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Goal Orientation Profiles and Task Performance Growth Trajectories

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Abstract

Goal orientation theories were used to generate predictions regarding the moderating effect of goal orientation profiles on task performance growth trajectories. Participants were given multiple trials of practice on an air traffic control task. Analyses were conducted using growth curve modeling. As expected, individuals with high performance-approach orientation improved their task performance scores faster than their counterparts. The interaction between mastery and performance-avoid orientations moderated the performance growth curve such that individuals with high mastery and low performance-avoid orientation improved their performance at the fastest rate. The interaction between performance-approach and performance-avoid orientations also moderated the performance growth curve. Individuals with low performance-approach and high performance-avoid orientation improved their performance at the slowest rate. These findings contribute to theory and practice by elucidating how various combinations of goal orientations influence the rate of skill acquisition.

Goal Orientation Profiles and Task Performance Growth Trajectories

Goal orientation refers to the pattern of cognition and action that results from pursuing achievement goals (DeShon & Gillespie, 2005). It plays an important role within achievement contexts (Dweck & Leggett, 1988), and has been associated with concepts such as meta-cognitive activity (e.g., Schmidt & Ford, 2003), intrinsic motivation (e.g., Elliot & Church, 1997) and learning strategies (Zusho, Pintrich, & Coppola, 2003). We focus on the widely-used three-factor model of goal orientation, which consists of mastery, performance-approach and performance-avoid dimensions (Elliot & Church, 1997; Vandewalle, 1997)[1]. This model distinguishes between the two forms of performance orientation rather than merging them together as is done in the two-factor model. This separation is vital because theory and empirical research suggest that they are independent constructs with differential antecedents and consequences (e.g. Payne, Satoris, & Beaubien, 2007). The current study extends goal orientation research by using this three-factor model to generate and test predictions regarding goal orientation profiles and performance growth trajectories. We use a complex relative judgment task to test our hypotheses.

Goal Orientations and Growth Trajectories

Theory implies that goal orientation dimensions should influence the rate at which individuals acquire task knowledge and skill (Dweck, 1986). However, most research has only examined the effects of goal orientations at a single point in time and most studies that have assessed these relationships at two or more time points have conducted analyses at the between-person level (i.e. assessed mean differences in performance between individuals at discrete time points, e.g. Elliot & McGregor, 1999; Ford, Smith, Weissbein, Gully, & Salas, 1998; Harackiewicz, Barron, Tauer, Carter, & Elliot, 2000; Harackiewicz, Barron, Tauer, & Elliot, 2002), which do not account for the changes in performance that occur within individuals over time. To our knowledge, only one study has used multilevel analyses to examine the effect of goal orientations on performance at multiple time points (Yeo & Neal, 2004). This study, however, failed to distinguish

[1] Note that researchers have conceptualized additional dimensions of goal orientation such as mastery-avoidance orientation (Elliot & McGregor, 2001) and normative ability goals (similar to performance-approach orientation except that the focus is on intelligence rather than performance outcomes) (Grant & Dweck, 2003).

theoretically, methodologically or empirically between approach and avoidance forms of performance orientation. In the next section we develop hypotheses regarding the moderating effect of three goal orientation dimensions on task performance growth trajectories.

Mastery Orientation

Mastery orientation reflects a desire to develop knowledge and skills and master a task (Elliot & Church, 1997). It is viewed as an adaptive motivational construct because it is associated with approach-oriented activities including effort, persistence and task absorption (Elliot, Shell, Bouas Henry, & Maier, 2005). In line with this, research consistently demonstrates positive links with cognitive, affective and behavioral outcomes (e.g. Elliot & Church, 1997; Elliot & McGregor, 1999, 2001; Harackiewicz, Barron, Tauer et al., 2002; Payne et al., 2007). The findings regarding performance outcomes are less consistent. Although Payne et al.'s meta-analysis (2007) reported a positive relationship between dispositional mastery orientation and both learning (exam performance) and academic (course grades or "Grade Point Average", GPA) performance, as well as job performance, there was a non-significant relationship with task performance.

We suggested previously that goal orientations may moderate performance growth trajectories. This argument may be particularly relevant for mastery orientation, given that adaptive constructs may take longer to be activated than maladaptive constructs (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). Elliot and McGregor (1999) found that despite non-significant effects on initial exam performance, students with high mastery orientation performed better than their counterparts on a later retest of the same material. In a skill acquisition context, mastery orientation has been positively associated with knowledge and task performance (Bell & Kozlowski, 2002). However, these studies focused on differences *between* individuals. Yeo and Neal (2004) used within-person analyses; however, mastery orientation did not influence the performance growth rate on an Air Traffic Control (ATC) task. It is possible that Yeo and Neal's (2004) finding was in some way influenced by the scale used to measure mastery orientation. These authors used Button, Mathieu and Zajac's (1996) ten item scale, which includes four items that assess the expected outcomes of a mastery orientation rather than the orientation itself (e.g., “When I fail to complete a difficult task, I plan to try harder the next time I work on it”) and two items that assess an incremental implicit theory of ability (e.g., “Your performance on most tasks or jobs increases with the amount of effort you put into them”). Further, the task fidelity may have been limited by the scoring system, which placed equal weighting on all types of decision outcomes regardless of their importance (e.g., missing a conflict was not penalized more heavily than making a false alarm). We examine this relationship in an ATC task with a more ecologically valid scoring system and use a different measure of mastery orientation. These arguments suggest the following hypothesis:

Hypothesis 1. Mastery orientation will moderate the task performance growth trajectory, such that individuals with high mastery orientation will improve their performance at a faster rate than their counterparts.

Performance-Avoid Orientation

Performance-avoid orientation reflects a desire to avoid the demonstration of incompetence relative to others (Elliot & Church, 1997). This construct is viewed as maladaptive because it is associated with avoid-oriented ego management activities such as effort withdrawal, distraction and self-handicapping (Elliot et al., 2005). Empirical studies consistently demonstrate negative links between performance-avoid orientation and cognitive, affective, behavioral and performance outcomes (e.g., Church, Elliot, & Gable, 2001; Cury, Elliot, Sarrazin, Da Fonesca, & Rufo, 2002; Elliot & Church, 1997; McGregor & Elliot, 2002; Payne et al., 2007). Further, Yeo and Neal (2004) demonstrated that a measure of generic performance orientation (i.e., one that blurred the distinction between the approach and avoidance forms of this orientation; Button et al., 1996) moderated the rate of skill acquisition on an ATC task, such that individuals with high generic performance orientation improved their performance at a slower rate than their counterparts. This finding supported Yeo and Neal’s (2004) prediction, which was based on the traditional maladaptive view of performance orientation (i.e. similar to the conceptualization of performance-avoid orientation). We expect to replicate this finding with a pure measure of performance-avoid orientation:

Hypothesis 2. Performance-avoid orientation will moderate the task performance growth trajectory, such that individuals with low performance-avoid orientation will improve their performance at a faster rate than their counterparts.

Performance-Approach Orientation

Performance-approach orientation reflects a desire to demonstrate competence by outperforming others (Elliot & McGregor, 2001). It is associated with approach-oriented processes such as effort and persistence (Elliot et al., 2005) but may also focus attention on performance indicators rather than the task itself (Brown, 2001; S. Fisher & Ford, 1998). This orientation is expected to promote high competitive striving, effort and persistence in situations where success is likely, but may result in high anxiety and poor intrinsic motivation if failure seems probable (even in these situations, however, persistence may remain high in an effort to avoid failure; Elliot, 1997).

Payne et al.'s (2007) meta-analysis revealed that dispositional performance-approach orientation was unrelated to self-efficacy, self-set goal level, feedback seeking and performance, positively associated with state anxiety and associated with an increased number of learning strategies. However, they included studies that assessed *generic* performance orientation in their analyses of performance-approach orientation, arguing that such measures tended to be more approach- than avoidance-oriented. Given that some of the items were avoid-oriented, these findings should probably be interpreted with caution. Studies which have specifically examined performance-approach orientation have generally demonstrated positive effects on performance outcomes (e.g. exam performance, course grades and GPA; Barron & Harackiewicz, 2001; Church et al., 2001; Elliot & Church, 1997; Elliot, McGregor, & Gable, 1999; Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997; Harackiewicz et al., 2000; Harackiewicz, Barron, Tauer et al., 2002).

