

An Examination of a Ripple Effect in Industrial Web System Change

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Introduction

- In the C programming world, the notion of a 'ripple' effect, where one change can cause a series of knock-on coupling changes is well known:
 - PhD Sue Black
- Very little if any research has explored the role that a ripple effect might have on the development of web-based systems

Research Questions

- Firstly, can we associate the source of a ripple effect with a particular type of maintenance in the actual context of actual effort data?
 - Effort data to make requested changes
- Secondly, can we observe any consistent pattern across ripple and non-ripple based changes?
 - In terms of maintenance categories

Three Maintenance Categories

- *Adaptive* maintenance is in response to changes in the data and processing environment in which the project (in the case of the study presented) resides
- *Corrective* maintenance is performed in response to processing, performance or implementation failure
- *Perfective* maintenance is performed to eliminate processing inefficiencies, enhance performance or improve maintainability

Study Context

- The research was carried out in an IT-development division of a small-medium sized enterprise over a three month period
 - The company was an established web services development provider with over 15 years' experience of development
- The development methodology adopted by the company was based on the waterfall methodology and the *handover date* of the project to the customer was the date from which:
 - Change Request Forms (CRFs) used as a basis of our study were collected
- A core of the same group of development staff worked on all three systems used in this study

The three systems

- **Project P1:** a system to disseminate and market human resource products and support services - commissioned by an established software development company. The company provides business services and support to organizations seeking human resource management applications
- **Project P2:** a system providing customers with asset management facilities; assets included equity, fixed income and liquid assets. The tool provided customers with continuous access to investment portfolios. The WIS provided a calculation facility to compute complex financial queries and generate appropriate reports
- **Project P3:** an online implementation of financial business services, in particular the investment and wealth management portfolios of its customers. The on-line interface for this system required a level of inter-connectivity between existing sub-systems which were then linked to the web application

Data Collected

- The following three data items were collected:
 - **Amount of effort** required to complete a CRF in “wall-clock” hours and minutes
 - **Evidence of a ‘ripple’ effect** (this was categorized as a binary ‘yes’ – there was a ripple effect or ‘no’ - no ripple effect was observed). A ripple effect can be viewed as a change to one aspect of a project necessitating subsequent changes to other parts/components of the same project
 - Architectural layers
 - **The maintenance category** in which the original change or set of changes were made in order to satisfy the particular CRF

Categories with ripple effect

Project	Adaptive	Corrective	Perfective	Total
1	17	27	18	62
2	56	14	20	90
3	20	6	29	55
Total	93	47	67	

