

Motivating Testers - What's in a Role?

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Abstract

The results of a motivation survey of over 600 testers are presented in this paper. The study separated out the survey respondents into six distinct testing roles: Developer/Tester, Test Analyst, Test Lead, Test Manager, Test Consultant and Head of Testing. The factors and job characteristics that affect testers in each of the roles are compared and contrasted, as are the range of activities they perform. It is clear from the results that different roles are best motivated by different factors and job characteristics, and, for some factors, something that motivates testers in one role demotivates testers in another. The effects on motivation of education, professional qualifications, experience levels, salary, and outside interests for each of these different roles are also reported.

Introduction

This paper provides findings from a large survey into the motivation of software testers (over 600) over a two year period. The main objective of the study was to identify the best means of motivating today's testers and a number of approaches were followed. One was to determine whether generic motivation theories were relevant and usable to the day-to-day practices of software testing and if these could be improved upon. A second was to identify those factors that are most important to testers so that they and their managers can focus their effort in improving their motivation – and presumably their job satisfaction and productivity.

Given the high number of survey respondents performing a range of different testing roles, it is possible to compare and contrast the motivation results for six of these different roles:

- Developer/Tester
- Test Analyst
- Test Lead
- Test Manager
- Test Consultant
- Head of Testing

A number of other roles were identified, but none in significant enough numbers to allow statistical analysis. Figure 1 shows the composition of the analysed group of 545 testers (see 'The Survey' section).

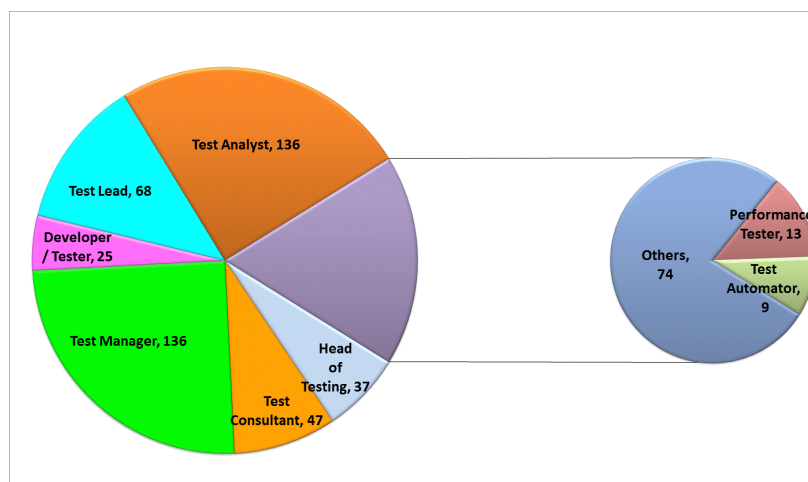


Figure 1: Respondent by Role

Background

Motivation is one of the most well-studied areas of management, and new theories are proposed on a regular basis. Despite this, many managers of software testers appear to favour the traditional 'carrot and stick' approach even when there is ever growing evidence that this approach is ineffective. More enlightened managers recognize that other approaches are available, but may find the diversity of motivation theories overwhelming and may wonder whether they apply to those working in software testing today.

This study has considered how two motivation theories apply to software testers. Hackman and Oldham's Job Characteristics Model [5] has been the most popular model for researchers since its publication in 1974, while Daniel Pink's Motivation 3.0 is a current theory popularized by his 2010 book, *Drive: The Surprising Truth About What Motivates Us* [8]. There are obviously many other motivation theories and some have been applied to software development and testing - for an overview of how motivation has been applied to software engineering see [10].

Hackman and Oldham's Job Characteristics Model (JCM) - This theory is based on the idea that individuals need to achieve three critical psychological states to be motivated: 'Meaningfulness of work', 'Outcome responsibility' and 'Knowledge of the final results'. Five core job characteristics are used to determine these states:

- Skill Variety (V) (the range of different skills used)
- Task Identity (I) (the degree of completing a whole job)
- Task Significance (S) (the importance of the job)
- Autonomy (A) (the level of control of your own time)
- Feedback (F) (the degree of supervisory & results-based feedback)

$$MPS = \frac{(V + I + S)}{3} * A * F$$

These five characteristics can then be combined to calculate the 'Motivating Potential Score' (MPS) for a job, with the aim of providing guidance on how the job can be (re-)designed to provide greater motivation (and satisfaction) to the employee and productivity for the employer. The (partial) rationale for the formula is that the 'Meaningfulness of work' psychological state can be achieved by attaining a high score for at least one of variety, identity and significance, and a high score must also be achieved for both autonomy and feedback to achieve the other two psychological states. The first 13 questions in Annex A were used to measure scores for each survey respondent for each of the five job characteristics.

Daniel Pink's Motivation 3.0 – This motivation model is outlined in his book, *Drive: The Surprising Truth About What Motivates Us* [8], and it suggests motivation is based on three major factors: autonomy, mastery (constantly challenging yourself to improve) and purpose (doing something for the good of others).

Motivation 3.0 is reportedly based on evidence from 40 years of scientific research and is presented as an evolution from the Motivation 2.0 carrot and stick model, which in turn replaced the simple motivation to survive (Motivation 1.0). He suggests (and provides evidence) that whereas with simple repetitive tasks it is possible to motivate using extrinsic motivators, such as salary, those performing today's more complex jobs, such as in IT, can actually be made less motivated and in turn less productive if promised bonuses on completion. He goes on to suggest that for innovative tasks requiring more skills, intrinsic motivators such as the need to challenge oneself have been shown to be more effective. Questions 4 to 7 and 14 to 18 in Annex A were used to measure scores for each survey respondent for each of the three major factors.

The Survey

The data in this survey was gathered through a forty-question questionnaire that was available both online and on paper. The survey was publicised at conferences, tester specialist meetings, through online articles and by word of mouth. The questions covered demographics (e.g. number of years in testing, industry sector), motivation characteristics using a five-point Likert scale (based on the Job Diagnostic Survey of JCM) and motivation/demotivation using open-ended questions. The motivation characteristics questions are shown in Annex A.

