Comp 410
Assignment 3
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Briand and Wüst were able to calculate effort to within a reasonable percentage of the actual effort, which was recorded by the developers as they worked. Interestingly, they found inheritance, coupling, and cohesion did not contribute as much to the accuracy of the estimate as size metrics [1]. This would seem to contradict what intuition would suggest: that deep inheritance trees, strong coupling, and weak cohesion should should result in greater effort. Therefore, I see a few issues with this paper:

1) Only one project was used in the experiment, and therefore the result may be anomalous.
2) It could be speculated that the design of the project was excellent, with shallow inheritance trees, weak coupling, and strong cohesion. This would explain the low contribution of these metrics to the effort estimation. Perhaps if the project was poorly designed, these metrics would have been more prominent.
3) The estimate does not consider one of the greatest contributors to cost: post delivery maintenance. It only considers the effort required for a specific iteration.

This leads me to Li and Henry, who found that maintenance effort could be predicted for a project using a number of metrics: depth of inheritance trees, number of sub-classes, degree of coupling and cohesion, numbers of methods, and the complexity of those methods. Historical data consisted of three years of change logs for two different projects: greater number of changes to the code would indicate greater effort [2]. This paper is very important to this discussion because all of these metrics, excepting perhaps the complexity of methods, can be obtained from design artifacts even though they are created long before maintenance starts. This suggests that an organization can estimate maintenance effort, a large contributor to the cost of a project, early in the project.

Finally, Basili, Briand, and Melo found that the quality, in terms of fault-proneness, could be measured using size, cohesion, and coupling metrics [3]. While we are discussing effort, it is self-evident that fault-proneness will be contributor to effort. A project with a design that invites more faults will take more effort to get operational, and will require even more effort to maintain. This serves as further evidence that analysis and design artifacts can be used to estimate effort, and hence, cost.

According to the reviewed literature, it should be possible to estimate a cost from object-oriented analysis and design artifacts. This cost is best represented as a measurement of effort required, modified by historical data from the organization. That is, the dollar cost of a project would be difficult to calculate from the design alone, but could be factored into other variables pertinent to the organization, such as state of hardware and software, skill of employees, or it's capability maturity model. Suppose an organization previously carried out a project, and knows the cost of that project precisely. After the fact, one could obtain an effort measurement from the project's analysis and design artifacts. If a new project's analysis and design workflows are measured the same way, and found to require twice as much effort, it could be guessed that the cost of the new project will be double that of the prior one. The more prior projects there are, the more accurate this prediction will become.

Citations

[1] Briand, Lionel C. and Wüst, Jürgen, "Modeling development effort in object-oriented systems using design properties," *IEEE Trans. Softw. Eng.*, vol. *27*, pp. 963–986, Nov. 2001.

[2] Li, Wei, and Sallie Henry. "Object-oriented metrics that predict maintainability." *Journal of systems and software* 23.2 (1993): 111-122.

[3] Basili, Victor R., Lionel C. Briand, and Walcélio L. Melo. "A validation of object-oriented design metrics as quality indicators." *Software Engineering, IEEE Transactions on* 22.10 (1996): 751-761.