

Improving the Quality of Use Case Descriptions: Empirical Assessment of Writing Guidelines

Keith Phalp & Jonathan Vincent
Software Systems Modelling Group, Bournemouth University
www.sosym.co.uk
&
Karl Cox
National ICT Australia

Overview / Context

Improving the Quality of Use Case Descriptions

- Rationale: Why Use Case Descriptions
- Guidelines for Use Case Descriptions
- Comparing guidelines
- Measuring the Impact of Guidelines for Structure (H1)
- Results for Impact of Structure Guidelines.
- An 'independent' assessment of quality – the 7Cs of communicability.
- Measuring impact of guidelines on communicability of use case descriptions (H2)
- Results for communicability.
- Analysis and Conclusions
- Further developments

Rationale for Study

Improving the Quality of Use Case Descriptions

- Use cases popular and widespread.
- Little to guide the user, particularly for the description.
- Problems of structure and comprehension (and the importance of both requirements and specification).
- Previous studies suggest improvements when guidelines applied.
- Suggestion that application of existing guidelines might be problematic.
- Some issues with previous studies.
- **Aim:** Take the principal factors which had a positive impact on use case quality and to distil these into a smaller, more applicable set of rules.

Problems with studies

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In essence, the argument often goes:

- Treatment 1 – No guidelines given (normal)
- Treatment 2 – Give subjects guidelines or rules
- Result: *“When we gave subjects the rules we found that more of them used the rules”*. REALLY.
- Hence, why not compare the impact of rules against other (admittedly similar) rules?
- **Aim revisited:** A ‘*cut-down*’ set of guidelines to perform ‘as well as’ (or better) than the leading approach.
- Test against the leading approach (the CREWS guidelines). Just consider structure guidelines here.

Hypothesis for Structure

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- **H1** The constructs suggested by the CP rules are found in significantly higher numbers than the equivalent CREWS guideline constructs when both guideline sets are applied to the same problems.
- *In other words: Do they follow the rules we gave them?*
- Two sets were (could be) compared:
 - CP1 versus CG5 and
 - CP2 versus CG1-3

Comparing Guidelines

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CP Structure 1: Subject verb object. For example,
The operator presses the button.

CG5: <agent> <action> <object>. For example,
The operator presses the button.

CP Structure 2: Subject verb object prepositional phrase. For example,
The system reminds the operator to save all the open files.

CG1: <agent> <'move' action> <object> from <source> to <destination>.
For example,

The clerk sends the report from the store to the office.

CG2: <source agent> <'put' action> <object> to <destination agent>. For
example,

The clerk gives the report to the manager.

CG3: <destination agent> <'takes' action> <object> from <source agent>.
For example,

The manager gets the report from the clerk.

Background

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- 60 students were formed into four experimental groups. (There had been a smaller pilot).
- Each group of comparable ability
- Two treatments across two set problems.

Group	Guidelines	Use case task
A	CP Rules	ATM
B	CP Rules	Retail
C	CREWS Guidelines	ATM
D	CREWS Guidelines	Retail

H1: Results Tables

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Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	33	33	0	4	29	50	47	16	83	61	20	33	62	70	31
C	35	25	48	10	65	50	45	33	69	62	18	46	79	20	33
B	6	33	45	30	6	57	24	14	22	29	36	30	42	12	22
D	4	0	23	0	25	38	35	5	15	0	18	45	18	0	13
$\alpha = 0.05$	A, C $p = 0.30$					B, D $p = 0.02$					AB, CD $p = 0.27$				

Table 2: CP structure 1 versus CREWS equivalent

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	0	0	0	0	0	33	5	37	0	0	0	5	0	23	8
C	8	13	5	3	4	23	0	7	6	15	0	4	0	0	0
B	50	33	36	17	22	29	29	14	33	14	18	40	16	29	17
D	21	15	38	23	15	0	6	35	16	25	18	0	0	0	0
$\alpha = 0.05$	A, C $p = 0.34$					B, D $p = 0.004$					AB, CD $p = 0.02$				

