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Personality Theory as a Predictor for Agile Preference

David Bishop
Dakota State University/California Baptist University, david.b.bishop@gmail.com

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ABSTRACT

Since their arrival on the software development scene, agile software development methods have been a source of intense study. One promising aspect of research in relation to agile methods is personality theory. Although there have been some studies utilizing personality theory, to date no research has been performed to investigate the potential link between personality attributes and preference for agile methods. This study seeks to explore this research gap using a quantitative survey based approach. The outcome of this study provides evidence that there may not be a correlation between personality and agile methods, at least in terms of personality characteristics as measured by the Five Factor Model. In addition to this finding, the research provides a contribution in the form of an instrument to measure agile software development methodology preference.

Keywords

Agile software development, personality, preference.

INTRODUCTION

Agile software development methods are becoming ubiquitous in industry and are a leading area of research within academia (Dingsøyr, Nerur, Balijepally, & Moe, 2012). One promising but lightly explored area of research is the relationship of personality theory and agile methods (Balijepally, Mahapatra, & Nerur, 2006). The research focus in this study is an effort to investigate if there is a potential correlation between personality traits and preference for agile methods. There are a number of measures available for personality traits. The Five Factor Model as operationalized in the Big Five Inventory survey instrument (John, Naumann, & Soto, 2008) was selected as the personality trait measure. In addition to measuring personality traits there was a need to measure agile software development methodology preference. An extant instrument for this purpose could not be found so an instrument was developed to measure this preference. In the next section there is a review of available literature related to the research interest. Following that is a discussion of the research methodology. Next is an analysis of the data and following that a discussion of the results. Finally, some concluding thoughts and future research opportunities.

LITERATURE REVIEW

Agile and Plan-Based Methodologies

Over the last decade two decidedly different approaches to software development have emerged. The traditional approach is characterized by terms like waterfall, CMMI, or even spiral development. These approaches are often called "plan-based" or "plan-driven" in the literature (Boehm & Turner, 2004). They emphasize planning, sequential execution, documentation, specific roles and predictability (Balijepally, et al., 2006; Boehm & Turner, 2004). Philosophically, traditional approaches have sought to impose order and control on the software development effort (Bonner, 2010).

In contrast to the plan-driven approach are agile methodologies. Rather than control and prediction, agile methods seek to react and adapt (Cockburn & Highsmith, 2001). Agile methods have their roots in the 1990s culminating in a manifesto developed in 2001 which stated the essential concepts at the heart of agile methods. The manifesto lists a set of twelve guiding principles developed by the Agile Alliance (2004). Among the emphasis in the twelve principles are the beliefs that working software code is a priority over documentation, early and frequent delivery of working software code is a priority, daily collaboration between users and developers, trust in the front line workers (business and technical), face-to-face communication is better than written documents, progress is measured by working software, consistent pacing rather than periodic heroic efforts, emergent rather than prescriptive design/architecture, reflective team adjustments (Alliance, 2004). The enduring value and importance of the principles found in the Agile Manifesto is confirmed by a recent study performed by Williams (2012).

Clearly the two approaches have very different orientations, plan-driven is command-control oriented while agile is reactive and people centric. Part of the motivation behind this research is to investigate the possibility that an individual's personality may influence their preference for one or the other software development methodology.

Personality Theory and Software Engineering

Studies have suggested that there is a significant difference in regard to personality traits in the United States between the population at large and engineers including software engineers (Capretz & Ahmed, 2010). A variation on this theme was done to show a relationship between the Meyers-Briggs Type Indicators (MBTI) personality traits and specific roles used in traditional plan-driven software engineering (Capretz, 2003). Capretz (2002) also compared software engineer MBTI personality traits with all other engineer personality traits and found them to be very similar and distinct from the distributions in the general population. Similar work has been done among the Cuban software engineer population (Varona, Capretz, & Piñero, 2011).

In addition to MBTI based studies, some personality/software engineering studies have been performed using the Five Factor Model (Feldt, Torkar, Angelis, & Samuelsson, 2008). The Five Factor Model uses the following traits openness (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), and Neuroticism (N). In their paper, the authors illustrate using the conscientiousness characteristic to evaluate preference for working alone or in groups as an illustration of the types of studies that can and should be done using this personality based approach. The authors call for more empirical and personality based studies to be published in the software engineering domain.