To our knowledge, no research has examined the moderating effect of performance-approach orientation on task performance growth trajectories (although see Pintrich, 2000a for a median-split, repeated measures ANOVA approach involving academic performance; and Yeo & Neal, 2004 for an examination involving generic performance orientation). We expect to find a positive effect of performance-approach orientation in this study because success is likely in our task context, which is expected to promote the positive, striving aspect of performance-approach orientation (e.g. Elliot, 1997). Although the task is cognitively complex, sufficient feedback and practice is provided to allow individuals to demonstrate competence. This claim is supported by previous research that has shown that participants improve their performance on a similar task (e.g. Yeo & Neal, 2004; 2006). The previous arguments suggest the following hypothesis:

Hypothesis 3. Performance-approach orientation will moderate the task performance growth trajectory, such that individuals with high performance-approach orientation will improve their performance at a faster rate than their counterparts.

Goal Orientation Profiles and Growth Trajectories

In line with the view that the structure of goal orientation reflects at least three independent dimensions (Elliot & Church, 1997; Elliot & McGregor, 2001; Vandewalle, 1997), researchers have begun to consider the potential for goal orientation interactions (e.g. Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Pintrich, Conley, & Kempler, 2003; Yeo & Neal, 2004). Some research has investigated interactions among goal orientation dimensions in the prediction of achievement outcomes. Much of this research has focused on the interaction between mastery and performance-approach orientations. This research has produced mixed findings.

In terms of the most beneficial combination, some studies provide support for high mastery orientation and high performance-approach orientation (Bouffard, Boisvert, Vezeau, & Larouche, 1995; Wentzel, 1991), while others suggest that the combination of high mastery orientation and low performance-approach orientation is best (Helmreich, Beane, Lucker, & Spence, 1978; Meece & Holt, 1993; Sanders, 1978, cited in Spence & Helmreich, 1983). Further, some studies suggest that a high mastery orientation is the best, regardless of the level of performance-approach orientation (Ames & Archer, 1988; Pintrich, 2000a), while others have reported non-significant interactions (Archer, 1994; Barron & Harackiewicz, 2000; Barron & Harackiewicz, 2001;

Harackiewicz et al., 1997; Harackiewicz et al., 2000; Harackiewicz, Barron, Tauer et al., 2002; Schraw, Horn, Thorndike-Christ, & Bruning, 1995).

It is difficult to interpret these mixed findings because most past research has used analytic techniques such as median splits or cluster analysis which prevent a powerful test of interactions by collapsing the variance in goal orientation dimensions into two groups (see Cohen, 1983 for discussion of the conceptual and statistical problems with this technique). Some studies have used moderated regression (Barron & Harackiewicz, 2001; Harackiewicz et al., 1997; Harackiewicz et al., 2000; Harackiewicz, Barron, Tauer et al., 2002; Hofmann & Strickland, 1995). However, this research is limited because it focused on goal orientation effects at only one or two time points and analyzed relationships at the between-person level, thus precluding a test of how goal orientations moderate performance growth trajectories. Also, there appears to be limited theoretical discussion of, or empirical tests of, interactions involving performance-avoid orientation. Therefore, we now generate hypotheses regarding goal orientation profiles and performance growth trajectories.

Early theorists focused on generic performance orientation (which blurs the approach and avoid components) and proposed that although performance orientation tends to be associated with a maladaptive achievement pattern, some focus on normative outcomes is still important, so a balance of both mastery and performance orientations should enhance achievement (Dweck & Leggett, 1988; Maehr, 1983, cited in Harackiewicz et al., 1997; Veroff, 1969; Wentzel, 1991). From a growth curve modeling perspective, this suggests that individuals with high mastery and high performance orientations should learn at the fastest rate. As reviewed previously, recent theorizing (Elliot & Church, 1997; Pintrich, 2000a; Vandewalle, 1997) conceptualizes performance-avoid orientation as maladaptive and performance-approach orientation as generally adaptive. We suggest that the above arguments apply to the interaction between mastery and performance-approach orientations. To our knowledge, no research has tested the following hypothesis:

Hypothesis 4. The interaction between performance-approach and mastery orientations will moderate the performance growth trajectory, such that individuals with high performance-approach and high mastery orientation will improve their performance at the fastest rate.

Further, in line with recent theory and research suggesting that a low performance-avoid orientation is the more adaptive end of the continuum (Elliot & Church, 1997; Payne et al., 2007), we suggest that a combination of high mastery and low performance-avoid orientation should be associated with the fastest rate of performance improvement. In support of this notion, Yeo and Neal (2004) demonstrated that individuals with high mastery and low (generic) performance orientation improved their performance on an ATC task at a faster rate than individuals with other combinations of mastery and (generic) performance orientation. As noted earlier, although these authors conceptualized performance orientation as a maladaptive construct, they used a measure of generic performance orientation. Thus, it is important to replicate this finding with a pure measure of performance-avoid orientation.

Hypothesis 5. The interaction between performance-avoid and mastery orientations will moderate the performance growth trajectory, such that individuals with low performance-avoid and high mastery orientation will improve their performance at the fastest rate.

We now consider the interaction between performance-approach and performance-avoid orientations. Both of these orientations relate to ego management, but the former concerns maximizing favorable normative comparisons and the latter concerns minimizing unfavorable normative comparisons. A focus on avoid-oriented ego management activities is viewed as uniformly maladaptive (Elliot & Thrash, 2001; Kanfer & Ackerman, 1989; Linnenbrink & Pintrich, 2000), and this orientation combined with a *low* performance-approach orientation should be particularly detrimental because the avoid-oriented activities are not being buffered by approach-oriented activities. In other words, the approach-oriented activities associated with a strong performance-approach orientation should counteract, or diminish the negative effects of performance-avoid orientation. To our knowledge, no research has tested the following hypothesis:

Hypothesis 6. The interaction between performance-approach and performance-avoid orientations will moderate the performance growth trajectory; such that individuals with low performance-approach and high performance-avoid orientation will improve their performance at the slowest rate.

In summary, although some researchers have investigated interactions among goal orientation dimensions, mixed findings and inappropriate statistical treatment of data limit the extent to which we can draw firm conclusions. Furthermore, the only study that has examined these profiles in the context of skill acquisition failed to distinguish between the approach and avoidance forms of performance orientation (Yeo & Neal, 2004). The current research will test the hypotheses generated above by using growth curve modeling techniques to examine the effects of goal orientation profiles on performance growth trajectories in a complex relative judgment task.

Method

Participants

The sample consisted of 102 undergraduate psychology students who participated in return for course credit. There were 72 females and 30 males. The mean age was 19.99 years (*SD* = 4.56).

Experimental Task

This study used a conflict recognition task from ATC-lab (Loft, Hill, Neal, Humphreys, & Yeo, 2004). Air traffic control tasks are commonly used in studies of skill acquisition because they are cognitively complex (Ackerman, Kanfer, & Goff, 1995). Indeed, previous research using this task indicates that classification accuracy at the beginning of practice is not significantly different from chance (Yeo & Neal, 2004). In this computer-based task, participants judged whether pairs of converging aircraft would conflict or pass safely. Each trial involved four pairs of aircraft, each of which was converging on a common way point. Each aircraft had an information tag attached to it, displaying its call sign and speed. Participants were required to use this information to make a ‘conflict’ or ‘pass’ decision for each aircraft pair. A conflict occurred when aircraft passed within 5 km (to scale) of each other (approximately 1cm on the screen). A pass occurred if aircraft passed at a distance greater than 5 km. Participants made their decisions by clicking a conflict (C) or pass (P) button associated with the relevant aircraft pair. Pairs of aircraft turned yellow while they were in conflict, and a beeping noise was heard. A timer was displayed in the top left-hand corner of the screen to indicate how much time had elapsed during each trial.

