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The Influence of Flow on Standard and Adaptive Performance in Teams

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THE INFLUENCE OF FLOW ON STANDARD AND ADAPTIVE PERFORMANCE IN TEAMS

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Jennifer N. Baumgartner ENTITLED The Influence of Flow on Standard and Adaptive Performance in Teams BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF Master of Science

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ABSTRACT

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The purpose of this study was to examine flow as it relates to different types of performance in teams. Participants ($N = 165$) in teams of five engaged in an airport simulation that included an unforeseen change during the second session. Flow was expected to be positively correlated with standard and adaptive performance and predict performance along with cognitive ability and personality. Positive affect was expected to mediate the relationship between flow and performance. Flow was positively correlated with the number of aircraft departed under standard conditions, negatively correlated with aircraft departed under adaptive conditions, and positively correlated with subjective ratings of adaptive performance. Cognitive ability and extraversion positively predicted duty adaptive performance. The relationship between flow and subjective adaptive performance was partially mediated by positive affect. Findings suggest that flow is deleterious for performance requiring adaptive responses and inflates reports of subjective adaptive performance partially through positive affect.

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I. INTRODUCTION

Technology influx, cultural diversity, and global competition place increasing demands on workers to be resilient in the face of novel or changing work situations (Connaughton & Shuffler, 2007; Ilgen & Pulakos, 1999; Quinones & Ehrestein, 1997). Impermanence and change occurring in jobs and organizations is a present-day reality, and adaptation is of critical importance. One strategy in which organizations enhance adaptability is by structuring work in teams. Teams may be more adaptive than individuals because collectives have a broader repertoire of capacities, experiences, and networks to draw on when engaging in performance that may confer resilience in the face of novel stressors (Zaccaro & Bader, 2003). However, some research has shown that work may be derailed by teams (Salomon & Globerson, 1989). Derailing typically occurs when one or more team members do not expend their efforts as expected or do not subscribe to the team goal. Consequently, the team is ineffective.

Adaptation is a manifestation of team effectiveness under conditions of unforeseen change. The construct of adaptive performance emerged through the goal of maintaining effective job performance in the context of novel stressors or unforeseen change. Research has attempted to understand adaptive performance by exploring individual differences in cognitive ability and personality to enhance the selection of an adaptive workforce (Pulakos, Arad, Donovan, & Plamondon, 2000). Although individual differences predict who is more likely to adapt, little is known about psychological states that may also confer adaptive performance. The purpose of this study was to examine flow, a positive valence state, and its predictive utility of performance in teams.

Adaptive Performance

Challenging and dynamic or changing tasks require adaptation. Team adaptation manifests in the innovation of new or modification of existing structures, capacities, and/or goal-directed behaviors (Burke, Stagl, Salas, Pierce, & Kendall, 2006). Adaptive performance is emergent within team adaptation and reflects the capacity to resist vulnerability to novel stressors through effective coping with task or job demands (Ilgen & Pulakos 1999; LePine, 2005; Schneider, Stokes, & Lyons, 2011). This capacity to adapt to novel or changing situations has been examined in the domain of organizations to better understand and improve job performance (Ilgen & Pulakos, 1999; LePine 2005; Pulakos et al., 2000). For example, Pulakos and colleagues (2000) performed a content analysis of over 1,000 critical incidents from over 21 different jobs and developed an 8-dimension taxonomy of adaptive performance (see Appendix A for a summary). Subsequent exploratory and confirmatory factor analyses indicated a good fit for the 8-factor model (Pulakos et al., 2000; Pulakos et al., 2002). The taxonomy was organized into eight adaptive behaviors (dimension names italicized) starting with *handling emergencies or crisis situations*, which is characterized by reacting with appropriate urgency in life threatening, dangerous, or emergency situations. Next is *handling work stress* by maintaining resilience when confronted with challenging situations and managing negative emotions by directing efforts to constructive solutions. *Solving* *problems creatively* is defined by generating innovative ideas in complex situations. Another dimension is *dealing with uncertain and unpredictable work situations* by taking effective action despite the inherent ambiguity in the situation. Adaptive performers *learn work tasks, technologies, and procedures* enthusiastically and actively keep knowledge and skills current. *Interpersonal adaptability* is defined as demonstrating flexibility and open-mindedness when working with others, listening to and considering their viewpoints, and altering opinions when appropriate. Next is *demonstrating cultural adaptability* by embracing diversity and integrating the needs and values of other groups into the work culture. Lastly, adaptive performers are *physically adaptable* because they adjust to challenging environmental demands as necessary for the job.

Predictors of adaptive performance in individuals. Research has examined numerous variables that may predict the ability of individuals to adapt and function well when confronted with unexpected changes. Pulakos and colleagues (2002) examined cognitive, non-cognitive, and personality variables, and their ability to predict supervisor ratings of adaptive performance in military personnel. Supervisors completed two measures of adaptive performance. The first measure was a set of eight behaviorally-based rating scales constructed to reflect the taxonomy of adaptive behaviors. The second measure asked supervisors to rate how effective each soldier was at handling situations requiring adaptability. The findings showed that cognitive ability, openness to experience, emotional stability (the inverse of neuroticism), and achievement motivation significantly predicted adaptive performance. In this study, achievement motivation referred to the desire to achieve results and master tasks beyond expectation. Coupled with dependability, achievement motivation is a major component of conscientiousness (Hough, 1992; Pulakos et al., 2002). Another study examined decision-making performance before and after unforeseen changes in the task context (LePine, Colquitt, & Erez, 2000). Participants engaged in a computerized task where they made rule-based decisions about the characteristics of unidentified aircraft. Unbeknownst to the participants, a change in the rules determining correct characteristics was introduced. Thus, rapid and effective relearning needed to occur to effectively make correct decisions. The findings showed that cognitive ability predicted pre-change decision-making performance. Similarly to Pulakos and colleagues (2002), cognitive ability also predicted post-change performance, in addition to facets of conscientiousness such as dependability (order, dutifulness, and deliberation) and openness to experience.