Personality Theory and Team Orientation

There have been numerous studies published in relation to team and peer-programming situations utilizing personality traits. Agile methods emphasize people, relationships and teamwork, so it makes sense that a variety of studies have been published in this area. Some studies use the Five Factor Model previously mentioned and a very closely related model called the Big Five model. For example, an empirical study was performed using the Five Factor Model to identify relationships between the five personality traits and autonomy, interdependency, cohesion and conflict within the team (Acuña, Gómez, & de Lara, 2008).

Balijepally et al. (2006), argue for the use of the Five Factor Model (FFM) as a psychometric tool for understanding agile team dynamics and call for more studies using FFM in Information Systems research. One operationalization of the Five Factor Model is through the International Personality Item Pool Representation, otherwise known as the IPIP instrument, which is freely available online (Balijepally, et al., 2006). Another implementation of the Five Factor Model is the Big Five Inventory survey instrument (John, et al., 2008). A concrete implementation of agile principles is eXtreme Programming (XP). One of the practices of XP is that programmers work in pairs to mutually understand and solve problems while development the software. This practice is called paired-programming. A recent study used the MBTI assessment to investigate the relationship between personality types of paired programmers and cohesiveness in the team environment (Karn, Syed-Abdullah, Cowling, & Holcombe, 2007).

Given this background of research in personality theory and information systems, along with the call for additional research, the current study is designed to explore the possible relationship between personality traits and preference for agile methods.

RESEACH METHODOLOGY

General Research Design

The research study was designed to answer the question, can personality theory, specifically the Five Factor Model, be used as a predictor for agile software methodology preference. The hypothesis can be stated as:

H1: Personality theory predicts agile software methodology preference

The theoretical model for the study is shown in Figure 1 below.

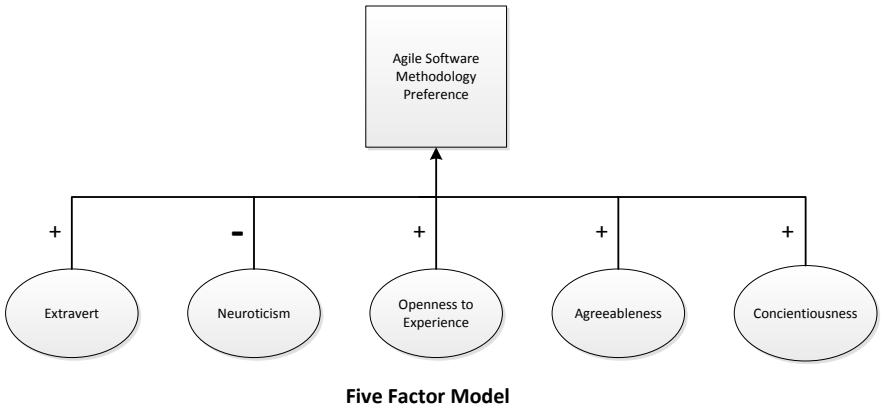

Figure 1 - Theoretical Model

The study involved administering a preference instrument followed by an instrument to measure personality traits. A literature review determined that there were no instruments available to measure agile software development methodology preference so an instrument was developed for this purpose.

Participants completed a two part survey; the first part was made up of a few demographic questions plus the newly developed agile preference instrument. The second part incorporated the Big Five Inventory survey questions. Only surveys with all questions completed were preserved in the research database. The entire survey was delivered via a custom developed database driven web application.

The target population was software developers in general. The sample primarily targeted public employee software developers at the state and county level. We had access to a state CIO who could email the survey request to the other state CIOs and large county CIOs requesting that their staff participate on a voluntary basis. The response rate was low, so we eventually sent requests through informal colleague channels including other university professors and corporate contacts at Microsoft, Garmin, Google and Amazon. We also posted the survey on a few discussion boards in the appropriate subject areas like Linked-In, Scrum Practitioner, and extreme programming on Yahoo Groups. The response rate was still lower than desired. We ended up with a total of 84 participants who completed the preference instrument, 53 that completed both the preference instrument and the BFI instrument.