Scores for each trial depended on whether participants made correct or incorrect decisions and the type of decision that was made. A correct decision was made if participants accurately detected a conflict or a pass. An incorrect decision was made if participants failed to detect a conflict or made a false alarm (incorrectly calling something a conflict when it was actually a pass). As each aircraft pair either conflicted or passed safely through the potential conflict zone, participants were given feedback about the decision outcome. The relevant outcome (Conflict detected; Pass detected; False alarm; Conflict NOT detected) appeared in the scoring box, along with the appropriate score. Correct decisions were presented in green and incorrect decisions in red. At the end of the trial the total number of points scored was presented, along with the maximum score possible for the trial.

Points were awarded for correct decisions and deducted for incorrect decisions. However, the ecological validity of this task was increased relative to previous versions (e.g., Yeo & Neal, 2004, 2006) by ensuring that the scoring was weighted according to the decision outcome. A greater number of points were *deducted* for *not* detecting a conflict than for making a false alarm. Failing to detect a conflict has the potential to result in more catastrophic outcomes than being overly cautious and making a false alarm. A greater number of points were *awarded* for detecting a conflict than for detecting a pass. The number of points awarded also depended on the time taken to respond. Correct decisions made quickly were most strongly rewarded, while incorrect decisions made too hastily were most strongly penalized. The maximum score for correctly *detecting a conflict* was 80 points. This was awarded for decisions made in the first quarter of the trial. Slower conflict detections were awarded 70, 60 and 50 points as time progressed. The maximum score for correctly *detecting a pass* was 40 points. Slower pass detections were awarded 30, 20 and 10 points as time progressed. If participants incorrectly identified a conflict as a pass (i.e., *conflict NOT detected*) during the first quarter of the trial they were penalized 80 points. Slower errors of this sort were penalized 70, 60 and 50 points as time progressed. The maximum penalty for *false alarms* was 40 points and slower false alarms resulted in deductions of 30, 20 and 10 points as time progressed. If participants failed to make a decision about an aircraft pair they were penalized 80 points. Thus, the scores for each trial ranged between -320 and +320.

The presentation of aircraft events (pairs A, B, C and D) was randomized across five blocks of six trials. Within the six trials, each pair had both conflicts and passes that took each of 100, 95 and 90 seconds to occur. However, the order of presentation was randomized across each block, meaning that the combination of conflicts and passes varied in each trial. As a result, the maximum possible score for each trial depended on how many conflicts and passes were presented. In order to make scores comparable across trials for analysis purposes, scores for decisions regarding conflicts were converted from their scale of -80 to 80 to a scale from -40 to 40 (e.g. a score of 80 for correctly detecting a conflict in the first quarter of the trial was converted to 40). Scores for decisions regarding passes remained the same (e.g. a score of 40 for correctly detecting a pass in the first quarter of the trial was maintained). The range of scores for analysis purposes was therefore -160 to 160, essentially removing the differential weighting of outcome types. This was not a problem for our analyses given that we were not interested in individuals' performance on different types of aircraft events. That is, the differential scoring was applied purely to enhance the perceived ecological validity of the task.

Measures

Goal orientation. We used Horvath, Scheu and DeShon's (2001) global (i.e. dispositional) goal orientation measure. This measure comprises five items each for mastery, performance-approach and performance-avoid goal orientations. It was created through a comprehensive validation project that began with a 60-item pool that represented items from existing measures as well as newly developed items. This initial validation project and ensuing research supports the measure's validity and reliability (Horvath, Herleman, & McKie, 2006; Schmidt & Ford, 2003). The mastery orientation scale (α = .80) includes items such as "I enjoy challenging and difficult tasks where I'll learn new skills." The performance-approach orientation scale (α = .77) consists of items such as "I enjoy proving my ability to others on tasks", and the performance-avoid orientation scale (α = .67) includes items such as "I try to avoid discovering that others are better than me." Participants responded on a 7-point scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Task performance. The total number of points obtained on each trial was used as a measure of task performance. As noted above, the converted scores that were comparable across trials were used for the analyses.

Task practice. Task practice was examined by modeling the performance growth trajectory. This was achieved by including linear and quadratic parameters as orthogonal contrasts in the model. The nature of this coding means that the intercept represented performance at the midpoint of practice. The contrasts were specified as orthogonal in order to prevent multicollinearity (Ployhart, Holtz, & Bliese, 2002) and weighted according to Fisher and Yates (1974).

Procedure

The task was performed on computers in a laboratory, with up to six students per session seated in separate carrels. When participants arrived they were asked to complete the goal orientation scales and demographic items. Next, participants were presented with pre-prepared verbal instructions explaining how to perform the task. The task involved 30, 2-minute trials. The first trial was treated as familiarization, and was not included in the analyses.

Results

The means and standard deviations for each variable, and their intercorrelations at the inter-individual level, are displayed in Table 1. The hypotheses were tested via growth curve modeling, conducted using Hierarchical Linear Modeling (HLM; Bryk & Raudenbush, 1992). In multilevel research, greater power is often required to detect cross-level interactions, such as moderated growth trajectories, due to reduced parameter reliability (Snijders & Bosker, 1999). For this reason, these effects were tested at a significance level of .10, as in previous research with multilevel methods (Smillie, Yeo, Furnham, & Jackson, 2006; Yeo & Neal, 2004, 2006; Yeo & Neal, in press). Other effects were tested at $p<.05$. All predictors were grand-mean centred except for the orthogonal polynomial contrasts which are already centred in their raw form.

The Empty Model

The first model that was run was an empty model, allowing examination of the variance in performance without reference to any predictor variables. The task performance intercept was specified as a random effect (see Equation 1). This model was used to calculate the intra-class correlation coefficient (ICC1), which indicates the proportion of total variability in the dependent measure that is inter-individual, rather than intra-individual variance. The ICC1 for task performance was .38, indicating that 38% of the variance in performance could be attributed to inter-individual differences, while 62% of variance was at the intra-individual level. A chi-square test of the intercept variance component indicated that the proportion of inter-individual variability in performance was statistically significant, $\chi^2(101, N = 102) = 1940.14$, $p < .001$. The second intra-class correlation coefficient (ICC2) indicates the proportion of inter-individual variability that is parameter variance, rather than error. The ICC2 for task performance was .95. Given that the ICC1 was significant, and the ICC2 was substantive (greater than .05), it was deemed appropriate to introduce level-2 predictors (Snijders & Bosker, 1999).

Level 1: $Y_{ti} = \beta_{0i} + r_{ti}$

Level 2: $\beta_{0i} = \gamma_{00} + U_0$ [1]

where Y_{ti} is task performance, β_{0i} is the Level 1 intercept, r_{ti} is Level 1 error, γ_{00} is the average intercept, U_0 is Level 2 error around the intercept.

The Growth Model

The next model included only the linear and quadratic trajectory parameters as level-1 predictors (see Equation 2). Examination of their variance components indicated that significant variance existed between people for both the linear, $\chi^2(101, N = 102) = 394.05$, $p < .001$, and quadratic, $\chi^2(101, N = 102) = 216.37$, $p < .001$, trajectories. The ICC2s for these trajectory parameters were .74 and .53, respectively, indicating that 74% of the variability around the linear trajectory, and 53% of that around quadratic trajectory, was parameter variance. This indicated that there was sufficient parameter variance to specify the goal orientation variables as predictors of the linear and quadratic trajectories. This was necessary in order to test the moderated growth trajectories (Hypotheses 1-6).