Table 3: CP structure 2 versus CREWS equivalent

Analysis for H1

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- No difference between A and C (both sets)
- Significant difference B to D (both sets).
- A positive interpretation is leaner CP rules perform as well or better than in producing the desired structure constructs
- However, pilot study reported that CP fared better with the ATM problem and that results with retail were not significantly different.
- Variation might also suggest that the effects are relatively small.
- *It does seem that the smaller CP rules perform at least as well, and possibly better, in guiding the structure of use case descriptions. BUT...*

Communicability

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- H1: and similar studies *still* have element of self-fulfilling prophecy.
- In order to judge use case quality we adopt a set of quality factors, or use case facets,
- Mark quality according to these ‘independent’ quality criteria (facets).
- These facets are derived primarily from discourse process research, and other research in use case description.
- Consideration primarily to allow a degree of independent assessment.
- Some dependency inevitable: rules influence writer to produce desirable qualities.

Hypothesis for Communicability

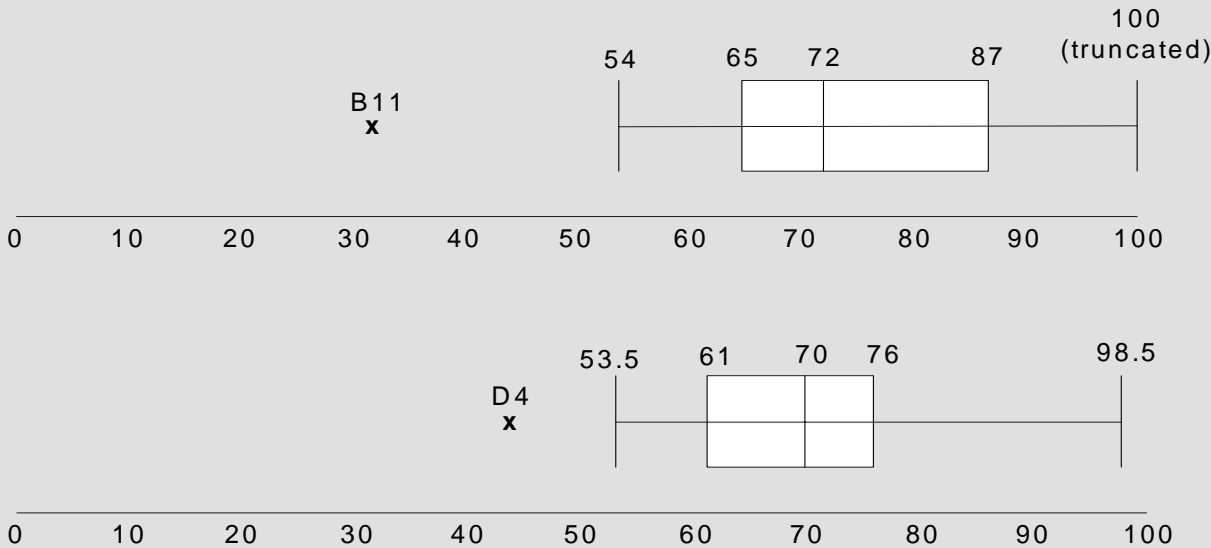
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- **H2:** Use case descriptions produced with the CP rules score significantly better than the equivalent CREWS use case descriptions, when marked against the 7Cs use case quality facets.
- *In other words does the fact that rules are being followed actually produce better use case descriptions.*
- Where better is judged according to the quality criteria.
- Actually allocate numerical marks
- *Worried about this even though we do it all the time.*

Results for H2

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Group A	35	53	56	58	60	62	64	66	68	69	69	70	73	73	90
Group C	22	29	36	55	57	61	62	63	69	70	75	76	77	82	82
Group B	32	56	62	65	67	69	71	72	76	78	79	87	89	92	95
Group D	44	58	60	61	61	65	69	70	71	71	76	76	76	82	97
Means	Group A: 64.4, Group C: 61.07							Group B: 72.67, Group D: 69.13							
Std Deviation	Group A: 12, Group C: 18.77							Group B: 15.99, Group D: 12.19							