Predictors of adaptive performance in teams. LePine (2005) extended the findings of adaptive performance in individuals and examined variables that may predict adaptive performance in teams. Performance was evaluated as pre- and post-change decision-making performance in the context of an experimentally induced communication disruption. Consistent with prior research in individuals, cognitive ability was a positive predictor of adaptive performance in teams. Adaptive performance was also influenced by an interaction of perceived goal difficulty and team goal orientation. Teams composed of members with high-learning orientation and who worked toward goals perceived as difficult were rated higher in adaptive performance. In this study, learning orientation reflected the desire to understand something novel or to increase competence in a task.

Taken together, the research of adaptive performance in individuals and teams suggest that an adaptive team should be staffed of members who are high in cognitive ability, are dependable, are emotionally stable and open to experience, and are motivated by learning and achievement. Although these stable variables are useful for predicting who is more likely to adapt, they do not consider the state or transient phenomenology of the individual that may also facilitate adaptation.

Although rarely examined in regard to adaptive performance, psychological states have been linked to enhanced performance. Stressor appraisals are one psychological state that confers advantages for performance. Stressor appraisals are psychological evaluations about the personal relevance of a situation in relation to the ability to cope with the demands of the situation (Schneider, 2004; Tomaka, Blascovich, Kibler, & Ernst, 1997). Such evaluations are comprised of primary and secondary appraisals (Lazarus & Folkman, 1984; Schneider, 2004, 2008). Primary appraisals are evaluations of the personal relevance of a situation in relation to individual goals, values, and beliefs. Secondary appraisals are evaluations of resources for coping with the demands of the situation. The interplay of primary and secondary evaluations produces appraisals that range from challenge to threat (Blascovich & Mendes, 2000; Lazaurs & Folkman, 1984; Schneider, 2004, 2008). Challenge appraisals result when evaluations of personal resources are commensurate with or exceed evaluations of demands. Threat appraisals result when evaluations of personal resources are outweighed by evaluations of demands. Research has shown that performance during a stressor can be enhanced by challenge relative to threat (Gildea Schneider, & Shebilske, 2007; Schneider, 2004, 2008), suggesting that performance outcomes are largely dependent on whether people believe they can cope with situational demands. Stressor appraisals have also been linked to adaptive performance in teams (Schneider, Stokes, & Lyons, 2011; Stokes, 2008). Teams comprised of members in a state of threat were less successful at adapting; whereas teams comprised of members in a state of challenge were more successful at adapting. Although stressor appraisals are one psychological state that predicts different types of performance, research is needed to examine additional states.

Flow

Flow is another psychological state that has been linked to enhanced performance, with some research suggesting that flow is the psychological state underlying peak performance (Jackson & Roberts, 1992; McInman & Grove, 1991). Flow is a positive valence state of consciousness that manifests when the perceived challenges associated with a task match the capabilities of an individual to perform or meet the demands of the task (Csikszentmihalyi, 1990). Flow is considered a pleasurable state and is accompanied by positive emotions (Csikszentmihalyi, 1990; Csikszentmihalyi & LeFevre, 1989; Rogatko, 2009). Personal narratives of flow often include descriptions of feeling happier, joyous and content, and having more concentration and creativity (Csikszentmihalyi, 1975; Csikszentmihalyi & LeFevre, 1989). People who have experienced flow are motivated to engage in activities that induce flow and seek out challenging tasks (Csikszentmihalyi, 1990, 1993; Jackson & Marsh, 1996). Consequently, flow can be considered a highly functional state that itself fosters enhanced performance (Engeser & Rheinberg, 2008).

Flow dimensions. Qualitative and quantitative research has identified nine dimensions of flow phenomenology (dimension names are italicized below; see Appendix B for a summary) (Csikszentmihalyi, 1990, 1993; Jackson & Marsh, 1996). The dimension that is particularly critical to flow is a *challenge-skill balance* where the challenges associated with a task meet the skill level to successfully cope with task demands. Frustration rather than flow occurs when challenges exceed skills. Boredom results when skills outweigh challenge. Second, there is a *merging of action and awareness.* This dimension is characterized by high engagement with the task where performance becomes automatic and spontaneous. There is little awareness of the self separate from the task. The third dimension is *clarity of goals*. An objective is defined clearly and one knows exactly how to perform the task to achieve those objectives. In the fourth dimension of flow, the task itself provides clear, immediate, and *unambiguous feedback* concerning progress towards achieving task objectives. The fifth dimension involves a high degree of *concentration on the task at hand.* Attention is maximally focused on the task, and there is an absence of distraction. The sixth dimension is a *sense of control* where the person does not actively engage in exerting control. The flow state is lost as soon as attention shifts to trying to assert or maintain control. The seventh dimension entails a *loss of self-consciousness* where all concerns for the self disappear, and the person becomes completely immersed in and engaged with the task. The eighth dimension of flow is characterized by a *transformation of time,* such that time alters perceptually, either slowing down or speeding up. Lastly, the ninth dimension of flow is the *autotelic experience* where the experience of flow is enjoyable and becomes intrinsically rewarding, motivating the person to return to the state again. Given these dimensions, flow should afford people with enhanced ability and skill capacity for effective performance.