Level 1: $Y_{ti} = \beta_{0i} + \beta_{1i}L_{ti} + \beta_{2i} Q_{ti} + r_{ti}$

Level 2: $\beta_{0i} = \gamma_{00} + U_{0i}$

$\beta_{1i} = \gamma_{10} + U_{1i}$

$\beta_{2i} = \gamma_{20} + U_{2i}$ [2]

where β_{1i} is the effect of the linear trajectory for each individual, L_t is linear trajectory, β_{2i} is the effect of the quadratic trajectory for each individual, Q_t is quadratic trajectory, γ_{10} is the effect of the linear trajectory, U_1 is Level 2 error around the linear trajectory, γ_{20} is the effect of the quadratic trajectory, U_2 is Level 2 error around the quadratic trajectory.

This model indicated that the fixed effect coefficients for the linear and quadratic trajectory parameters were significant, $b = 3.41$, $t(101) = 14.07$, $p < .001$, and $b = -.11$, $t = -4.73(101) = -4.73$, $p = .001$, respectively. This suggested that task performance did improve, at a diminishing rate, as would be expected when participants gain skill at a task. As a result, it was concluded that the task provided an appropriate learning environment in which to address the research hypotheses.

The Final Model

The final model included the three goal orientation variables and their three two-way interactions as level-2 predictors of the intercept and the linear and quadratic trajectory parameters. Hypotheses 1 to 3 were assessed by examining the results for the goal orientation variables as predictors of the growth trajectories. Hypotheses 4 to 6 were assessed by examining the results for the goal orientation interaction parameters as predictors of the growth trajectories. These fixed effects are tested for significance with *t*-tests. These results are presented in Table 2[2].

$$\text{Level 1: } Y_{ti} = \beta_{0i} + \beta_{1i}L_{ti} + \beta_{2i}Q_{ti} + r_{ti} \quad [3]$$

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + \gamma_{01}M + \gamma_{02}Pap + \gamma_{03}Pav + \gamma_{04}M \cdot Pap + \gamma_{05}M \cdot Pav + \gamma_{06}Pap \cdot Pav + U_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}M + \gamma_{12}Pap + \gamma_{13}Pav + \gamma_{14}M \cdot Pap + \gamma_{15}M \cdot Pav + \gamma_{16}Pap \cdot Pav + U_{1i}$$

$$\beta_{2i} = \gamma_{20} + \gamma_{21}M + \gamma_{22}Pap + \gamma_{23}Pav + \gamma_{24}M \cdot Pap + \gamma_{25}M \cdot Pav + \gamma_{26}Pap \cdot Pav + U_{2}$$

where γ_{01} is the effect of mastery orientation, γ_{02} is the effect of performance-approach orientation, γ_{03} is the effect of performance-avoid orientation, γ_{04} is the effect of mastery X performance-approach orientations, γ_{05} is the effect of mastery X performance-avoid orientations, γ_{06} is the effect of performance approach X performance avoid orientations, γ_{11} is the moderating effect of mastery orientation on the linear growth curve, γ_{12} is the moderating effect of performance-approach orientation on the linear growth curve, γ_{13} is the moderating effect of performance-avoid orientation on the linear growth curve, γ_{14} is the moderating effect of mastery X performance-approach orientation on the linear growth curve, γ_{15} is the moderating effect of mastery X performance-avoid orientation on the linear growth curve and γ_{16} is the moderating effect of performance-approach X performance-avoid orientation on the linear growth curve.

Hypotheses 1 to 3 predicted that the goal orientation variables would moderate the task performance growth trajectory. Hypothesis 1 was not supported. Mastery orientation did not moderate the linear or quadratic performance trajectories, $\gamma_{11,}$ *t*(95) = 0.65, *ns*, and $\gamma_{21,}$ *t*(95) = -0.81, *ns*, respectively. Hypothesis 2 was also not supported. Although performance-avoid orientation was significantly negatively related to task performance, $\gamma_{03,}$ *t*(95) = -1.99, *p* = .049, it did not moderate either the linear, $\gamma_{13,}$ *t*(95) = -1.64, *ns*, or quadratic, *t*(95) = 0.45, *ns*, $\gamma_{13,}$ performance

2 Results presented are based on a model with a homogenous error structure. A model with an autoregressive error structure was significantly different from the unrestricted model, χ^2 (427) = 675.99, *p*<.001, however it was not significantly different from the model with a homogenous error structure, χ^2 (1) = 2.27, *p*<.001. Therefore, we report results from the more parsimonious homogenous model. The substantive interpretation of results did not differ between the homogenous and autoregressive models.

trajectories. Hypothesis 3 was supported. Performance-approach orientation significantly moderated the linear trajectory, $\gamma_{12,}$ $t(95) = 3.67$, $p = .001$. As seen in Figure 1, individuals with high performance-approach orientation improved their task performance at a faster rate than those with low performance-approach orientation.

Hypotheses 4-6 predicted that interactions among the goal orientations would moderate the task performance growth trajectory. Hypothesis 4 predicted that individuals with high performance-approach orientation and high mastery orientation would learn at the fastest rate; however this prediction was not supported. The interaction between performance-approach orientation and mastery orientation was not significant, $\gamma_{04,}$ $t(95) = 0.19$, *ns*, and did not moderate the linear, $\gamma_{14,}$ $t(95) = 1.32$, *ns*, or quadratic trajectories, $\gamma_{24,}$ $t(95) = -0.11$, *ns*. Hypothesis 5 was supported. The interaction between performance-avoid orientation and mastery orientation moderated the linear trajectory, $\gamma_{15,}$ $t(95) = -2.78$, $p = .007$. As seen in the lower graph of Figure 2, individuals with low performance-avoid orientation and high mastery orientation improved their task performance scores at the fastest rate. Hypothesis 6 was supported. The interaction between performance-avoid orientation and performance-approach orientation moderated the linear trajectory, $\gamma_{16,}$ $t(95) = 2.85$, $p = .006$. As seen in the top graph of Figure 3, individuals with high performance-avoid orientation and low performance-approach orientation improved their task performance at the slowest rate[3].

Effect Sizes

The introduction of predictors into an HLM model results in reductions in variance components. These reductions can be seen to represent the proportion of the relevant variance (inter- or intra-individual) that is accounted for by the new set of predictors (Smillie et al., 2006). They can therefore be utilized to calculate effect sizes (comparable to R^2 values in standard regression, Zickar & Slaughter, 1999). A comparison of the variance components from the null and growth models indicated that the linear and quadratic growth trajectories accounted for 30% of the

[3] A follow-up model indicated that the three-way interaction among the goal orientation dimensions significantly predicted the *quadratic* trajectory (but not the linear trajectory). However, this parameter increased rather than decreased the explained variance in the model, which casts doubt on the validity of this result.

intra-individual variability (r_t) (18% of total variance) in performance scores. A comparison of the variance components from the growth and final models indicated that the goal orientation variables accounted for seven percent of the inter-individual variance around the performance intercept (U_0) (3% of total variance) and six percent of the parameter variance around the linear trajectory (U_1) (.004% of total variance). The goal orientation interactions accounted for an additional 2 percent of the inter-individual variance around the performance intercept (.62% of total variance) and a further 9 percent of the parameter variance around the linear trajectory (.005% of total variance).

Discussion

This research sought to investigate the effects of dispositional goal orientation profiles on task performance growth trajectories. At a theoretical level, this research has extended goal orientation theories by considering interactions involving mastery orientation and the *two* forms of performance orientation. Consequently, we have demonstrated novel empirical findings. For example, individuals with low performance-approach and high performance-avoid orientation improved their performance at a slower rate than individuals with other combinations of these two goal orientations. In addition, individuals with high mastery and low performance-avoid orientation improved their performance at a faster rate than individuals with other combinations of these two goal orientations, replicating previous findings generated by a generic performance orientation measure. In the following sections we discuss the theoretical and practical implications of our research findings, in addition to potential limitations of the study and avenues for future research.