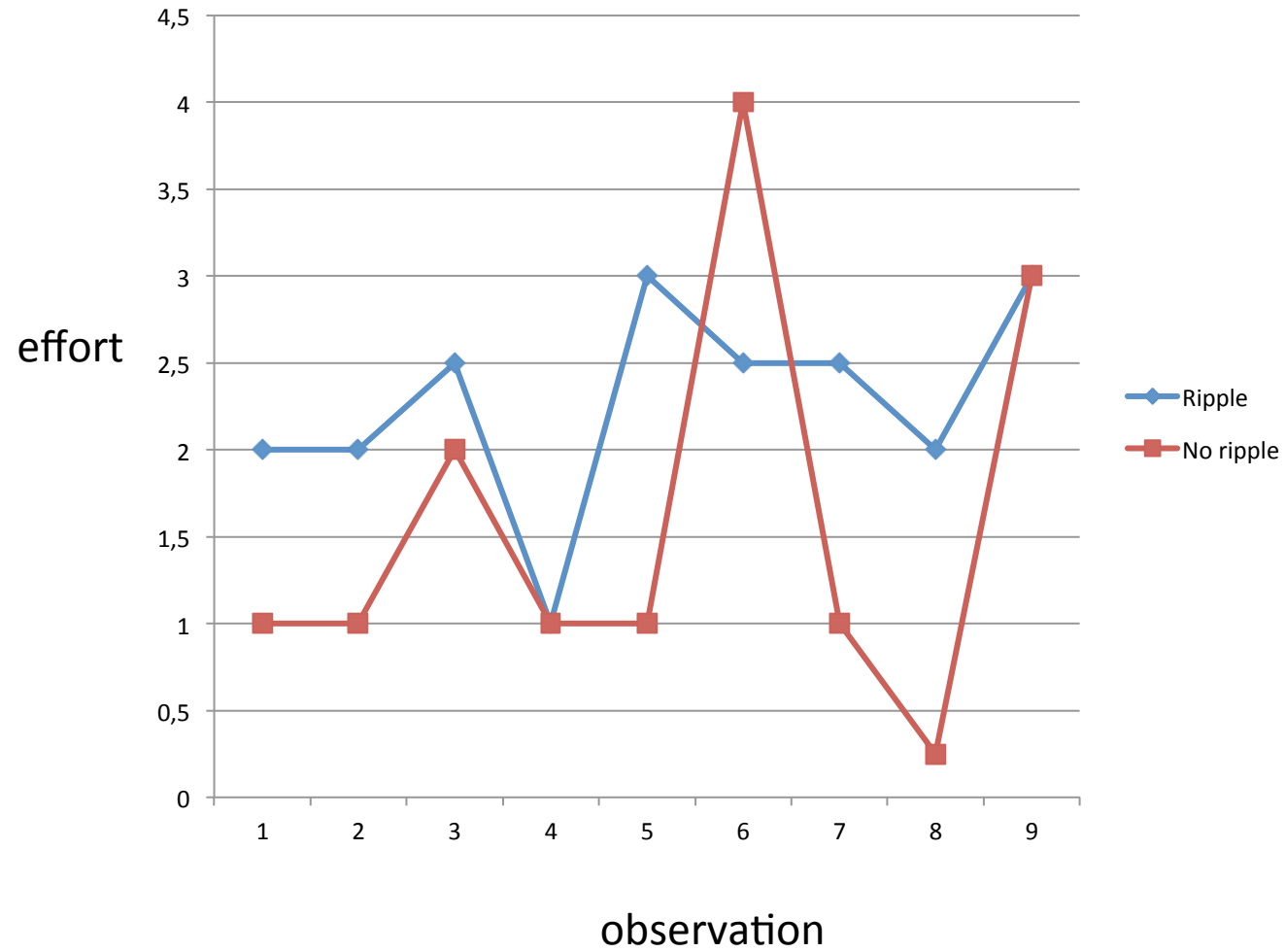
Summary Statistics for Ripple effect

Project 1	Mean	Med.	Max.
Adaptive	2.41	2	5
Corrective	2.76	2	8
Perfective	2.94	2.50	6
Project 2			
Adaptive	1.38	1	5
Corrective	3.54	3	10
Perfective	3.58	2.50	12
Project 3			
Adaptive	3.20	2.5	12
Corrective	2.59	2	6
Perfective	3.50	3	10

Summary Statistics (non-ripple)

Project 1	Mean	Med.	Max.
Adaptive	1.20	1	3
Corrective	1.30	1	4
Perfective	3.00	2	12
Project 2			
Adaptive	1.20	1	3
Corrective	1.63	1	7
Perfective	4.33	4	6
Project 3			
Adaptive	1.50	1	10
Corrective	0.70	0.25	4
Perfective	3.21	3	10

Comparison of medians



Overall System Effort

Project	Adaptive	Corrective	Perfective
1	1.64 (1)	2.03 (1)	2.97 (2)
2	1.33 (1)	2.58 (2)	3.67 (3)
3	1.85 (1)	1.41 (0.63)	3.38 (3)

Mean (median)

Explanation for Perfective vs. Adaptive

- We potentially identify two types of CRF:
 - ‘*forward*’ ripple CRFs common to the perfective category are characterized by a change at the business logic layer and requiring changes at the presentation layer as well
 - these changes are relatively effort-intensive.
 - On the other hand, ‘*backward*’ ripple CRFs common to the adaptive category start at the presentation layer and require only relatively minor changes at the business logic layer (as evidenced in the relatively low effort values for this category)
 - they are also less effort-intensive.

Threats to validity

- Only 3 systems
 - But then how many is enough?
- Only one company
 - But again, a threat arises with comparing environments and staff
- Same development team
 - Ditto above (comparing teams)
- Subjective issues in cases
 - Time might not have been exact
- An interesting observation about the Waterfall methodology and shipped faults

- Thanks for listening!