By August 2013, after two years, over 600 responses had been gathered. The motivation characteristics questions were balanced between those asked positively and those asked negatively in an effort to reduce response bias [7]. For some characteristics several questions were used to cover different aspects and this allowed consistency of responses by an individual to be measured. A number of responses were incomplete and some responses were inconsistent (e.g. every answer was 'strongly disagree') and these were removed from further analysis, leaving 545 complete responses (>21,800 data points).

Demographics

The demographic information shown in figure 2 characterises the studied group.

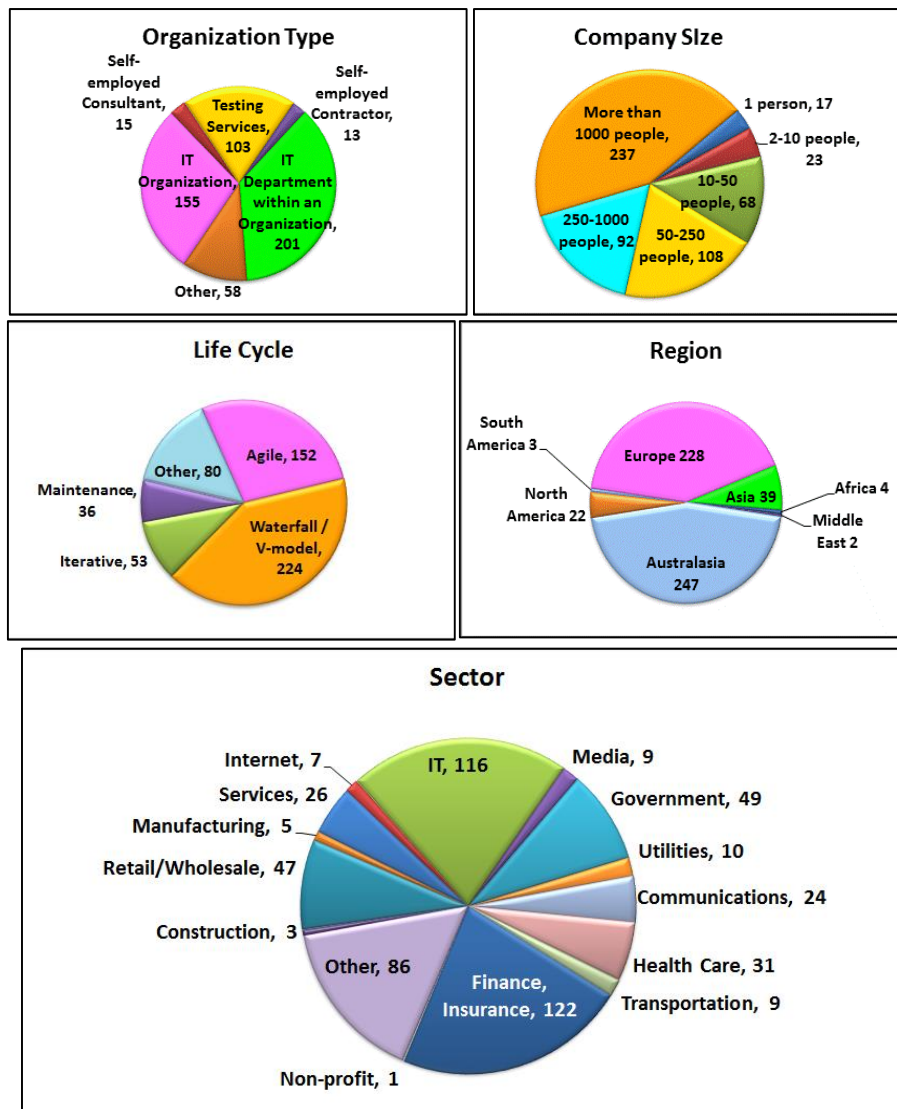


Figure 2: Respondent Demographics

Evaluation of Results

A core part of the study was to determine whether different motivation models provide a valid means of predicting intrinsic motivation for testers. The intrinsic motivation was measured using question 19 in Annex A, which specifically considers how respondents perceived their own level of motivation. The validity of the models (or parts of models) at predicting this perceived level of motivation was determined by measuring the Pearson's Product-Moment correlation coefficient between the scores produced by the different models and the declared perceived level of motivation from respondents in question 19. This provides a measure of how strongly the score correlates with (i.e. can predict) the perceived motivation on a scale of -1 to +1, where a

positive score indicates a positive relationship. Scores below 0.2 indicates a negligible relationship, while scores above 0.4 indicate a strong relationship. Where correlation results are provided for the complete set of 545 respondents the statistical significance exceeds a confidence level of 99% ($p < 0.01$).

Results & Analysis

Individual Motivation Factors

Table 1 shows the average scores for each of the *individual* factors represented by the questions in Annex A. The scores shown are in the range 1 (strongly disagree) to 7 (strongly agree), but have been reversed where a question was shown to be negative. These are the factors suggested by the Job Characteristics Model and Motivation 3.0, plus a factor associated with the work environment and the respondents' perception of motivation.

Table 2 shows the correlation for each of the *individual* factors represented by the questions in Annex A with the perceived level of motivation (question 19).

	Developer/ Tester	Test Analyst	Test Lead	Test Manager	Test Consultant	Head of Testing	All Roles Average
FEEDBACK 1	4.6	5.0	5.0	4.9	5.1	5.2	5.0
FEEDBACK 2	4.0	4.2	4.3	4.5	4.8	4.8	4.4
FEEDBACK 3	4.5	4.7	4.6	4.6	4.4	4.6	4.6
AUTONOMY 1	3.9	3.9	4.6	5.2	4.8	5.9	4.7
AUTONOMY 2	4.5	4.6	4.5	4.4	5.1	5.1	4.6
AUTONOMY 3	3.2	2.8	3.4	3.4	3.1	4.1	3.3
AUTONOMY 4	4.4	4.1	4.5	4.9	5.2	5.6	4.7
SIGNIFICANCE 1	4.7	4.3	4.6	5.1	5.1	5.6	4.8
SIGNIFICANCE 2	5.3	5.4	6.0	5.9	5.8	5.9	5.7
IDENTITY 1	5.3	5.3	5.4	5.6	5.0	5.5	5.3
IDENTITY 2	5.4	5.5	5.2	5.2	5.2	4.5	5.3
VARIETY 1	3.6	3.9	4.5	4.9	4.7	5.5	4.5
VARIETY 2	5.0	4.7	4.9	5.1	5.6	5.7	5.1
MASTERY 1	4.7	4.6	4.6	5.0	5.5	5.8	5.0
MASTERY 2	3.3	3.1	2.9	2.9	2.9	2.7	3.0
MASTERY 3	4.6	4.6	4.7	5.0	5.0	5.5	4.9
PURPOSE 1	4.2	4.0	3.5	4.3	4.9	4.9	4.2
PURPOSE 2	2.6	2.9	2.8	2.9	3.2	2.7	2.9
PERCEPTION	5.0	5.1	5.2	5.4	5.9	6.0	5.3
ENVIRONMENT	4.7	4.5	4.4	4.5	4.8	5.0	4.5

