging in general, and the spreadsheet debugging process in particular.

The ubiquity of spreadsheet programs within all levels of management in the business world (Chan 1996) indicates that important decisions are likely to be made based on the results of these, mainly end-user developed, programs. The financial sector is particularly dependent on spreadsheets (Croll 2005). Unfortunately, the quality and reliability of spreadsheets is known to be poor following empirical and anecdotal evidence collected on the subject (Panko 1998), (Rajalingham 2000) and (Chadwick 2004). From the experience of one consulting firm, Coopers and Lybrand in England, 90% of spreadsheets with over 150 rows of data were found to contain one or more faults (Panko 1998), and due to the nature of spreadsheets, when failures do occur, the results can be quite significant. For example, sudden budget cuts were necessary at the University of Toledo after an erroneous spreadsheet formula inflated projected annual revenue by $2.4 million (Fisher 2006).

Very little research has been conducted on the error detection process for spreadsheets. The emphasis of the small amount of spreadsheet research available is instead being placed on the prevention of spreadsheet errors through spreadsheet design and testing methodologies. The notable exceptions to this are (Galletta 1993), (Galletta 1996) and (Howe 2006) in which studies on error-finding performance, the effect of spreadsheet presentation in error detection and the factors affecting the ability to detect spreadsheet errors were undertaken respectively. Importantly, none of these papers, unlike our work, deal with the process by which, or the order in which, these errors are found and corrected. In (Galletta 1996), the author concludes that more understanding of the error-finding process could help avert some of the well publicised spreadsheet errors.

Many spreadsheet auditing tools have been developed and are widely available, but to develop auditing tools that compliment end-users natural auditing and debugging behaviour, research on this behaviour needs to be conducted. To date, we have found no research that directly addresses end-user behaviour in debugging spreadsheets. To this end, we propose to investigate and record the behaviour of industry professionals during the spreadsheet debugging process. Two key questions we seek to answer are as follows:

- Can common patterns of spreadsheet debugging behaviour be identified, and are there particular patterns that are more effective than others?

- What are the success rates and average discovery times for different types of error?

We propose to answer the questions described above through a structured set of experiments with experienced industry based spreadsheet developers. Crucially, a tool has been developed to record the time and detail of all cell selection and cell change actions of individuals when debugging a spreadsheet. More complex spreadsheet activities can also be identified from the resulting data log. These include copy and past, undo typing, redo typing and drag-and-fill.

Regarding the detail of the experiment, a spreadsheet model has been developed, consisting of three worksheets seeded with errors. Participants are asked to debug the spreadsheet, and each error found is to be corrected directly in the spreadsheet itself. This spreadsheet model is based on a previous experiment carried out by Howe(2006), in which 228 students took part in an experiment designed to identify the factors which influence error-detection capability. Among other advantages, using a similar spreadsheet model as Howe(2006) will allow us to compare results obtained from students with those of industry based professionals. The need for spreadsheet experiments with industry professionals as opposed to the student population has been voiced by many researchers in this area, including the author of the aforementioned paper.

An initial investigation comprising 3 suitably qualified individuals was conducted to ensure the suitability of the experiment. Lessons learned were incorporated into the full experiment which is ongoing. We are on course to recruit between 10 and 20 participants, and initial results and analysis will be available for presentation at the workshop.

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