Flow and individual performance. Research supports the link between flow and effective performance in individuals, and holds for subjective and objective performance criteria. In one study, athletes described experiences of peak, general, and poorer performance (Jackson & Roberts, 1992). Peak performance was defined as superior functioning, which resulted in personal bests and outstanding achievement. Independent raters coded performance descriptions with reference to flow dimensions, and flow scores were calculated. Results revealed that flow was experienced more during peak relative to general and poorer performance. For peak performance, athletes rated their challenge and skills to be in balance relative to poorer performance where challenge was rated as higher than skills. Athletes also frequently mentioned concentration and autotelic experience in descriptions of peak performance. Other research has found a link between flow and performance of elite athletes in an endurance race (Jackson, Thomas, Marsh, & Smethurst, 2001). Researchers collected self-reported flow, subjective performance ratings, and objective finishing position. Results revealed that the experience of flow predicted higher ratings of subjective performance and better finishing position. Challenge-skill balance, merging of action and awareness, and clear goals were key predictors of subjective and objective performance. Another study examined flow and performance on a final exam (Engeser & Rheinberg, 2008). College students performed a task to aid in their preparation for the exam and self-reported flow ten minutes into performing the task. Flow explained a significant amount of variance in performance beyond that of cognitive ability and prior knowledge, offering some support that flow is not just a function of high performance itself, but may actually play a causal role.

Flow and team performance. Flow can become a collective phenomenon given that members are working together on the same task, and as a positive valence state, may spread by a phenomenon known as emotional contagion (Schiepe-Tiska & Engeser, 2012). Emotional contagion is the tendency to automatically mimic facial expressions, vocalizations, postures and movements with those of another person, which facilitates interpersonal convergence of positive or negative emotions (Hatfield, Cacioppo, & Rapson, 1994). The effect is more likely and intense when individuals are participating in interdependent group activities, a hallmark of the team dynamic (Barsade, 2002; Hatfield et al., 1994). Emotional contagion can have beneficial effects on groups. Barsade (2002) found that group members who spread positive emotions experienced improved cooperation, decreased conflict, and increased perceived task performance. Research suggests that flow is capable of spreading to others. Bakker (2005) found a positive relationship between the experience of flow (i.e., absorption, work enjoyment, and intrinsic work motivation) in music teachers and the experience of flow in their students.

Research supports the link between flow and enhanced team performance. Research in sport psychology has shown that when team members report greater flow, their soccer games result in a tie rather than a loss (there was no difference with wins) (Bakker, Oerlemans, Demerouti, Slot, & Ali, 2011). These results highlight the importance of challenge-skill balance in inducing flow. In a tie, the challenge posed by an opponent is commensurate with the skills of the team. A win may sometimes represent opponents who do not pose a challenge-skill balance strong enough to induce flow. In contrast, a loss represents a challenge-skill mismatch between the opponent and team, and flow would be less likely to be experienced or disrupted. Other factors, such as the coach providing performance feedback and support, enhanced flow during the game. Flow also predicted higher self- and coach-ratings of performance. This study provides evidence that flow enhances subjective and objective team performance when conditions are present that foster flow.

Organizational researchers have found that flow enhances team performance. In one study, teams engaged in a project management simulation and then self-reported flow and team goal commitment (Aubé, Bunelle, & Rousseau, 2013). Researchers also assessed information exchange among teammates. Teams were instructed to build a scale model of a road vehicle using pieces in a construction set. Performance was evaluated by the extent to which the vehicle successfully traveled two given routes. Results showed that flow predicted team performance, and this relationship was mediated by individual commitment to team goals. The relationship of flow and performance was stronger the more the team communicated during the task. It is possible that flow at times facilitates less communication among teammates given a heightened concentration and disregard for time and self. Nevertheless, this study suggests that flow is compatible with interdependent teamwork, exchange of information, and enhanced performance. Overall, there appears to be a positive relationship between flow and performance in both individuals and teams, and in diverse tasks and domains. However, research has not examined the relationship between flow and performance in dynamic situations that require adaptive responses.

Mechanisms. Although flow has been linked to individual and team performance, the mechanisms linking flow to enhanced performance are less clear. Emotion may be one mechanism that facilitates better performance outcomes during the experience of flow. According to Csikszentmihalyi (1975), positive emotions are sustained during flow because people are completely immersed in the task and are utilizing their capabilities to their fullest. Performance of the task itself is experienced as rewarding. During the experience of a stressor, flow states should facilitate positive affect and their associated challenge appraisals (Schneider, 2004; 2008; Schneider, Baumgartner, & Capiola, under review). Similar to the dimension of challenge-skill balance, challenge appraisals manifest when people evaluate their resources are relatively commensurate with stressor demands. The flow experience is described as a positive experience that should foster positive emotions, and coupled with challenge-skill balance, should assist in sustaining coping efforts on dynamic and challenging tasks.

Hypotheses

Based on the extant literature, the following hypotheses were drawn:

H1: Standard performance would be positively correlated with adaptive performance and self-/peer-report adaptive performance.

H2: Flow would be positively correlated with standard performance, adaptive performance, and self-/peer-report adaptive performance.

H3: Flow, cognitive ability, and personality would predict standard performance, adaptive performance, and self-/peer-report adaptive performance.

H4: Positive state affect would mediate the relationship between flow and standard performance, adaptive performance, and self-/peer-report adaptive performance.

II. METHOD

Participants

One hundred and sixty-five people (age $M = 24$, $SD = 7$) participated in exchange for partial course credit in an introduction to psychology course ($n = 108$, 65%) or monetary compensation. The majority were male ($n = 104$, 63%). Of those who reported their race/ethnicity, the majority were Asian ($n = 71$, 43%), followed by White ($n = 63$, 38%), Black ($n = 14$, 9%), Hispanic ($n = 7$, 4%), American Indian ($n = 2$, 1%), and Pacific Islander ($n = 1$, 0.5%). Seven participants (4%) reported being of other race/ethnicity. Participants were assembled into 33 teams comprised of 5 members.