Table 1: Factor Scores for each Tester Role

	Developer/ Tester	Test Analyst	Test Lead	Test Manager	Test Consultant	Head of Testing	All Roles Correlation
FEEDBACK 1	0.22	0.31	0.27	0.29	0.08	0.22	0.25
FEEDBACK 2	-0.23	0.15	-0.08	0.30	0.23	0.48	0.21
FEEDBACK 3	0.11	0.18	0.09	0.23	0.11	0.39	0.19
AUTONOMY 1	0.24	0.16	-0.15	0.19	0.14	0.13	0.17
AUTONOMY 2	0.05	-0.02	0.05	0.08	0.04	0.32	0.06
AUTONOMY 3	0.36	0.21	0.24	0.22	0.23	0.24	0.25
AUTONOMY 4	0.15	0.15	-0.10	0.24	0.30	0.34	0.21
SIGNIFICANCE 1	-0.43	0.06	-0.05	0.12	0.24	0.13	0.08
SIGNIFICANCE 2	-0.48	0.06	-0.03	0.20	0.40	-0.11	0.12
IDENTITY 1	0.31	0.28	0.29	0.30	-0.01	-0.15	0.22
IDENTITY 2	-0.30	0.13	0.13	0.39	-0.28	-0.10	0.06
VARIETY 1	-0.23	0.00	0.06	0.10	0.21	0.34	0.10
VARIETY 2	0.53	0.32	0.46	0.45	0.17	0.54	0.39
MASTERY 1	0.09	0.25	0.24	0.36	0.45	0.63	0.31
MASTERY 2	-0.06	-0.08	0.00	-0.06	0.05	-0.43	-0.11
MASTERY 3	0.35	0.38	0.44	0.33	0.14	0.40	0.33
PURPOSE 1	0.37	0.08	0.29	0.26	0.42	0.26	0.24
PURPOSE 2	0.49	0.06	0.15	0.13	0.17	-0.18	0.08
ENVIRONMENT	0.53	0.28	0.35	0.44	0.37	0.52	0.38

Table 2: Factor Correlation with Perceived Motivation for each Tester Role

Analysis of Motivation Scores and Correlations

The scores and the correlation with perceived motivation for each of the motivation characteristics from both the models were analysed – this corresponds to questions 1 to 18 in Annex A – the analysis has been grouped by characteristic. The scores for perceived motivation and work environment (questions 19 and 20) were also analysed along with their correlations. Note that this analysis only applies to the surveyed testers and it may not be applicable to generalise this analysis to all testers.

Feedback

The Heads of Testing scored Feedback in general higher than any of the other roles, meaning that they felt more positive about the feedback they received on their work than any of the other roles. One explanation for this better feedback could be because senior managers (i.e. those managing Heads of Testing) are more likely to set goals that are measurable enough to provide feedback. This problem was identified at Microsoft, where 25–40% of employees were working under goals that were either not specific enough or not measurable enough to offer feedback [1]. Microsoft managers are now trained to use SMART (specific, measurable, attainable, relevant and time-bound) goals and so ensure they are measurable.

In contrast, the Developer/Testers get relatively poor feedback compared to the other roles and for them feedback from colleagues has a weak negative correlation with perceived motivation, suggesting that, if anything this feedback appears to demotivate them. This could be due to the quality and type of feedback received. For instance, poor original requirements may result in valid feedback to the Developer/Tester although not due to their poor performance. Thus the feedback can reflect badly on the recipients of it, even though they were not to blame, and it also heralds extra, unplanned work.

Consultants scored lowest for feedback from supervisors, which could reflect them working on client sites and so remotely from their supervisors.

For Heads of Testing, feedback from colleagues and feedback from supervisors correlated *positively* and relatively strongly with perceived motivation, but the relationship between feedback from the work itself and perceived motivation was far weaker. This could be because this group spend more of their time organizing and delegating rather than performing tasks themselves, a position supported by their low score for the Identity 2 question on the completion of tasks.

Autonomy

Developer/Testers and Test Analysts have the least control over what tasks they are expected to perform next, but for both, and especially the Developer/Testers, having control in this area is a positive motivator.

Only Heads of Testing found job flexibility in terms of which hours to work each day to be a moderately positive motivating factor, whereas for all other roles it made no difference. They (and consultants) have most control in this area.

Being able to choose who they will work with is a motivator for all tester roles, especially so for the Developer/Testers. Strangely those working on agile projects scored this lower on average than those working on non-agile projects, when the expectation would be that agile team members have more autonomy.

Heads of Testing have higher levels of autonomy for all forms of autonomy, which is unsurprising given the strong relationship between autonomy and responsibility, and the contrast with the other roles is pronounced. This group, who are also the most experienced (and presumably the oldest), are motivated by all forms of autonomy and this result aligns with other studies that show that autonomy has the strongest positive relationship with increasing age [3].

Apart from work time flexibility (lowest for Test Managers), Test Analysts score lowest for all other forms of autonomy, including choosing the way activities are performed. A higher proportion of Test Analysts perform test execution than any other of the roles (see figure 3), while exploratory testing is performed by fewer Test Analysts than those performing test design.

Significance

In general, the more senior roles with more responsibility believe the work they do has more significance.