Preference Instrument Design

The basis for the survey instrument is found in the 12 agile methods principles stated by the Agile Alliance in their Agile Manifesto (2004). Reviewing the twelve principles we found a few issues which caused us to evaluate and either combine or eliminate certain principles. Two principals were essentially redundant, principle one and principle three both communicated the desire to deliver software frequently so the study combined those two principles when constructing the preference instrument. There were also three other principles that were determined to be universally desirable by all methodologies and software developers and therefore did not provide discrimination or differentiation between agile methods and any other methods. These principles consisted of the desire to involve motivated people on a project; to deliver technical excellence in the solution; and to minimize the work done (or maximize the work not done). Since these were considered not to be unique to agile software development methods we chose to eliminate them from the survey since we assumed all developers would find these attractive regardless of their preferred software methodology.

This left eight remaining principles to use as the basis for developing the preference survey instrument. Next, development of the instrument proceeded by forming 10 statements per principle, 80 statements total. Each statement indicated whether a participant preferred an agile principle or preferred the antithesis of an agile principle. The next step involved creating a tool with the 80 statements and to query a panel of five experts from academia and private industry to categorize each statement by either associating the numbered agile principle or indicating that the statement was not agile. A fragment of the instrument is shown in Figure 2.

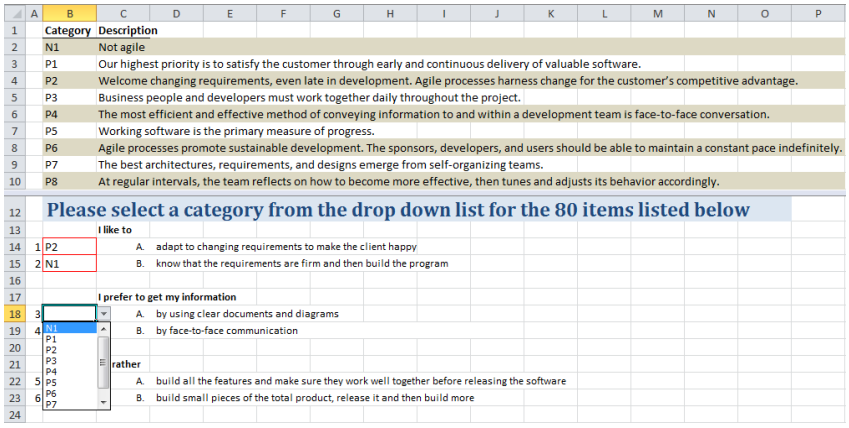

Figure 2 - Expert Categorization Tool

The responses and comments were reviewed from the panel of experts and some statements were eliminated and others modified. This left five statements per principle to be used in the survey instrument. There are 40 statements each with two options for completion. The two options are dichotomous, one being in the form of an agile principle the other option the antithesis of the principle. The participant is forced to choose the option that best represents their preference. A sample of the survey instrument is shown in Figure 3.

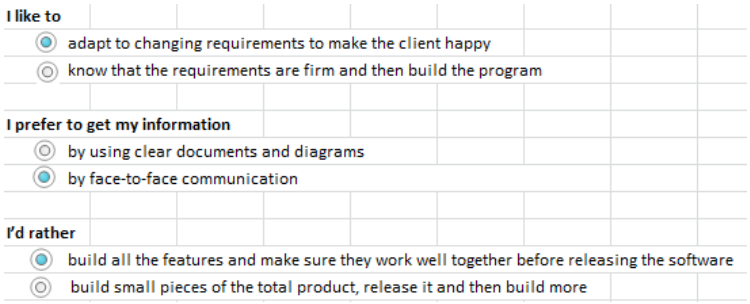

Figure 3 - Sample Preference Instrument Questions

Preference survey results were analyzed to determine if there is convergence on a per-individual and per-principle basis. In other words, for a single participant the desire was to confirm that the five answers for a given principle are consistent. For example, regarding principle 1, ideally either five selections should be in favor of the principle or five selections opposed to the principle. If the results for an individual are mixed for a given principle, say they had three affirmative responses and two negative responses then either the participant is indecisive in regard to that principle or the statements are confusing. If this scenario is repeated for a particular principle over a significant number of individuals then the statements for that principle will need to be improved. As noted in the following data analysis section there was good consistency on a per-person, per-principle basis.

DATA ANALYSIS

Agile Software Methodology Preference

The study ran from August of 2012 through the end of September 2012. A total of 84 participants completed the preference survey instrument, 53 participants completed both the preference and the BFI instruments.