Task Simulation

Computer-based Aerial Port Simulation (CAPS). Researchers developed the Computer-based Aerial Port Simulation (CAPS) to provide a research tool to study performance in virtual teams (Lyons, Stokes, Palumbo, Seyba, & Ames, 2006). The CAPS software simulates logistics operations associated with an aerial port squadron. A team is composed of five networked computer stations: (a) passenger services, (b) fleet services, (c) cargo services, (d) ramp services, and (e) air terminal operations flight (ATOF). A sixth computer serves as the experimenter's station where the sequence of task activities is initiated and monitored. Passenger services processes, loads, and unloads all passengers. Fleet services cleans the aircraft and stocks the aircraft for the new passengers. Cargo services processes in-bound and out-bound cargo, which includes sequencing cargo for pick-up by ramp services. Ramp services unloads and transports inbound cargo to the cargo bay and loads outbound cargo to the aircraft. The ATOF monitors and directs the sequencing of all activities in the aerial port and provides all information regarding the aircraft to the other four stations/teammates.

The stations are interdependent. For example, fleet services should not clean the aircraft until passenger services has unloaded all passengers. Similarly, cargo services should not process in-bound cargo until ramp services transports and unloads the cargo. Teammates must coordinate and communicate their individual duties to achieve the shared goal of preparing aircraft for timely departure. A virtual component of CAPS is the instant message (IM) system, which was created to facilitate task communication. Participants use the IM system to send text-based messages to teammates individually or globally (see Appendix C).

CAPS incorporates a training phase, which consists of general and specific training, as well as hands-on practice. The training is described more fully in the procedure. Following training, the experimenter generated two 30-minute tasks sessions. Session 1 began immediately after each participant indicated they were ready to proceed and included five aircraft and required processes that were consistent with training. The aircraft arrived one at a time and were separated by six minute increments. Participants were instructed to perform their duties in sequential order and communicate their progress or concerns to their teammates via the IM system.

Consistent with session 1, session 2 involved maintenance of five aircraft, but the process was more complex. The first three aircraft required processes that were similar to training. However, upon departing the third aircraft, a disturbance requiring adaptation was introduced. The disturbance was announced via an IM sent to all team members, and stated there was a destination change and all passengers and cargo for the third aircraft must be repurposed. The passengers and cargo already loaded had to be removed to accommodate new passengers and cargo for the new destination. Two minutes into repurposing, communication links in the IM system became dysfunctional. A red box with a message stating, "Communication Link is Down" notified participants of the breakdown. Participants had to reroute information through previously unused pathways, which they had to discover on their own. For example, with the communication link between cargo and ramp services down, team members had to route information through other team members, namely fleet and passenger services. In short, the last two aircraft required adaptive responses to efficiently repurpose aircraft and cope with a communication breakdown. Consequently, CAPS includes three components that require adaptation: (1) an aircraft is redirected and repurposed, (2) communication channels experience a breakdown, and (3) task completion requires interdependency of teammates.

Objective performance

Objective performance scores were calculated for each teammate based on required task duties. The calculations were based on the sum of a series of yes (one point awarded) to no (zero points awarded) questions. For example, for fleet services this sum was based on whether (a) the aircraft was cleaned, (b) the correct number of meals was delivered, (c) the meals were transferred to the correct aircraft, and (d) the meals were placed on the correct aircraft. Also a part of this sum was a point for each duty performed in the appropriate sequence relative to the other team members' duties. One point was awarded if the duty was performed in the appropriate sequence or one point was taken away if the duty was performed out of sequence. Individual performance scores were calculated for each aircraft in a session using this format. A total of ten individual performance sums were calculated for each of the five aircraft in session 1 and five aircraft in session 2.

Duty standard performance. Performance sums for the first eight aircraft were considered *standard performance* because the situation was consistent with training. A composite sum was created by adding the 5 aircraft sums in session 1 to the 3 aircraft sums in session 2 to represent duty standard performance.

Duty adaptive performance. Performance sums for the repurposing event and communication failure in session 2 were considered *adaptive performance* due to the increased complexity and ambiguity inherent in these events. A composite sum was created from the last 2 aircraft in session 2 to represent duty adaptive performance.

Four raters were trained to code duty standard and adaptive performance data. To investigate consistency in coding, a multivariate analysis of variance (MANOVA) was computed with the rater as the independent variable and the performance coding for each of the 10 aircraft as the dependent variables. There was a significant multivariate effect of rater on performance coding, Wilks' Lambda (30, 443) = 1.72, $p < .05$, suggesting that different raters had different sums. Bonferonni corrections revealed which raters different from the others in the 10 sums. Table 1 displays the pattern of results showing that some raters significantly and systematically coded differently for some aircraft compared to other raters. For aircraft 1, 2, 6, 9, and 10, raters A and C tended to be higher than raters B and D. Outliers were assessed by examining means and standard deviations for each coder relative to the total mean for all raters. All means were within 3 standard deviations of the total mean. There were no adjustments or transformations conducted on coding because of the systematic nature of the coding and the lack of true outliers.

Subjective performance

Self-/peer-report adaptive performance. Griffin and Hesketh's (2003) adaptive performance rating scale obtained subjective reports of adaptive performance. Twenty items measured seven dimensions of adaptive performance as proposed by Pulakos and colleagues (2000). Physical adaptability was excluded because it was irrelevant to the task. Participants rated their own adaptive performance and the adaptive performance of their teammates using a 7-point response format ranging from 1 = *performed very poorly* to 7 = *performed very well*, with the option of responding *not applicable*. A one-way analysis of variance (ANOVA) was computed to assess similarity in ratings across self and peers. Ratings were not significantly different, $F(4, 159) = .78, p = .54$, and were therefore collapsed to create a single score per participant. Sample items are as follows with dimension names italicized: *handling crisis situations*: "Was able to take an alternative course of action to deal with a new and urgent priority," *problem solving*:

"Was able to look at problems from many different angles," *new learning*: "Learned new skills, knowledge, or ways of doing things to keep up to date with the changing situation," *interpersonal adaptability*: "Was flexible and open-minded when dealing with teammates," *cultural adaptability*: "Integrated well with teammates of a different background or culture," *copes with uncertainty*: "Was able to function in the face of uncertainty or ambiguity," and *copes with stress*: "Remained calm and composed when faced with demanding workloads." The full scale demonstrated high reliability, $\alpha = .99$.