Developer/Testers and Test Analysts both score low on task significance, suggesting they do not believe that what they do has a large effect on their colleagues or the project as a whole. This is thought to be an effect of disassociation with the final project deliverable rather than a result of believing the project to be of low significance. Workers who are distanced from information about how their efforts make a difference to the final result can exhibit low task significance scores, but research [4] indicates that it is relatively easy to increase these scores (and worker productivity) by providing 'cues' on the importance of their role to the overall project. However, the Developer/Testers also show strong negative correlations with motivation for their job affecting both other colleagues and impacting the project. This suggests that they are demotivated when they believe what they are doing has a greater effect. It appears as if this feeling of responsibility creates stress that acts as a demotivator, therefore, managers need to be careful to balance their emphasis on the importance of the work done by Developer/Testers with the effect it can have, perhaps also explaining that later project activities (typically testing) will mediate any adverse effects of inevitable defects that may not be the fault of the Developer/Testers in the first place.

Test consultants are strongly motivated when they think their work affects the outcome of the project, whereas there is no such relationship for Heads of Testing, perhaps because they are not project-oriented, but more oriented on cross-organization improvement.

When considering the correlations between the two forms of task significance with perceived motivation for the different testing roles, it is clear that anyone attempting to motivate testers using this particular characteristic needs to be very careful. There are no obvious trends with correlations varying from -0.43 to

+0.24 for affecting colleagues, and from -0.48 to +0.40 for impacting the project. Thus treating testers as a homogeneous group in respect to task significance should not be attempted and care taken to not accidentally demotivate particular roles.

Identity

The Developer/Testers and Test Analysts score highest for task completion, while Heads of Testing score low, presumably because they delegate tasks to others once they can see that they have started successfully.

Task completion is negatively correlated with perceived motivation for Developer/Testers, Consultants and Heads of Testing. For these roles this negative correlation with motivation could be due to the interdependence of tasks being perceived as being too high. Where you are responsible for completing a task that must be finished before another can begin means that there is the potential for demotivating stress.

Seeing projects through to completion motivates all roles apart from the Consultants and Heads of Testing. Consultants score low on this presumably because they do not expect to be associated with projects from start to end. Meanwhile, Heads of Testing probably consider their role to be looking across multiple projects rather than completing single projects.

Variety

Developer/Testers and Test Analysts score low on variety of tasks performed, while as seniority increases the roles report more variety, perhaps due to the extra (non-testing) management tasks included in their roles. A study of IT Consultants [11] reported that the "...IT consultants state that variety in tasks is crucial to job satisfaction...", whereas this study showed only a weak positive correlation between task variety and motivation for Test Consultants.

For all roles the opportunity to work on a variety of projects is a motivating factor, with moderate to strong correlations for all except Consultants. This is somewhat surprising, but may be because the Consultants associate the variety of projects with lack of completion of projects.

Developer/Testers appear to be demotivated by performing a large variety of tasks, but this may be because task variety can be demotivating if the tasks themselves are small, repeated often and lack challenge (see next section on Mastery). It may also be that Developer/Testers do not want to be distracted from performing what they perceive as their main role of programming.

Mastery

More senior roles score the job as more challenging and stretching, implying that more junior roles do not feel challenged by the job. This is supported by the results that Test Analysts do the most repetitive work (46% of their time on average). Test Consultants do the least repetitive work (30% of their time on average).

More senior roles also report that they get in 'the flow' of work (losing track of time) more than their more junior colleagues, however while all the roles find getting into the flow as positively motivating, for Consultants the effect is negligible.

There are unexpected correlation results for 'Mastery 2' – five show negligible correlations and one shows a negative correlation of -0.43 (for Heads of Testing). This was a negative question - "I have mastered most of the skills required to perform my job". One of the ideas underlying mastery is that people are more motivated when there is a continuing challenge in their job that requires them to keep learning new skills. The intention was that those disagreeing with the statement would consciously be aware that there were more skills required to fully master their job, and would consider this challenge to be motivating. The strong negative correlation with motivation for Heads of Testing could be because testers in this most senior role felt that they should have mastered most (if not all) skills to be in their role and any feeling that they were missing required skills would be stressful and hence demotivating.

Purpose

Heads of Testing and Test Consultants have far more opportunity for working for the good of the wider community than the other roles – this appears to be related to their higher levels of autonomy ($p < 0.01$). In contrast, Test Leads report having the least opportunity in this area. Only Test Analysts are not motivated by the opportunity for working for the good of the wider community.

Developer/Testers are strongly motivated by the idea of working for an organization that is not primarily focused on profits, whereas Heads of Testing are motivated by an organization that *is* primarily focused on profit making. This could be due to the likelihood of personnel in such senior roles being rewarded based on organizational profit levels. Test Consultants were least likely to believe that their organization was primarily focused on making a profit.

Perception

As tester roles increase in seniority they perceive their motivation to be higher.

Environment

The work environment is considered by all roles to positively motivate them, most especially strongly for Heads of Testing and Developer/Testers.

Motivation Models for Different Roles

By combining scores from Table 1 (on a scale of 1 to 7) the Motivating Potential Score (MPS) can be calculated for each of the testing roles.

Daniel Pink provides no formula for combining his suggested three characteristics, so a simple summative approach was used (M+A+P) by adding scores from Table 1 (on a scale of 1 to 7).

For both models, the average scores for each tester role and corresponding correlations with the perceived motivation are shown in Table 3. The correlations provide a measure of the predictive accuracy of the respective models for intrinsic motivation.

	Developer/ Tester	Test Analyst	Test Lead	Test Manager	Test Consultant	Head of Testing	All Roles
MPS	85	91	101	114	117	144	106
MPS CORRELATION	0.12	0.31	0.21	0.53	0.28	0.53	0.40
M+A+P	11.6	11.4	11.5	12.4	13.0	13.8	12.1
M+A+P CORRELATION	0.46	0.27	0.35	0.42	0.45	0.32	0.36

Table 3: Motivation Model Scores for each Tester Role

As can be seen, if all testers are treated as a homogeneous group, the MPS scores provide a stronger correlation with perceived motivation than the simple summative M+A+P scores. If the unexpected results from the MASTERY 2 question are excluded from the calculations then the M+A+P correlation increases to +0.41, and it is possible to create better predictive models with correlations up to +0.5 using specific subsets of the factors in Table 1. This is described in detail in [9].