Since the agile preference survey is a new instrument analysis was necessary to ensure it is providing valid indication of a participant's preference for agile software development methods. In order to establish convergent validity we constructed five questions for each of the eight principles resulting in forty agile questions on the preference instrument. If convergence is present then we would expect each participant to answer the five questions per principle consistently. Based on the coding scheme, if a participant answered a question in a way that indicates preference for agile that response it is coded as a 1, if they choose a response that indicates a non-agile preference it is coded as a zero. Since there are five questions for each of the eight principles, if there is perfect convergence it is expected to see scores of zero or five for each participant for each principle. If the range is expanded and some variance is allowed for participant preference then it can be said that if scores of zero, one, four and five for each

principle for each participant is achieved then there is convergence. This is the case with regard to the data, for each of the eight principles, over 70% of the participant's results demonstrated convergence. In other words they either demonstrated a preference for agile principles by scoring 4s and 5s or they showed an aversion for agile principles by scoring 0s or 1s.

Figure 4 below shows the number and percentage of 0s, 1s, 4s and 5s for the 84 participant response for the preference survey instrument. Based on this evidence there is convergent validity.

P1	P2	P3	P4	P5	P6	P7	P8
64	59	59	64	65	72	60	73
76%	70%	70%	76%	77%	86%	71%	87%

Figure 4 - Number of 0s, 1s, 4s and 5s per Principle, N=84

In order to arrive at an overall agile software methodology preference each participant's responses across the eight principles were summed to calculate a Total Preference score. If the participant answered each of the five questions affirmatively for agile preference on all eight principles their Total Preference score is calculated as 40. If they answered each of the five questions as non-agile preference for all eight principles they would receive a Total Preference score of 0. So the possible range of Total Preference scores is from 0 to 40. Figure 5 shows the actual descriptive statistics for the Total Preference variable.

Descriptive Statistics: Total Pref

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Total Pref	84	0	28.405	0.891	8.170	4.000	22.000	30.000	35.750	40.000

Figure 5 - Total Preference Descriptive Statistics

Correlation of BFI to Total Preference

A linear regression was configured using the dependent variable of Total Preference derived from the Agile Development Software Methodology Preference (ADSMP) instrument and the values from the BFI instrument. The five independent variables from the BFI instrument are extraversion, agreeableness, conscientiousness, neuroticism, and openness. Using SAS Enterprise Guide we generated the output shown in Figure 6.

Dependent Variable: total_pref Total Pref

Number of Observations Read	53
Number of Observations Used	53

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	219.90027	43.98005	0.58	0.7138
Error	47	3553.64690	75.60951		
Corrected Total	52	3773.54717			

Root MSE	8.69537	R-Square	0.0583
Dependent Mean	27.67925	Adj R-Sq	-0.0419
Coeff Var	31.41478		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	40.92393	16.39021	2.50	0.0161
extraversion	Extraversion	1	1.48154	1.66246	0.89	0.3774
agreeableness	Agreeableness	1	-1.19580	2.52616	-0.47	0.6381
conscientiousness	Conscientiousness	1	-0.47158	2.12270	-0.22	0.8252
neuroticism	Neuroticism	1	-1.71869	1.75695	-0.98	0.3330
openess	Openess	1	-1.81500	2.21093	-0.82	0.4158

Generated by the SAS System ('Local', XP_PRO) on September 29, 2012 at 12:16:46 PM

Figure 6 - SAS Linear Regression Output

Due to the low R-Squared value the data show that there is no significant correlation between the BFI independent variables and agile Total Preference. This provides disconfirming evidence for the hypothesis. Further analysis was conducted to determine if there was a relationship between the BFI independent variables and any of the individual eight agile principles. Again, no relationship was substantiated by the data.

CONCLUSIONS

The primary conclusion from the study is that there is no evidence that the Big Five Inventory personality factors have any predictive power in regard to an individual's preference for the agile software development methodology. Further study in this regard may still be valuable using alternative measures of personality like the Myers-Briggs Type Indicators or other personality instruments. In addition, a larger sample would add statistical power and may provide alternative results.

An additional contribution made by this study was the creation and testing of an instrument to measure agile software methodology preference. This instrument may prove useful for future research regarding agile preference. One example of a future research effort might be to determine if there are any treatments that increase a subject's preference for the agile software development methodology.

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