Materials

Cognitive ability. The Wonderlic Personnel Test (Wonderlic, 1983) assessed general cognitive ability. The Wonderlic is a 50-item, paper-based, and 12-minute timed test of general verbal, mathematical, and analytical abilities. Reported test-retest reliability ranges from .82 to .94, and internal consistency ranges from .88 to .94 (Wonderlic, 1983). Scores were calculated by summing correct items.

Personality. The International Personality Item Pool-Five Factor Model (IPIP-FFM: Goldberg, 1999) assessed conscientiousness, extraversion, and agreeableness. Participants rated their agreement with each item on a 7-point response format ranging from 1 = *strongly disagree* to 7 = *strongly agree*. An example of a conscientious item is, "I am always prepared." An example of an extraversion item is, "I know how to captivate people." An example of an agreeableness item is, "I have a good word for everyone." The reliabilities were as follows: conscientiousness $\alpha = .78$, extraversion $\alpha = .77$, and agreeableness $\alpha = .67$.

Flow. The flow scale was adopted from the Flow State Scale (FSS) (Jackson & Marsh, 1996) developed for use in sports settings, and the Flow in Computer Game Play Scale (FCGP) (Fang, Zhang, & Chan, 2013). For the present study, items were selected based on appropriateness for the experimental task and reported factor loadings on each flow dimension. As recommended by Tabachnick & Fidell (1989), items were considered if they loaded at least .40 on each flow dimension. Two items were selected to represent each of the nine dimensions. Seventeen items were selected from Jackson and Marsh (1996), and one item was selected from Fang and colleagues (2013), for a total of 18-items. This item total is shorter than the aggregate of the two scales to decrease participant burden and fatigue. Participants reflected on the task session and rated items on a 5-point response format ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Sample items are as follows with dimension names italicized: *challenge-skill balance*: "My abilities matched the high challenge of the task," *action-awareness*: "I did things spontaneously and automatically without having to think," *clear goals*: "My goals were clearly defined," *unambiguous feedback*: "I could tell by the way I was performing how well I was doing," *concentration*: "I was completely focused on the task," *sense of control*: "I had a feeling of total control," *loss of self-consciousness*: "I was not concerned with how I was presenting myself," *transformation of time*: "It felt like time stopped while I was performing the task," and *autotelic experience*: "The experience left me feeling great." Scores were calculated by averaging items into a composite score for session 1 ($\alpha = .82$) and session 2 ($\alpha = .83$).

State Affect. The Positive and Negative Affect Scale (PANAS: Watson, Clark, & Tellegen, 1988) obtained reports of state affect. Participants rated twenty items regarding their feelings at the time of administration using a 5-point response format ranging from 1 = *slightly or not at all* to 5 = *extremely*. The positive items are attentive, interested, alert, excited, enthusiastic, inspired, proud, determined, strong, and active. The negative items are distressed, upset, hostile, irritable, scared, afraid, ashamed, guilty, nervous, and jittery. Scores were calculated by averaging positive and negative items for each session: positive affect session 1 ($\alpha = .87$), negative affect session 1 ($\alpha = .83$), positive affect session 2 ($\alpha = .84$), and negative affect session 2 ($\alpha = .84$).

Demographics. Demographic information included age, sex, and ethnicity.

Manipulation check. Manipulation checks assessed whether participants perceived session 2 as more difficult and requiring more adaptation than session 1. The item responses ranged from 1 = *not at all* to 5 = *extremely*. Two items assessed perceived difficulty and adaptability requirements, respectively: "In your opinion, how difficult was the task?" and "To what degree do you feel you had to adjust or adapt your behavior to cope with the task demands?"

Procedure

Participants provided demographic information and completed the personality scales before arriving to the lab. Upon arrival, participants were randomly assigned to one of five computer stations where they remained throughout the experimental session. After obtaining written informed consent, participants completed the Wonderlic. Then, participants received task instructions and training, followed by two 30-minute task sessions. The full experiment was approximately 2.5-hours.

Training was approximately 30-minutes and began as a self-directed PowerPoint presentation. Participants could proceed through the presentation at their own pace and were permitted to page-back to review slides. The presentation included general and specific training slides. General training slides provided an introduction to airport operations and overall goals of the task. Specific training slides detailed the duties of each team member, including individual goals and responsibilities, points of contact, and keyboard-related training to accomplish specific task activities. Participants were quizzed after the presentation to ensure comprehension of the material and were provided answers to questions they answered incorrectly. A hands-on practice session commenced after the presentation, which allowed participants to familiarize themselves with the task and their teammates. Training slides were available in a drop-down menu for reference. Participants were encouraged to ask the experimenter questions during the full training phase.

Participants proceeded to the first 30-minute task session following training. At the end of the session, participants completed the manipulation check and PANAS via computer. Participants then completed the flow scale via pen and paper. Session 2 commenced when each participant completed session 1 scales. At the end of session 2, participants completed the manipulation check, PANAS, and the self-/peer-report adaptive performance scale via computer. Participants then completed the flow scale via pen and paper. Participants were debriefed.

III. RESULTS

Manipulation check

Participants perceived significantly more difficulty in session 2 ($M = 2.93$, $SD = 1.15$) relative to session 1 ($M = 2.70$, $SD = 1.12$), $t(164) = 32.66$, $p < .01$. Participants perceived more adaptive behavior was required in session 2 ($M = 3.70$, $SD = 1.04$) relative to session 1 ($M = 3.32$, $SD = 1.05$), $t(164) = 45.60$, $p < .01$. Thus, consistent with the intent of CAPS, participants rated session 2 as more difficult and as requiring more adaptive responses than session 1.