When these scores are considered for each of the individual roles a more detailed picture can be seen. For the Developer/Testers the MPS correlation with perceived motivation is negligible at +0.12, while the M+A+P correlation is strong at +0.46 ($p < 0.01$). Test Consultants show a similar bias towards Daniel Pink's model. Their perceived motivation strongly correlates with the Motivation 3.0 (M+A+P) score (+0.45), whereas MPS provides only a weak correlation (+0.28).

Tester Activities

As part of the study, respondents were asked what specific activities they perform – figure 3 shows the percentage of respondents that selected each of the top eight activities. The radar charts show that each of the different tester roles comprises a different balance of activities. This suggests that for many testers moving between roles is not a simple transition, but could represent a major shift in their daily work programme and the requirement for either new or little used skills.

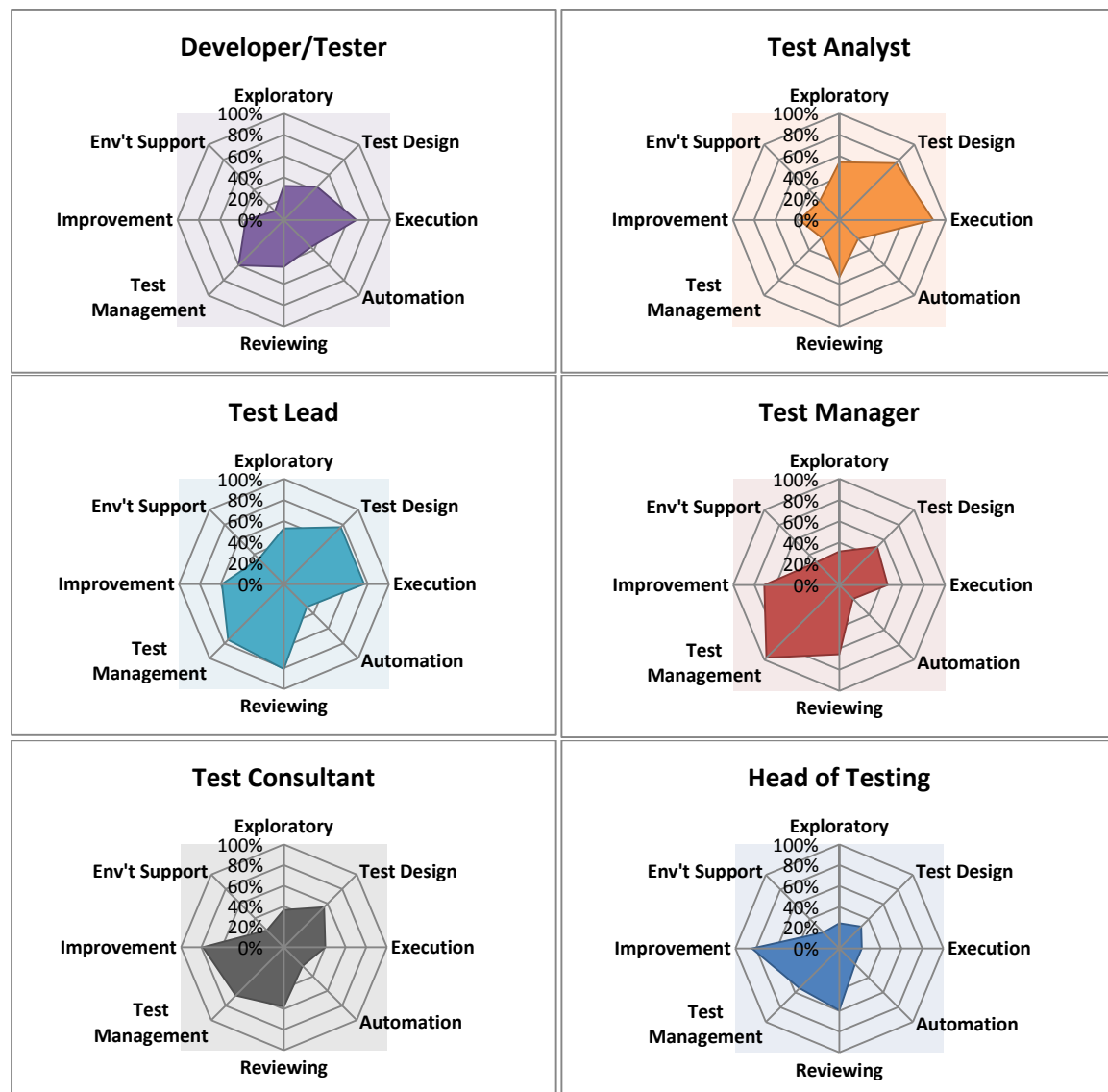


Figure 3: Test Roles vs. Test Activities

Only Test Analysts did less reviewing than test design, and all roles did more test design than exploratory testing. Process improvement was performed by respondents in all roles to some extent, but a higher percentage of Consultants and Heads of Testing were involved in this activity. Test management was performed by over 50% of respondents for all roles except Test Analysts, where only 24% performed this activity.

These figures provide an overview of the different testing activities performed in each of the six studied testing roles. It can be seen that no two roles are the same and that the degree of change necessary when moving from one role to another can be quite large. This suggests that organizations which change the roles of their

testers should ensure that adequate support is available to smooth these transitions, perhaps in the form of mentoring/coaching and/or training.

Further analysis of figure 3 shows that the overlap between roles is also higher than might be expected. For instance, reviewing, test management and process improvement is performed widely across most roles. This suggests that several areas are universally needed in all roles, but another interpretation could be that there is too much generalization of roles, and that more specialization is needed.

Experience Levels and Salaries

The spread of experience levels for each of the six testing roles are shown in figure 4.

The average experience of survey respondents was about 10 years in testing. As was expected, roles with more seniority had a higher proportion of testers with more experience. Those respondents with more than 10 years' experience perceived they had the highest level of motivation, while those with 1 to 3 years' experience perceived they had the lowest level of motivation. Of the 47 Consultants, two had less than 4 years' experience and one was working in their first year as a tester.