Goal Orientations and Growth Trajectories

Two of the key findings from this study relate to dispositional performance-avoid orientation and its interactions with dispositional mastery and performance-approach orientations. As predicted, the interaction between performance-avoid and mastery orientations moderated the performance growth trajectory. Individuals with high mastery *and* low performance-avoid orientations improved their performance at the fastest rate. Early theorists proposed that the best combination should be high mastery and *high* performance orientations, because some focus on normative outcomes is important in achievement contexts (Dweck & Leggett, 1988; Maehr, 1983, cited in Harackiewicz et al., 1997; Veroff, 1969; Wentzel, 1991). However, these early theorists were conceptualizing a generic performance orientation which blurred the approach and avoid components. Recent theory and research (Elliot & Church, 1997; Payne et al., 2007) support the notion that performance-avoid orientation is a distinct construct; and that this *avoid*-oriented focus on normative outcomes is consistently maladaptive. For this reason, we expected that a high mastery orientation coupled with a *low* performance-avoid orientation would be associated with the fastest rate of skill acquisition. We used a pure measure of performance-avoid orientation and replicated Yeo and Neal's (2004) finding generated by a generic measure of performance orientation (Button et al., 1996). This replication is important because it makes a methodological, in addition to an empirical contribution. Button et al.'s (1996) measure of performance orientation does not separate approach and avoid aspects of the orientation. In a recent meta-analysis, Payne et al. (2007) coded Button et al.'s measure as performance-*approach* orientation because they believed the items tended to reflect this dimension more so than performance-avoid orientation. Although this may be true at face value, it appears that, at least in Yeo and Neal's (2004) study, the avoid-oriented items were more influential in the prediction of task performance.

It is important to note that although the main effect of performance-avoid orientation was significant, it was not moderated by the growth curve. Also, mastery orientation did not have a significant main effect, nor did it moderate the growth curve. The latter result replicated Yeo and Neal's (2004) finding, despite the different measure and more ecologically valid scoring system used in our study. It is also consistent with Payne et al.'s (2007) meta-analysis that demonstrated a non-significant effect of dispositional mastery orientation on task performance. Other researchers have also started to question the widely held belief that mastery orientation will always translate into superior performance (e.g. DeShon & Gillespie, 2005; Elliot et al., 2005), suggesting that its consistent beneficial effects may be limited to other outcomes such as interest or enjoyment (Harackiewicz, Barron, Tauer et al., 2002; Pintrich, 2000b). A potential explanation for this null effect relates to our sample and the nature of the task we used[4]. When conceptualizing mastery-related orientations, Nicholls (e.g., Nicholls, 1984; Nicholls, Cheung, Lauer, & Patashnick, 1989) emphasizes the acquisition of knowledge and skill that is meaningful to the individual. It is possible that some of the students in our sample who were high on dispositional mastery orientation were not particularly motivated to acquire and improve competence on the ATC task we asked them to perform. Mastery orientation may have predicted the performance growth rate if we had sampled air traffic control trainees or assessed domain-specific mastery orientation.

Nevertheless, our findings still demonstrated that dispositional mastery orientation can have a positive impact on the rate of skill acquisition in combination with a low performance-avoid orientation, but repeated measurements are required to observe this pattern. More generally, our findings emphasize the importance of a growth curve modeling approach, because if we had not examined the more complex interactive relationships over time, we would have made the erroneous conclusion that mastery orientation was not relevant to performance in this skill acquisition context, and would not have discovered the importance of time when considering the effects of performance-avoid orientation.

A related methodological issue is that although the multilevel analyses did not demonstrate a main effect of mastery orientation on task performance, the strongest and only significant zero-order correlation between goal orientation and average task performance was with mastery orientation. This pattern of results illustrates that results from zero-order correlation and multilevel analyses can produce different findings. Multilevel analyses control for the different sources of variance at multiple levels of analysis (in this case, the repeated measurements of task performance vary within individuals, whereas average levels of task performance and dispositional goal orientations vary between individuals). This example underscores the importance of matching the analysis technique with the research hypotheses in question.

[4] We thank our Associate Editor, Ruth Butler, for this suggestion.

Another key finding relates to the interaction between dispositional performance-avoid and performance-approach orientations and how it moderates the task performance growth trajectory. First, it is important to note that as expected, performance-approach orientation moderated the task performance growth trajectory – individuals with high performance-approach orientation improved their performance scores at a faster rate than their counterparts. This novel finding supports our theoretically driven argument that dispositional performance-approach orientation is beneficial in skill acquisition contexts that allow for success because it is associated with adaptive approach-oriented ego management activities such as focusing on performance indicators in an effort to achieve goals (Brown, 2001; S. Fisher & Ford, 1998; Radosevich, Vaidyanathan, Yeo, & Radosevich, 2004). Our finding extends previous empirical research concerning performance-approach orientation and performance at one or two time points in an academic context (Church et al., 2001; Elliot & Church, 1997; Elliot et al., 1999; Harackiewicz et al., 1997; Harackiewicz et al., 2000; Harackiewicz, Barron, Tauer et al., 2002). Interestingly, our finding is inconsistent with Payne et al.'s (2007) meta-analysis which demonstrated a non-significant relationship between dispositional performance-approach orientation and task performance, however, as noted earlier, their analysis included studies that used a measure of generic performance-orientation and analyses focused on single measurements of performance rather than growth trajectories. Our finding regarding performance-approach orientation is in the opposite direction to the one demonstrated by Yeo and Neal (2004) which used a generic performance orientation measure. Combined with the fact that our finding regarding the interaction between mastery and performance-avoid orientation was the same as Yeo and Neal's mastery X generic performance orientation interaction, these results underscore the importance of using pure measures of performance-approach and performance-avoid orientations.

The findings relating to the interaction among performance-avoid and approach orientations indicated that individuals with a high performance-avoid and low performance-approach orientation improved their performance at the slowest rate. In other words, a high performance-approach orientation buffered the negative effect of performance-avoid orientation. This finding is consistent with our prediction drawn from goal orientation theories. In isolation, a high performance-avoid orientation is expected to have a detrimental effect on skill acquisition because the individual is expected to engage in maladaptive, avoid-oriented activities such as self-handicapping and effort withdrawal (Elliot et al., 2005). However, if this individual also has a high performance-approach orientation, he/she is expected to engage in some approach-oriented activities such as goal-setting and persistence (Elliot et al., 2005; Payne et al., 2007). These positive strivings should diminish the negative effect of performance-avoid orientation. To our knowledge, there is no existing theoretical or empirical research related to this relationship. Our finding is important for at least two reasons. First, it demonstrates the distinction between the two forms of dispositional performance orientation, and second, not only does it demonstrate that dispositional performance-approach orientation can be beneficial for performance, it suggests that it can act as a buffer of the maladaptive effects of dispositional performance-avoid orientation.

Our third moderation hypothesis concerned the interaction between dispositional performance-approach and mastery orientations. This interaction did not moderate the task performance growth trajectory. Drawing on goal orientation theories (Elliot & Church, 1997; Pintrich, 2000a), we expected that a combination of high mastery and high performance approach orientations would be associated with the fastest rate of skill acquisition because some focus on (approach-oriented) normative outcomes is important in achievement contexts. A potential explanation for this null finding relates to situations or time points in which mastery orientation is expected to be necessary for performance. Some researchers have suggested that the true benefits of mastery orientation emerge in terms of knowledge or skill retention (rather than initial learning), emerge over a longer time frame than that used in the present task, or emerge in terms of transfer to different tasks (e.g. Yeo & Neal, 2004). For example, Elliot and McGregor (1999) found that although mastery oriented students performed no better than others in terms of exam performance, they did outperform other students on a later follow-up test of the same material[5]. It follows that mastery orientation may be particularly important for performance in the automation phase of skill acquisition, when it is vital to focus attention toward the task for the purpose of maintaining or continuing to improve performance levels. If this is the case, the interaction between performance-approach and mastery orientations might moderate the performance growth trajectory during a longer performance session. This might also explain why mastery orientation did not moderate the task performance growth trajectory. However, this suggestion does not explain why mastery orientation interacted with performance-avoid orientation in the current context, unless mastery orientation is important for understanding the effects of performance-avoid orientation during an earlier phase of skill acquisition than for performance-approach orientation.