General relationships among study variables

Table 2 displays descriptive statistics and bivariate correlations of study variables. Figures 1-3 provide a visual representation of the distribution of performance variables: duty standard performance, duty adaptive performance scores, and self-/peer-report adaptive performance. Flow measured after session 1 was strongly and positively correlated with flow measured after session 2. Flow measured after session 1 and 2 was strongly and positively correlated with positive affect measured after session 1 and 2, respectively. Figures 4 and 5 provide a visual representation of the relationship between flow and positive affect. Flow measured after session 1 was significantly and positively correlated with agreeableness.

Hypothesis 1. To test hypothesis 1, that standard performance would be positively correlated with adaptive performance, bivariate correlations were computed for duty standard performance, duty adaptive performance, and self-/peer-report adaptive performance. Table 2 shows that duty standard and adaptive performance were significantly and positively correlated. Figure 6 provides a visual representation of the relationship between duty standard and adaptive performance. However, there was no relationship between duty standard performance and self-/peer-report adaptive performance.

Hypothesis 2. To test hypothesis 2, that flow would be positively correlated with standard and adaptive performance, bivariate correlations were computed for flow, duty standard performance, duty adaptive performance, and self-/peer-report adaptive performance. There were no relationships between flow and duty standard and adaptive performance. However, flow was significantly and positively correlated with self-/peer-report adaptive performance. Figure 7 provides a visual representation of the relationship between flow and self-/peer-report adaptive performance.

Hypothesis 3

To test hypothesis 3, that flow, cognitive ability, and personality would predict duty standard and adaptive performance, hierarchical regression analyses were computed. Positive affect was controlled for in all regression analyses because of the high correlation of flow measured after session 1 with positive affect measured after session 1, and flow measured after session 2 with positive affect measured after session 2.

Duty standard performance. Table 3 shows that the first block included positive affect and significantly and positively predicted duty standard performance, $F(1,159) = 4.17, p < .05$, accounting for 3% of the variance. The second block added cognitive ability, conscientiousness, extraversion, agreeableness, and flow and explained a significant increment of 5% of the variance in duty standard performance, $F(6,159) = 2.27, p < .05$. Only positive affect significantly and positively predicted duty standard performance. Conscientiousness was marginally significant, tending to positively predict duty standard performance, $p = .08$.

Duty adaptive performance. Table 4 shows that the first block included duty standard (prior) performance and positive affect and significantly predicted duty adaptive performance, $F(2,159) = 41.21, p < .01$, accounting for 34% of the variance. Only duty standard performance significantly and positively predicted duty adaptive performance. The second block added cognitive ability, conscientiousness, extraversion, agreeableness, and flow and explained a significant increment of 6% variance in duty adaptive performance, $F(7,159) = 14.30, p < .01$. Duty standard performance, cognitive ability, and extraversion significantly and positively predicted duty adaptive performance. Flow was marginally significant, tending to negatively predict duty adaptive performance, $p = .08$.

Self-/peer-report adaptive performance. Table 5 shows that the first block included positive affect and significantly and positively predicted self-/peer-report adaptive performance, $F(1,159) = 24.31, p < .01$, accounting for 13% of the variance. The second block added cognitive ability, conscientiousness, extraversion, agreeableness, and flow and explained a significant increment of 8% of the variance in self-/peer-report adaptive performance, $F(6,159) = 6.75, p < .01$. Positive affect and flow significantly and positively predicted self-/peer-report adaptive performance. Cognitive ability was marginally significant, tending to positively predict self-/peer-report adaptive performance, $p = .06$.

Hypothesis 4

Meditation analysis was used to test hypothesis 4, that positive affect would mediate the relationship between flow and performance. Table 2 shows that flow was uncorrelated with duty standard and adaptive performance, preventing mediation analysis. Flow was significantly and positively correlated with positive affect and self-/peer-report adaptive performance. Thus, a mediation analysis was computed to investigate whether the relation of flow with self-/peer-report adaptive performance was mediated by positive affect.

Self-/peer-report adaptive performance. Three regressions were computed to test for mediation. The first two equations show the mediator and dependent variable are related to the independent variable, and the third assesses the predictive utility of the independent variable with the mediator present (Baron & Kenny, 1986; Kenny, Kashy, & Bolger, 1998). Flow was entered as the independent variable, positive affect was entered as the mediator, and self-/peer-report adaptive performance was entered as the dependent variable. First, self-/peer-report adaptive performance was regressed on positive affect. Second, self-/peer-report adaptive performance was regressed on flow. Finally, self-/peer-report adaptive performance was regressed on positive affect and flow simultaneously. The first two equations revealed that positive affect ($\beta = .37, p < .01$)

and flow ($\beta = .40, p < .01$) significantly predicted self-/peer-report adaptive performance. The third equation revealed that both flow ($\beta = .29, p < .05$) and positive affect ($\beta = .20, p < .05$) significantly predicted self-/peer-report adaptive performance when positive affect was included in the model. The Sobel test was significant ($z = 3.03, p < .01$), indicating that the predictive utility of flow was significantly reduced by including positive affect into the model (Sobel, 1982). However, only partial mediation can be confirmed because both positive affect and flow remained significant when including positive affect into the model.

Additional analyses

Aircraft departed. Because of the lack of significant relationships between duty standard and adaptive performance and flow, additional analyses were conducted with a more simplified performance criterion that represented the team goal: departing aircraft. This is in contrast with duty standard and adaptive performance where performance was assessed by the number of duties performed and in correct sequential ordering. The maximum number of aircraft to depart was ten: five aircraft in session 1, three aircraft in session 2, one aircraft for the repurposing event, and one aircraft for the communication failure. One point was awarded if the aircraft departed. As with duty standard and adaptive performance, departed aircraft sums for the first eight aircraft were considered *standard performance*. A composite sum was calculated for session 1 and session 2 to represent aircraft departed standard performance. Departed aircraft sums for the repurposing event and communication failure were considered *adaptive performance*. A composite sum was created to represent aircraft departed adaptive performance. Figures 8 and 9 provide a visual representation of the distribution of aircraft departed standard and adaptive performance, respectively.