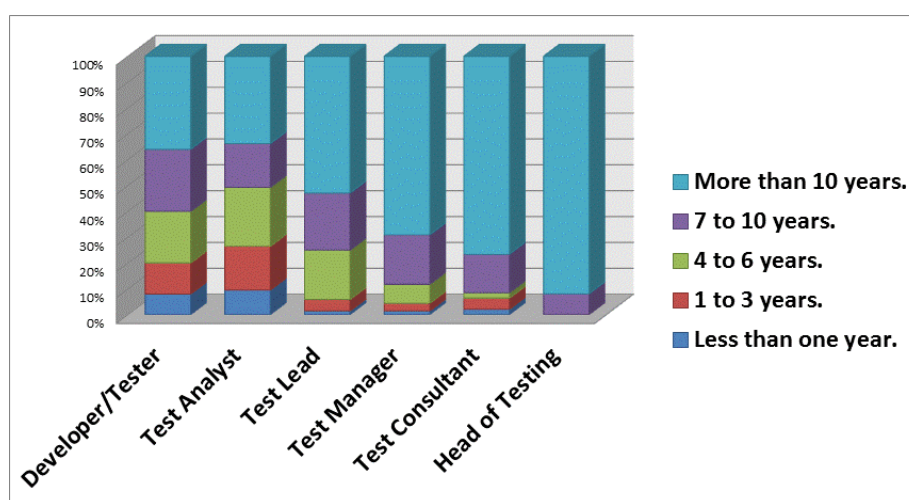


Figure 4: Experience Levels for each Tester Role

The correlations between experience level, salary levels and perceived motivation for each of the tester roles are provided in Table 4.

Correlation:	Developer/ Tester	Test Analyst	Test Lead	Test Manager	Test Consultant	Head of Testing	All Roles
EXPERIENCE - MOTIVATION	-0.33	-0.08	0.10	-0.01	0.02	0.26	0.09
SALARY – MOTIVATION	-0.10	0.12	0.21	0.07	0.02	0.10	0.15
SALARY – EXPERIENCE	0.45	0.43	0.30	0.39	0.33	0.24	0.51

Table 4: Experience and Salaries Correlations

When all roles are considered together, the correlation between experience and perceived motivation is negligible, however when individual tester roles are considered, it can be seen that there is a weak positive correlation ($p=0.12$) for the Heads of Testing and there is a moderate negative correlation for Developer/Testers ($p=0.11$). These positive and negative correlations (more experienced Head of Testing \Rightarrow more motivated & more experienced Developer/Tester \Rightarrow less motivated) could be due to career expectations and frustrations. The Heads of Testing could perceive that they had reached the pinnacle of the possible roles in testing and so were not disappointed in their current position, while the Developer/Testers with lots of

experience could be frustrated that they were still performing in the same role and had not been promoted to a role with more responsibility.

The relationship between salary and motivation appears to be very weak; only for Test Leads is there any statistically weak correlation ($p < 0.1$).

There is a strong positive correlation between salary and experience for all tester roles, suggesting that the longer you work in testing the more you will be paid. This correlation is strongest for Developer/Testers and Test Analysts, while weakest for Heads of Testing.

Education and Qualifications

Respondents had achieved the following *highest* levels of education within each of the tester roles. There is no measurable correlation between education levels and perceived motivation, nor between education levels and salary.

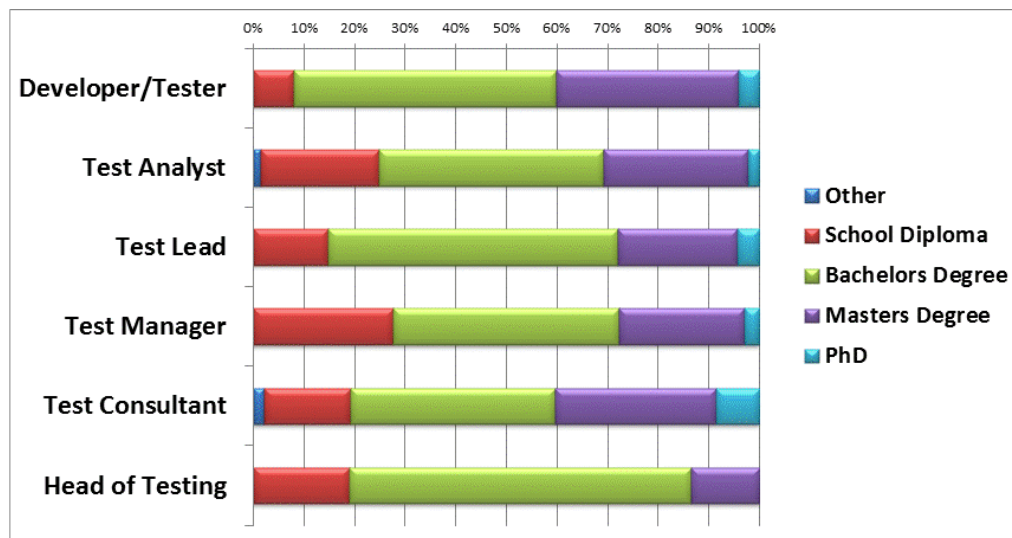


Figure 5: Education Levels for each Tester Role

Figure 6 shows the mix of professional qualifications attained by respondents for each of the tester roles. Respondents may have achieved more than one qualification. According to ISTQB their worldwide conversion rate from Foundation to Advanced is approximately 14% [6], but for the respondents to this survey the overall conversion rate was 30%. It was highest for Heads of Testing (74%), and lowest for Test Analysts (10%).