Boundary Conditions and Extensions

An important question is whether our findings will generalize to other samples and task contexts, considering that these results were based on undergraduate students engaged in a laboratory task. Research contexts do not need to have high ecological validity to generalize inferences across populations, settings and variables (Highhouse, in press). What we do need is external validity, which can in part be achieved via psychological fidelity, in which the task features induce psychological processes that emulate those found in other relevant contexts. The ATC task used in the current study (Loft et al., 2004) has sound psychological fidelity. It is a novel, challenging task which includes demands such as decision-making, judging the relative arrival times of moving objects, maintaining vigilance, balancing speed with accuracy, and working under time pressure. Therefore, the present findings could be expected to generalize to real-world tasks that require similar psychological processes.

A related question concerns the mechanisms behind the results we have demonstrated here and the role that the task context may play in drawing conclusions. For example, *why* did

[5] Please note that a follow-up analysis of these data (as reported in Harackiewicz, Barron, Pintrich et al., 2002) indicated that the interaction between mastery and performance-approach orientations did not predict performance on the follow-up test. However, this analysis involved only one measurement of performance. The point here is that if the effects of mastery orientation on performance take time to emerge, then any effects of mastery orientation on performance growth trajectories may only emerge over extended periods of observation.

individuals with high dispositional mastery and low dispositional performance-avoid orientation learn at a faster rate than individuals with any other combination of mastery and performance-avoid orientations? An obvious explanation is that individuals' dispositional goal orientation profiles translated into similar domain-specific (i.e. task-specific) goal orientation profiles. Self-regulatory constructs may also explain why certain goal orientation profiles appear to be most beneficial for performance growth rates. The results from Payne et al.'s (2007) meta-analysis suggest that self-regulatory constructs such as self-efficacy, goal level, learning strategies, feedback seeking and anxiety might be useful in this regard. However, we did not measure domain-specific goal orientations or self-regulatory activity, nor did we account for the fact that these constructs are likely to change over time in response to features of the task environment. These are limitations which should be remedied in future research. Indeed, existing theory and research suggests that features of the task environment such as performance feedback, specificity of goal content and performance contingencies can influence the impact of goal orientations on achievement outcomes (e.g. Dweck, 1986; Elliot et al., 2005; Seijts, Latham, Tasa, & Latham, 2004). For example, theory suggests that performance-approach orientation may have a negative impact on performance after initial or repeated failure (Dweck, 1986; Elliot, 1997). In our task, participants received genuine trial-by-trial feedback on their performance score in a context in which most individuals demonstrated performance improvements over time. A high performance-approach orientation may not buffer the negative effects of a high performance-avoid orientation on the rate of skill acquisition in contexts in which individuals are provided with more consistent negative feedback (for example, false negative feedback, or always framing feedback in terms of how many people the individual performed worse than) and/or in more difficult tasks.

Practical Implications

The significant interactions involving dispositional performance-avoid orientation may have practical implications. For example, assessment of dispositional goal orientation profiles may form a useful part of a training needs analysis. This type of information may indicate which individuals are likely to learn at a faster/slower rate than others and could be used to design individualized training plans. Further, research has shown that goal orientations can be induced via situational characteristics (Mangos & Steele-Johnson, 2001; Martocchio, 1994; Steele-Johnson, Beauregard, Hoover, & Schmidt, 2000; Tabernero & Wood, 1999; Wood & Bandura, 1989), suggesting that interventions might be an effective way of ensuring that trainees adopt the most beneficial goal profile. The current findings suggest that the common view of performance-avoid orientation as inherently maladaptive may not be entirely accurate. That is, in certain situations, a high dispositional performance-avoid orientation may not necessarily be worse than a low performance-avoid orientation. For example, our results suggest that this is the case for individuals who have a high dispositional performance-approach orientation. Thus, encouraging positive competition (e.g., by outperforming others) may facilitate skill acquisition rates for trainees with a tendency to worry about performing poorly relative to others. However, as noted earlier, further research is needed to determine whether our findings regarding dispositional goal orientation can be generalized to domain-specific goal orientations (DeShon & Gillespie, 2005). More significantly, research is required to clarify the impact of, and interactions between, dispositional and situationally induced goal orientations. Such findings would aid both theory and practice by placing goal orientation in a broader person X situation framework.

Conclusion

This study has made important contributions to the goal orientation literature. We have drawn on goal orientation theories to generate novel predictions regarding goal orientation profiles and task performance growth trajectories. In doing so, we demonstrated novel empirical findings. For example, a high performance-approach orientation buffered the negative effect of a high performance-avoid orientation on the rate of skill acquisition. We also demonstrated important replications using pure measures of performance-approach and performance-avoid orientation. For example, individuals with high mastery and low performance-avoid orientation learnt at a faster rate than individuals with any other combination of these two goal orientations. In combination, our research demonstrates the importance of distinguishing theoretically, methodologically and empirically between the approach and avoidance forms of performance orientation. It also emphasizes the importance of using a repeated measures design and growth curve modeling strategy when examining goal orientation effects on performance. These findings are of theoretical and practical significance, and highlight interesting avenues for future research into goal orientation profiles and growth trajectories.

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Table 1

Descriptive Statistics and Intercorrelations Between Variables at the Inter-individual Level

Variable	M	SD	Task Performance	Mastery orientation	Performance-approach orientation	Performance-avoid orientation
Task performance	39.42	53.21	-			
Mastery orientation	5.83	.72	.24*	-		
Performance-approach orientation	4.75	1.13	.13	.14	-	
Performance-avoid orientation	3.51	1.07	-.17	-.30**	.34***	-

* p<.05. ** p<.01. *** p<.001.

Note. The goal orientation dimensions were measured on a scale that ranged from 1-7.

Table 2

Final Model – Fixed Effects

Fixed effects	Coefficient	Standard error
Midpractice intercept, β_{0i}		
Intercept, γ_{00}	36.67	6.44
Mastery orientation, γ_{01}	9.43	6.44
Performance-approach orientation, γ_{02}	9.32*	4.54
Performance-avoid orientation, γ_{03}	-11.40*	5.72
Mastery orientation x Performance-approach orientation, γ_{04}	1.19	6.23
Mastery orientation x Performance-avoid orientation, γ_{05}	-6.12	6.36
Performance-approach orientation x Performance-avoid orientation, γ_{06}	8.42*	4.17
Linear growth trajectory, β_{1i}		
Intercept, γ_{07}	2.99	0.26
Mastery orientation, γ_{11}	0.24	0.38
Performance-approach orientation, γ_{12}	0.59**	0.16
Performance-avoid orientation, γ_{13}	-0.37	0.22
Mastery orientation x Performance-approach orientation, γ_{14}	0.39	0.30
Mastery orientation x Performance-avoid orientation, γ_{15}	-0.85**	0.30
Performance-approach orientation x Performance-avoid orientation, γ_{16}	0.46**	0.16
Quadratic growth trajectory, β_{2i}		
Intercept, γ_{20}	-0.10	0.03

Mastery orientation, γ_{21}	-0.03	0.04
Performance-approach orientation, γ_{22}	-0.02	0.02
Performance-avoid orientation, γ_{23}	0.01	0.02
Mastery orientation x Performance-approach orientation, γ_{24}	-0.003	0.03
Mastery orientation x Performance-avoid orientation, γ_{25}	0.03	0.03
Performance-approach orientation x Performance-avoid orientation, γ_{26}	-0.02	0.02