Exploratory analyses.

General relationships among study variables. Bivariate correlations were computed on aircraft departed standard and adaptive performance, flow, and positive affect. Aircraft departed standard performance was significantly and positively correlated with aircraft departed adaptive performance, $r = .46, p < .01$. Interestingly, aircraft departed standard performance was significantly and positively correlated with flow measured after session 1, $r = .15, p < .05$. Figure 10 provides a visual representation of this relationship. Aircraft departed standard performance was significantly and positively correlated with positive affect measured after session 1, $r = .17, p < .05$. Interestingly, aircraft departed adaptive performance was significantly and negatively correlated with flow measured after session 2, $r = -.18, p < .05$. Figure 11 provides a visual representation of this relationship. Aircraft departed adaptive performance was significant and negatively correlated with positive affect measured after session 2, $r = -.18, p < .05$. These results suggest that the higher degree of flow and positive affect experienced during session 1 was positively related to the number of aircraft departed under standard conditions. However, the higher degree of flow and positive affect experienced during session 2 was negatively related to the number of aircraft departed under adaptive conditions.

Mediation analyses. Because of the significant relationships between aircraft departed standard and adaptive performance, flow, and positive affect, mediation analyses were conducted to investigate whether the relationship of flow with aircraft departed was due to positive affect. For the first analysis, flow was entered as the independent variable, positive affect was entered as the mediator, and aircraft departed standard performance was entered as the dependent variable. First, aircraft departed standard performance was regressed on positive affect. Second, aircraft departed standard performance was regressed on flow. Finally, aircraft departed standard performance was regressed on flow and positive affect simultaneously. The first two equations revealed that flow predicted positive affect, $\beta = .60, p < .01$, and aircraft departed standard performance, $\beta = .16, p < .05$. The third equation did not demonstrate mediation. Aircraft departed standard performance was unrelated to both flow, $\beta = .10, p = .32$, and positive affect, $\beta = .11, p = .25$, when including positive affect into the model.

A second mediation analysis was conducted with flow entered as the independent variable, positive affect entered as the mediator, and aircraft departed adaptive performance entered as the dependent variable. The first two equations revealed that flow predicted positive affect, $\beta = .56, p < .01$, and aircraft departed adaptive performance, $\beta = -.18, p < .05$. The third equation did not demonstrate mediation. Aircraft departed adaptive performance was unrelated to both flow, $\beta = -.09, p = .32$, and positive affect, $\beta = -.13, p = .18$, when including positive affect into the model. Thus, positive affect did not mediate the relationship between flow and aircraft departed standard or adaptive performance.

IV. DISCUSSION

The present study examined flow as a novel predictor of different types of performance in teams. Standard performance was expected to be positively correlated with both objective and subjective measures of adaptive performance. Flow, cognitive ability, and personality were expected to positively predict standard, adaptive, and self-/peer-report adaptive performance. Lastly, positive state affect was expected to mediate the relationship between flow and performance. The hypotheses were partially supported.

The findings partially supported hypothesis 1 that there would be a positive relationship between standard performance, adaptive performance, and self-/peer-report adaptive performance. Duty standard performance was positively correlated with duty adaptive performance. Likewise, aircraft departed standard performance was positively correlated with aircraft departed adaptive performance. There was no relationship between duty standard and self-/peer-report adaptive performance, which may be due to measurement differences. The positive relationship between objective standard and adaptive performance suggests that effective performance under standard conditions is related to effective performance under conditions of unforeseen change. These findings replicate and extend research showing that future performance is best predicted by past performance (Hunter & Hunter, 1984; Owens & Schoenfeldt, 1979). The present study extends these findings by showing that standard performance predicts subsequent performance that requires adaptive responding.

The findings for hypothesis 2 that flow would be positively correlated with standard performance, adaptive performance, and self-/peer-report adaptive performance, was partially supported. There was no relationship between flow and duty standard and duty adaptive performance, but there was a significant and positive correlation between flow and self-/peer-report adaptive performance. Interestingly, exploratory analyses revealed that flow was significantly and positively correlated with aircraft departed standard performance. Based on the objective performance findings, flow does not predict the amount and accuracy of duties performed under standard conditions, but predicts whether an end result (depart aircraft) is achieved. This places the onus on the researcher or consumer to decide in a given situation which performance criteria is more important: the appropriate steps and sequence taken to achieve a goal or whether the goal was achieved in the end. For example, in sports settings it may be more important that the team won rather than all the intervening details that contributed to that win. In fact, research on flow and performance often measures performance in a goal-focused and binary manner (i.e., win/loss, yes/no) (see Aube et al., 2013; Jackson et al., 2001). The presents study showed that flow predicts performance under routine conditions and when the criterion for high performance is the end goal rather than the activities contributing to the end goal.

Hypothesis 3 that flow, cognitive ability, and personality would predict performance was assessed in three models. The first model examined the predictive utility of the variables on duty standard performance. Hypothesis 3 was not supported in this model. Only positive affect predicted duty standard performance. Conscientiousness was marginally predictive of duty standard performance. Although the hypothesis was not supported in the present study, the results replicated previous research by finding a relationship between positive affect and performance (Brief & Weiss, 2002; Lyubomirsky, King, & Diender, 2005). However, positive affect did not predict adaptive performance. This is supported by other research showing that positive affect relates to better performance in some situation but not others (Melton, 1995).