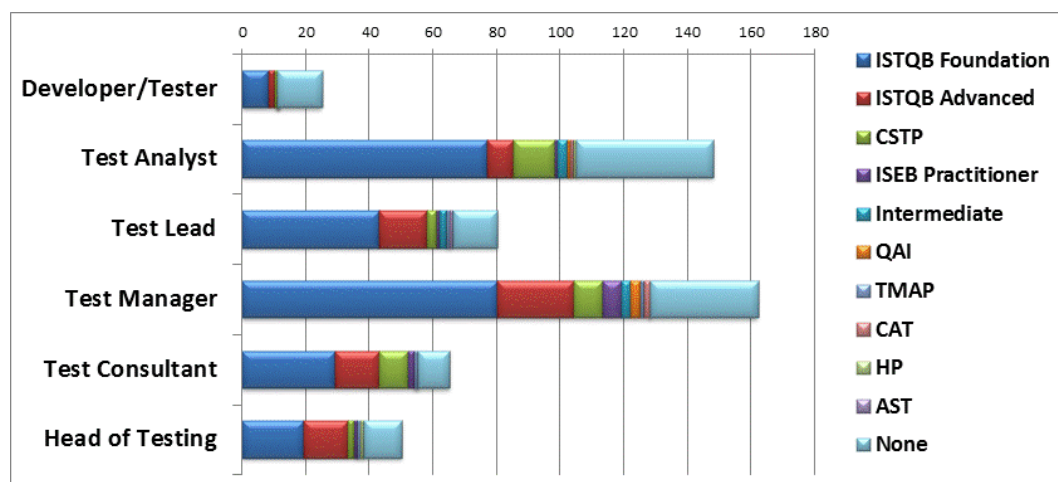


Figure 6: Professional Qualifications for each Tester Role

Overall 23% of respondents had no software testing qualifications, with Developer/Testers holding the least (56% had none). This result for Developer/Testers probably reflects their dual role as part developer and part tester.

For Developer/Testers and Test Analysts those with qualifications perceive themselves to be more motivated on average, while Consultants and Heads of Testing without qualifications perceive themselves to be more motivated on average. This could be because a large proportion of those in more senior roles started in testing before the advent of most of the professional qualifications and decided they were of little value to them. For Test Managers there is no difference between the two groups.

Outside Interests

Respondents provided details of any activities to do with testing that they did outside of their main job. The activities included speaking at conferences, attending/managing special interest groups, writing blogs, etc. Figure 7 shows the number of testers in each role answering yes and no.

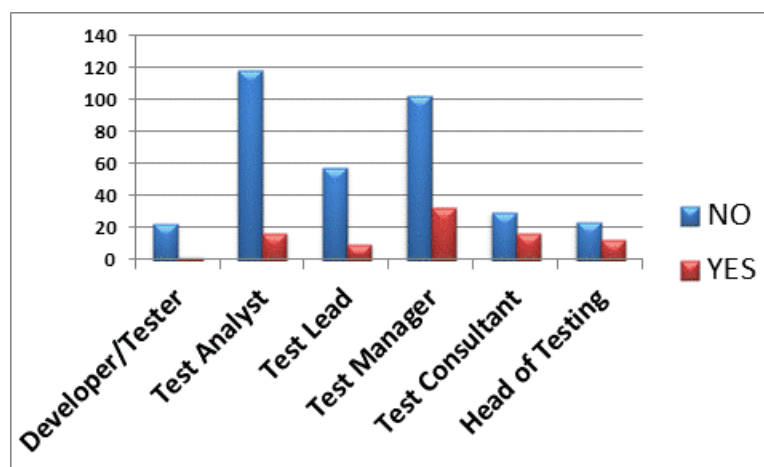


Figure 7: Outside Testing Interest for each Tester Role

The average perceived motivation (on a scale of 1 to 7 – on the y-axis) was determined for each of the tester roles, separated into those who are involved with testing outside their day job (YES) and those who are not (NO). As can be seen in figure 8, those involved in testing outside their job consistently perceive themselves to be more motivated for all roles. A paired two sample t-test showed that there is a statistically significant difference between the two groups ($p < 0.01$).

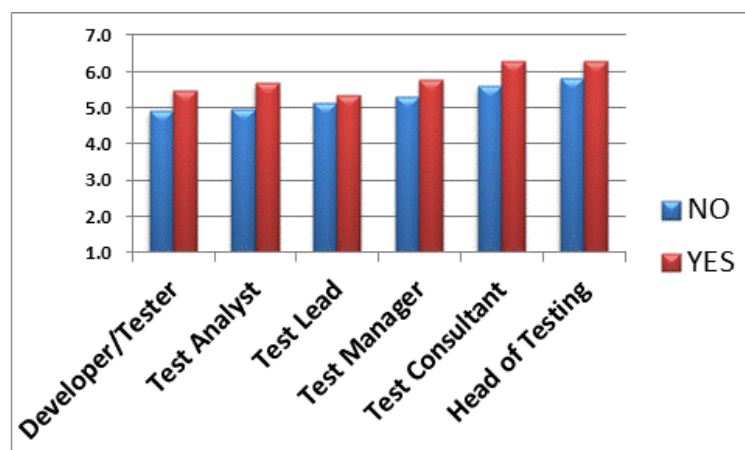


Figure 8: Outside Testing Interest Correlations with Motivation for each Tester Role

Discussion

Studying the applicability of generic motivation theories to software testers highlighted the need to consider some tester-specific factors if attempting to motivate testers (see [9]). That study also identified the fact that different sub-groups of the originally studied survey respondents showed some special characteristics. This led to the hypothesis that the factors motivating testers differed depending on their testing role. The hypothesis was correct and the following considers each of the roles individually:

- 1) Developer/Testers. This group appear to have some unique challenges, which should be expected as they are the only group who are not wholly performing a testing role. They receive poor feedback, have low autonomy, and score low on the variety of tasks performed, the significance of these tasks and the challenge the tasks present. One area where they do score highly is for task completion. Demotivating factors include feedback, the idea that their work affects both other colleagues and the project (significance), task completion, and performing a large variety of tasks. These demotivating factors are unusual and blindly implementing traditional motivation approaches may well cause more harm than good. The demotivation by task completion and variety of tasks may be explained by those tasks being small, repetitive, unchallenging and highly interdependent. The interdependency will introduce stresses that will be demotivating. The problems with task significance and feedback suggest that when their work does adversely affect others this is not communicated (or received) well. The low scores for significance suggest a need for increasing this group's belief in the importance of what they do, but this may exacerbate problems when things go wrong. Being able to choose who they work with is an important motivator for this group and they are also strongly motivated by their work environment, suggesting that they need careful management.
- 2) Test Analysts. This group feel that they have less autonomy than the other testing roles, and that the tasks they perform (which they believe they complete) are repetitive, not challenging, and do not greatly impact their colleagues or the project as a whole. Some degree of autonomy may be injected into their jobs by replacing some of the test execution by exploratory testing, which is currently only performed by 54% of respondents (exploratory testing provides a degree of autonomy by allowing test analysts to explore the item under test rather than simply following a script). It should also be relatively easy to improve the group's belief in the importance of their role, although as only 24% reported ever performing any test management activities there appears to be an education gap that could be contributing to this ignorance that also needs to be filled. Unusually, the Test Analysts were the only group not motivated by the opportunity for working for the good of the wider community.
- 3) Test Leads. This group have the strongest belief that what they do affects the outcome of the project, but do not see this significance as a motivator. Working on many interesting projects is a strong motivator, as is seeing both individual tasks and projects through to completion. This group are motivated by mastery – both being stretched and working 'in the flow' (losing track of time) are both motivators, and in terms of feedback they are motivated from what they do rather than getting feedback from colleagues and supervisors. Test Leads have an average level of autonomy overall and do not consider it a motivator – they also report having the least opportunity for working for the good of the wider community.
- 4) Test Managers. When considering autonomy, although this group score relatively highly in their ability to decide what they do next and how tasks should be performed, they score lowest of all groups in terms of work time flexibility. Test managers are highly project-oriented, scoring their influence both on the project outcome and colleagues highly – and they are more motivated by finishing projects than any other group. They also like working on a variety of projects. Test Managers find all forms of feedback are motivating – from the work itself, from colleagues and from supervisors.
- 5) Consultants. This group could be expected to have special characteristics compared to the other groups as typically they are working at a client's site on a client project, and for a local client manager. An

example of this is that Consultants scored lowest for feedback from supervisors, which could reflect their client manager not feeling the need to praise them and their remote organization manager not knowing enough to praise them. Test consultants are strongly motivated when they think their work affects the outcome of the project, but are not motivated by seeing projects through to completion, presumably because typically they are only employed for a part of the project.

Consultants have high levels of autonomy and this could be a reason they also have good opportunities for working for the good of the wider community. Consultants typically find their job to be challenging and stretching, and of all the testing roles studied they perform the smallest amount of repetitive work (30% of their time on average). They are also least likely to believe that their organization is primarily focused on making a profit.

- 6) Heads of Testing. This group has highest levels of autonomy of all the roles and are also motivated by all forms of autonomy, a happy situation which contributes to them believing themselves to be the most motivated group of those studied. They also have far more opportunity for working for the good of the wider community than the other roles.

The study confirms that they are not motivated by completing projects (although they believe they positively contribute to project success) and do not consider task completion as important as other roles and this is definitely not a motivator for them. This is probably because they see their role as more involved with process improvement across multiple projects.

This group believes it receives better feedback than for any of the other roles studied, and is motivated best by feedback from colleagues and supervisors rather than from the work itself. This could be because this group spend more of their time organizing and delegating rather than performing tasks themselves.

Unlike other roles, Heads of Testing are motivated by an organization that is primarily focused on profit making. This could be due to the likelihood of such senior roles being rewarded based on organizational profits.

The work environment is considered a strong motivator by Heads of Testing.

Further Work

There is still considerable further analysis of the original data set to be performed. For instance, there is data (and its effect on motivation) that is yet to be analysed, such as the effect of working on agile projects. So far most of the analysis has been one and two dimensional, but there is the potential to perform further analysis using a multi-dimensional approach (e.g. look at whether levels of experience affect motivation in different organization types).

Further surveys should be performed to validate the results of this first survey. There is potential to improve some of the questions and it would also be useful and informative to increase geographical coverage, which is currently largely restricted to Australasia and Europe.

Given the excellent response to the first survey, an attempt should be made to follow up the first set of respondents to create a form of longitudinal study to look at how motivation changes over time.

Conclusions

This study has provided a large number of results that should be useful to both those performing testing roles and those employing and managing testers.

It is clear that testers performing different roles have quite different characteristics and are driven by different motivators. The analysis of results shows that some factors act as a motivator for some roles while the same factors can also act as a demotivator for other roles. It also shows that many factors are irrelevant to a large number of roles. Thus treating testers as a homogeneous group is not an effective approach, and a smarter, evidence-based approach is needed.

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Annex A – Survey Questions

These questions were presented in random order in the survey. To allow consistency checking of the responses, approximately half the questions were negatively worded, which means they were reverse scored.

1	FEEDBACK 1	The work itself provides feedback on how well I am doing in my job. (POSITIVE)
2	FEEDBACK 2	My colleagues provide little or no feedback on how well I perform. (NEGATIVE)
3	FEEDBACK 3	My supervisor provides me with regular feedback on my performance. (POSITIVE)
4	AUTONOMY 1	Most of the time someone else decides what tasks I should do next. (NEGATIVE)
5	AUTONOMY 2	My job is flexible enough to allow me to decide which hours I work most days. (POSITIVE)
6	AUTONOMY 3	For most tasks I get to decide who I will work with. (POSITIVE)
7	AUTONOMY 4	I rarely get to choose the way that an activity is carried out. (NEGATIVE)
8	SIGNIFICANCE 1	My job is one that affects few other colleagues. (NEGATIVE)
9	SIGNIFICANCE 2	If not done well my job will have little impact on the project. (NEGATIVE)
10	IDENTITY 1	My job allows me to see projects through to completion. (POSITIVE)
11	IDENTITY 2	I often start tasks but then pass them on to colleagues before I finish them. (NEGATIVE)
12	VARIETY 1	My job comprises a relatively small number of different tasks. (NEGATIVE)
13	VARIETY 2	In my job I get the chance to work on many interesting projects. (POSITIVE)
14	MASTERY 1	My job does not challenge or stretch me. (NEGATIVE)
15	MASTERY 2	I have mastered most of the skills required to perform my job. (NEGATIVE)
16	MASTERY 3	I often become so engaged in my work that I forget the time. (POSITIVE)
17	PURPOSE 1	My job includes the opportunity to work for the good of the wider community (beyond my employer). (POSITIVE)
18	PURPOSE 2	My organization is primarily focused on increasing its profits. (NEGATIVE)
19	PERCEPTION	I am highly motivated to do my job in testing. (POSITIVE)
20	ENVIRONMENT	My work environment encourages me to perform my job better. (POSITIVE)