Toward a New Metric for Representing Output in Object-Based Software Development

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A new generation of software development processes is improving how organizations build systems. However, observers recognize that complementary efforts to improve cost estimation and managerial control are sorely lacking. Existing cost estimation procedures, especially those based on source lines of code or function point analysis, were designed to support 3GL development, in the absence of application generators, high-level object-based composition approaches, and other integrated computer-aided software engineering (ICASE) approaches.

The goal of this research is to propose software metrics that represent the output size of a software project when high-level software objects are used as the building blocks of application functionality. To begin, we investigated possible components of an output size metric in four different ICASE environments. We obtained about ten hours of responses from expert project manager interviews at each of the sites. Using high level objects to represent software functionality received uniform endorsement. Two new output size metrics — similar to concepts used in function point analysis — emerged in our research: OBJECT-COUNTS and OBJECT-POINTS. These metrics aggregate key objects that drive development effort and are used as building blocks in object-based development. The object types that populate the metrics were operationalized for the design phase.

Next, we investigated details of the object-based metrics using structured and unstructured interviews and experiments. The decision to focus on the details of one environment was pragmatic for our exploratory research, even though it reduces our ability to generalize from the results. Because of the competitive pressures associated with new technologies in the industry, we were only granted unrestricted repository access in one environment. Nevertheless, the results enabled us to propose a scheme for classifying complexity of instances of a particular object type in our object-based metrics.

Finally, we tested the metrics’ performance. Predictive ability was assessed using real-life, ICASE-developed project data and an econometric model for development effort. Accuracy of the object-based metrics for the analysis and the design phases compared favorably with the accuracy of estimates produced with function points analysis. Project managers reported that our metrics were better matched with their mental model of object-based software development. Construct validity was tested using correlations between object-based and function points metrics; the proposed metrics fared well.

The major contribution of this research is in establishing the utility of high level objects for representing application functionality and for estimating development costs. High level objects have the potential to yield accurate, quick and easy estimates of development costs as early as analysis and design. Boehm et al. (1996) report results supporting this view; their COCOMO II cost estimation approach also incorporates application functionality concepts similar to what we propose. Moreover, in automated software development environments such as the ICASE settings we studied, object-based metrics have the potential to be automated, which will allow for more proactive project management and better control of software project costs.

REFERENCE