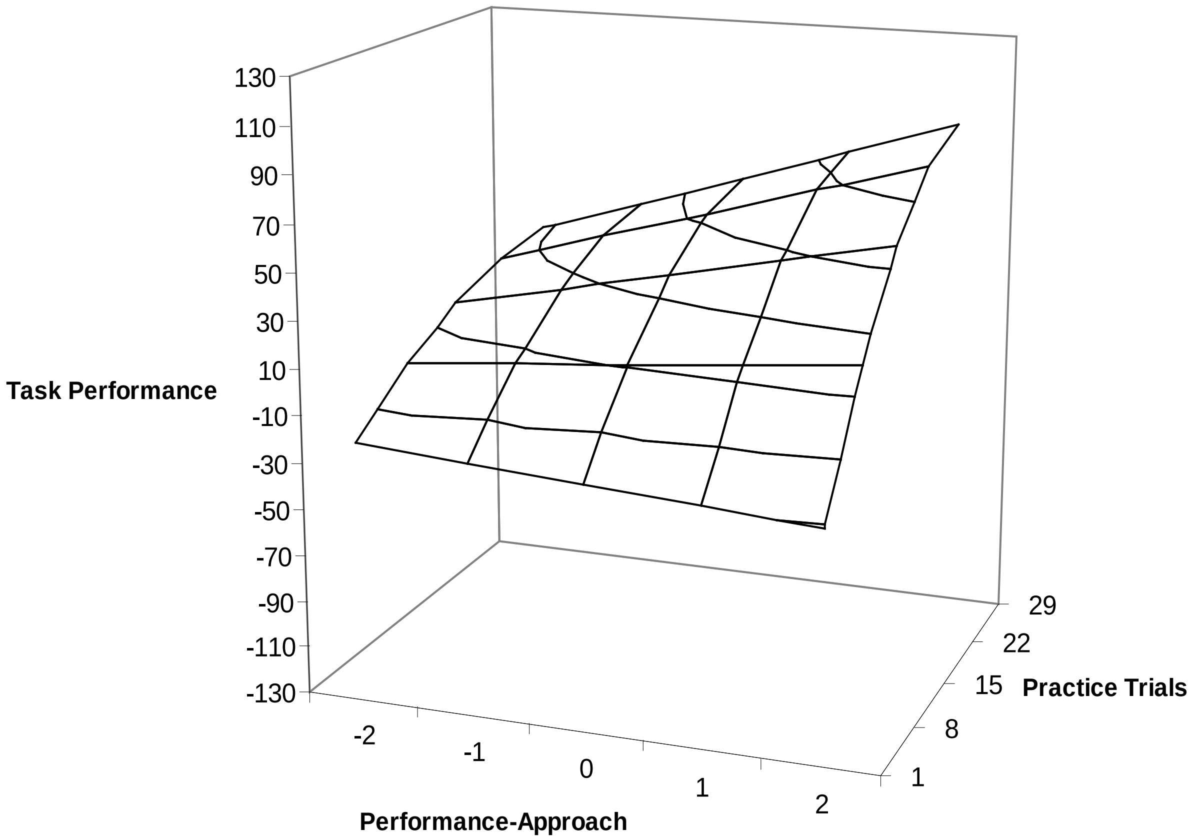
* p<.05. ** p<.01. *** p<.001.

Figure Captions

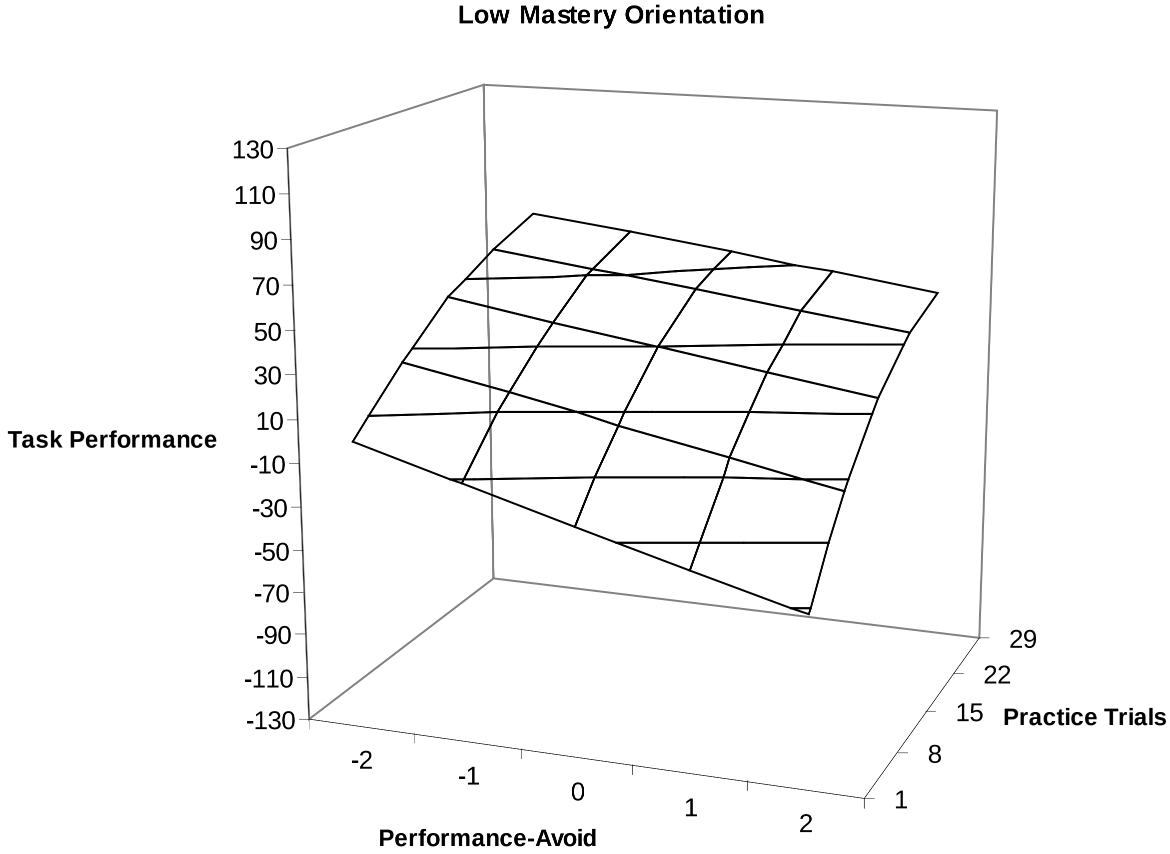
Figure 1. Performance-approach orientation as a moderator of the performance growth trajectory.

Figure 2. The interaction between mastery orientation and performance-avoid orientation as a moderator of the performance growth trajectory.

Figure 3. The interaction between performance-avoid orientation and performance-approach orientation as a moderator of the performance growth trajectory.



130
110
90
70
50
30
10
-10
-30
-50
-70
-90
-110
-130
Task Performance
29
22
15
8
1
Practice Trials
-2
-1
0
1
2
Performance-Approach