- 12 out of 15 of group B scored higher marks than group D.
- Paired t-test (single tailed) reveals a highly significant difference between the scores

Relating H1 to H2

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H1		H2	
<p>CP rules CREWS rules</p> <p>A C</p> <p>No difference in rule usage</p>	<p>CP rules CREWS rules</p> <p>A C</p> <p>No difference in quality</p>		
<p>CP rules CREWS rules</p> <p>B D</p> <p>B used rules significantly more</p>	<p>CP rules CREWS rules</p> <p>B D</p> <p>B significantly 'better' descriptions</p>		

Analysis: H1 and H2

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- For groups A and C the CP rules appear to perform slightly better - though not significantly so.
- However, we do find a highly significant difference in the performance of groups B and D, in favour of the CP rules.
- More importantly, the results suggest that guideline usage and overall quality are related.
- That is, where CP rules led to an increase in the structures found within the use case (H1), the quality assessment also confirmed that these appear to be better descriptions (H2).
- Similarly, we find no significant improvement in communicability where the rules are applied no better.
- Increased usage (of both rule sets) does appear to improve communicability. *For both sets of guidelines, when more rules are applied the resulting use case descriptions are improved.*

Conclusions

Improving the Quality of Use Case Descriptions

- Small 'cut down' set of guidelines (CP rules), compared with proven CREWS Use Case Authoring Guidelines
- *Both sets attempt to produce desirable structures in descriptions.*
- CP rules produced a significantly greater number of such structures for only one scenario.
- Then assessed descriptions against a set of quality criteria (H2).
- Found where there were significant differences in the number of structures (application of guidelines) use case quality was also significantly different.
- Study suggests that even differences in the number of times such structures are found may account for differences in the quality of the use case descriptions.
- *However, little difference in the performance of the CP Rules and the CREWS guidelines (although as good or better).*
- *Does suggest that adoption of a minimal set of guidelines is practical.*

Issues and Further Work

Improving the Quality of Use Case Descriptions

- Use cases still very valuable and popular.
- However, further problems with use case descriptions
- Notably they don't describe dependencies among events.
- Can't consider intra or inter use case event dependencies.
- Problems moving from business models to specification – loss of 'richness'.
- Some problems in moving towards design, detail available.
- Some users 'disappointed' by 'power' of notation.
- Issues suggest need for augmentation with (typically state based) information.
- Need to keep intuitive structure.
- Need to minimise effort on the part of the use case author.
- Need for support to help adherence to guidelines.
- Therefore, consider simple to use tool support.
- ***Benefits of enactment.***

EDUCATOR

Further Developments

- Follows from previous project on use case guidelines.
- Supports the analysis of use cases, by using state information (added) to control the logic of an enactment.

Educator :Use Case Enaction

File Use Case Actor Conditions Enact Tools CP Words Help

Description Client Connection

ID	Primary Actor	Event	Precondition	Postcondition	SecondaryActor	Precondition	Postcondition
1	Client	requests connection via Scheduler	initial	connectionRequested	Scheduler	waiting	connectionRequested
2	Scheduler	acknowledges connection	handlerRegistered	connectionAck	Client	handlerRegistered	connected
3	Client	sends network layout	connectionRequested	layoutSent	Scheduler	connectionRequested	layoutReceived
4	Scheduler	creates newtork handler	layoutReceived	handlerCreated			
5	Scheduler	registers network handler with client	handlerCreated	handlerRegistered	Client	layoutSent	handlerRegistered
6	Client	undertakes tasks	connected	readyToWork			

Add Description	Add Alternative path	Insert Event	Print
Change Precondtion	Change Postcondition	Add Loop	Quit