Low Mastery Orientation
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Performance-Avoid
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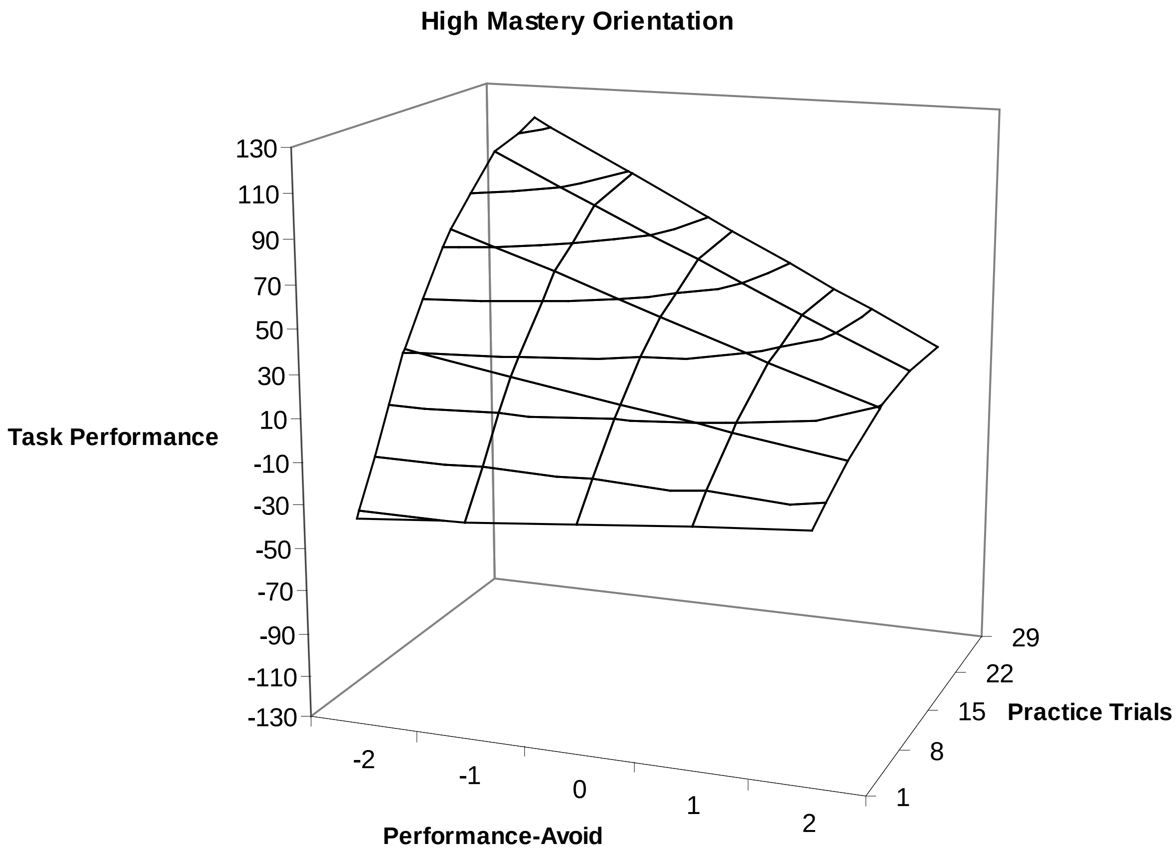
Practice Trials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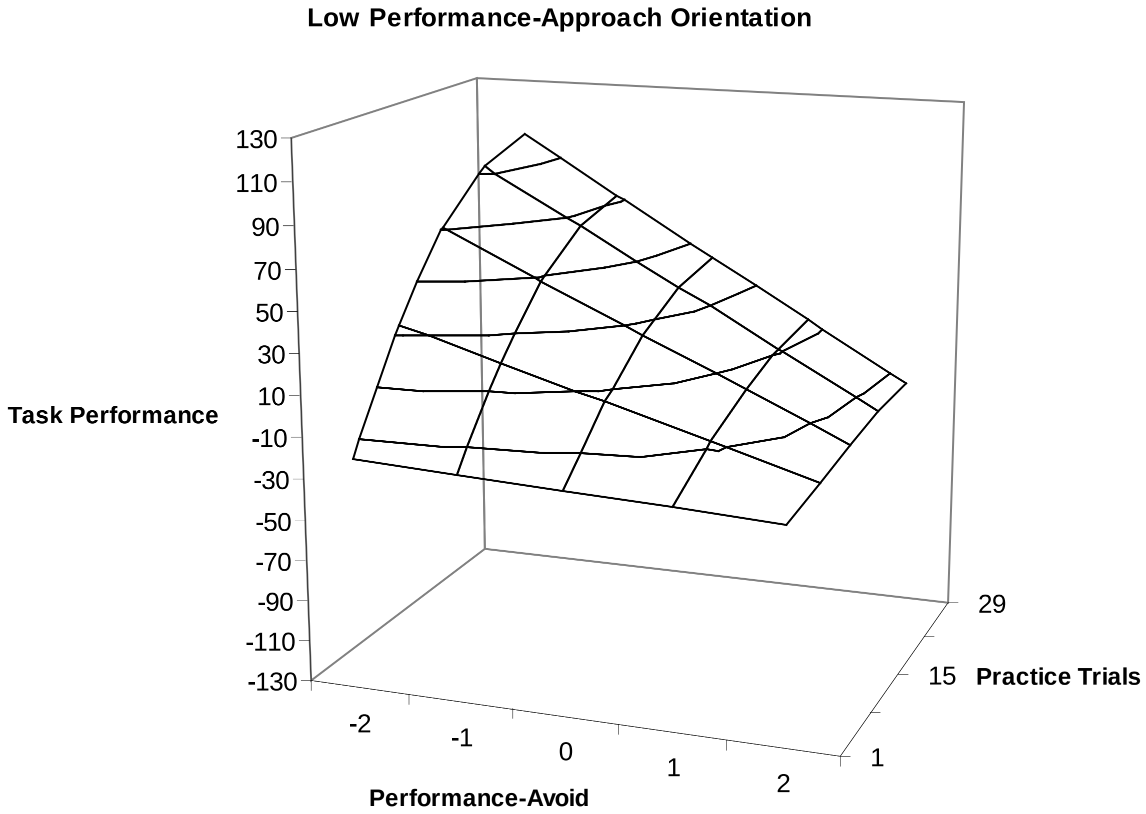
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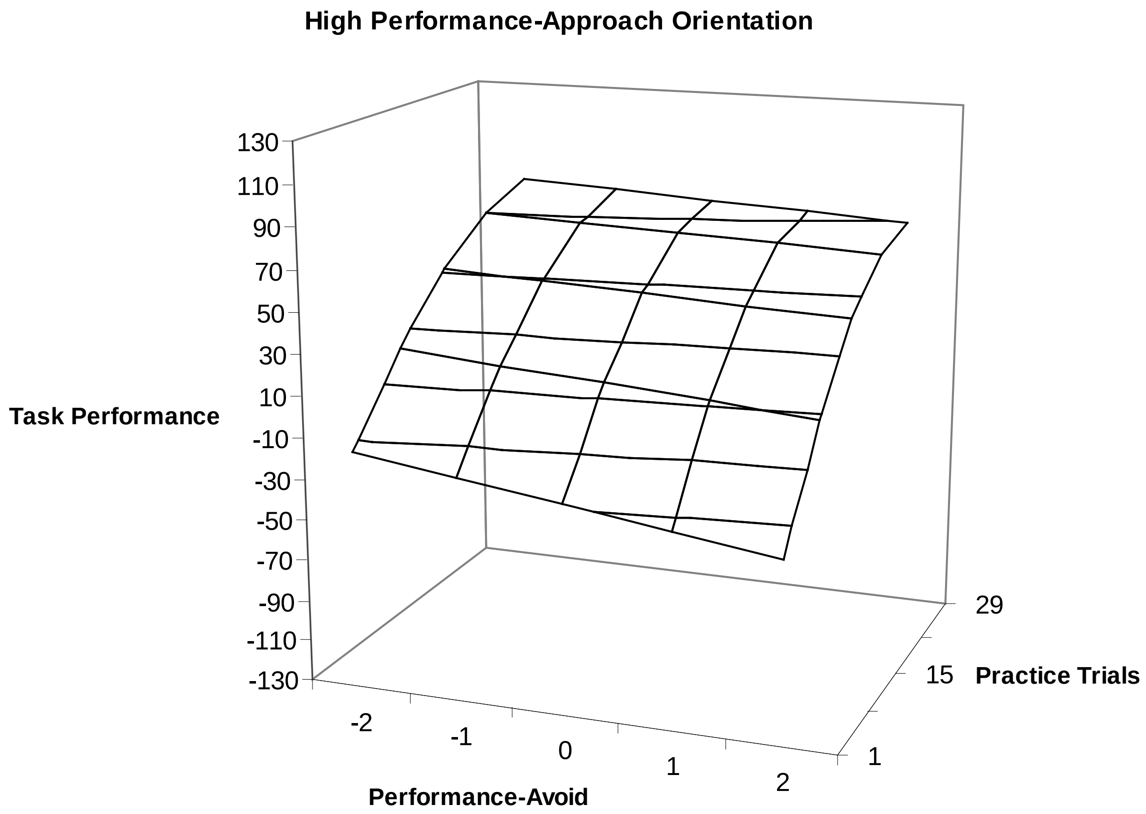
High Performance-Approach Orientation
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