The next model examined the predictive utility of flow, cognitive ability, and personality on duty adaptive performance. Hypothesis 3 was partially supported in this model. Not surprisingly, duty standard (prior) performance was the best predictor of subsequent performance requiring adaptive responses. Cognitive ability and extraversion were the second strongest predictors of duty adaptive performance. Cognitive ability is a robust predictor of adaptive performance (Allworth & Hesketh, 1999; LePine et al., 2000; LePine, 2005; Pulakos et al., 2000; Stokes, 2008). This relationship is not surprising because cognitive ability reflects the capacity to process and learn information (Kanfer & Ackerman, 1989). Further supporting this finding is research showing that cognitive ability predicts performance on novel and complex tasks better than routine and simple tasks (Hunter & Hunter, 1984). The present findings extend past research by showing that extraversion predicts adaptive performance. In the present task, a feature of sociability may have conferred effective adaptive responding. Extraversion is beneficial when situations require interpersonal interaction (Barrick & Mount, 1991) and fosters help seeking among team members (Porter et al., 2003).

Unexpectedly, flow tended to negatively predict duty adaptive performance, and exploratory analyses revealed a significant and negative relationship between flow and aircraft departed adaptive performance. These findings suggest that flow is deleterious for situations requiring adaptive responding. There may be a number of factors that contributed to the derailing effects of flow on adaptive performance. Flow enhances performance in established teams, where team mates are familiar in interacting with one another through practices and matches (Bakker et al., 2011). These processes foster the development of shared mental models, which facilitate team effectiveness and performance (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). In addition to being newly formed teams, teammates were novices. Knowledge of the task was limited to training and a short amount of time engaging in the task before disruption occurred. Research suggests that experts relative to novices have a richer repertoire of knowledge and skills of the task domain, which promotes quick and effective encoding of new information and problem solving (Day, Arthur, & Gettman, 2001; Ericsson, 2006). These abilities and strategies often allow experts to perform more efficiently during dynamic and changing tasks (Cañas, Quesada, Antolí, & Fajardo, 2003). Another explanation for the negative relationship between flow and adaptive performance could be cognitive consequences of flow. One study found that flow facilitates narrow processing of information, or cognitive inflexibility (Keller, Bless, & Blomann, 2011). In the present study, effective adaptation required intensive information processing and cognitive flexibility to effectively and rapidly employ adaptive responding. Given that teams were newly formed and consisted of novices, the cognitive inflexibility fostered by flow may have worsened adaptive performance.

The last model examined the predictive utility of flow, cognitive ability, and personality on self-/peer-report adaptive performance. Hypothesis 3 was partially supported in this model. Flow was the strongest predictor of self-/peer-report adaptive performance. These findings suggest that team mates felt they were experiencing flow and they and their team mates were being adaptive. Flow fostered inflated reports of adaptability because objective adaptive performance was poorer when teammates believed they were in flow. Unlike objective adaptive performance, self-/peer-report adaptive performance was based on self-reports of team members and their team mates. Common method variance may have accounted for some of the relationship between flow, positive affect, and self-/peer-report adaptive performance, but because team mates also rated each other, effects of common method variance are less concerning.

Hypothesis 4 that positive affect would mediate the relationship between flow and performance was supported for self-/peer-report adaptive performance. Positive affect partially mediated the relationship between flow and self-/peer-report adaptive performance, suggesting that positive affect is part of the driving force behind flow and higher ratings of adaptive performance. Previous research has demonstrated reporting bias of mood, such that people in a positive mood are more likely to highly rate the self, health status, job satisfaction, and coping abilities (Lyubomirsky et al., 2005). It is possible that flow fostered positive affect, and this in turn, inflated reports of adaptability. Research supports positive affect as an emergent property of flow because people are performing challenging activities at peak efficacy and with intrinsic reward (Csikszentmihalyi, 1990; Csikszentmihalyi & LeFevre, 1989; Rogatko, 2009).

Limitations and future research

The present study has notable limitations. Much of the research on flow and performance is conducted in the field and in established teams; whereas the present study was conducted in a laboratory setting and with new teams consisting of novices. Research is needed to examine the relationship between flow and different types of performance in the field and with established and experienced teams. Emotional stability and openness to experience have been noted as the best predictors of adaptive performance in individuals and teams (LePine et al., 2000; LePine, 2005; Pulakos et al., 2000). Unfortunately, these variables were not assessed in the present study.

Future research should examine whether various flow dimensions better predict different types of performance. Factor analytic results may indicate that some dimensions are more or less beneficial for objective or subjective performance. For example, merging of action and awareness is the experience of performing automatically and spontaneously, which may be deleterious for employing adaptive responses. Some jobs, such as soldiers, flight commanders, and emergency response personnel, require more routine adaptive responding than other jobs (Pulakos et al., 2002). Future research should examine flow and adaptive performance in these types of jobs as people may exhibit a higher level of actual challenge-skill balance and expertise. Thus, flow may facilitate adaptive performance in these jobs.

Implications

The present study provides practical implications for the utility of flow in predicting different types of performance. The present study showed that flow is related to effective performance under routine conditions and when the team goal is the performance criterion. Another contribution is the finding that when team mates believe they are in flow, they erroneously believe they are adapting. Lastly, the present study provides some evidence that flow is detrimental to objective adaptive performance. Overall, for jobs or situations where the environment imposes unforeseen adaptability requirements to the established routine, flow would not be beneficial to performance as it biases perceptions of adaptability and hinders adaptive responding.

Conclusion

The present study examined the effects of traditional predictors and a novel state predictor, flow, on standard and adaptive performance in an interdependent task. Overall, the present research highlights that in some circumstances flow is beneficial or detrimental for performance in teams. Positive affect is one mechanism that partially links flow to inflated reports of adaptive performance. Findings revealed that flow can bias perceptions of adaptive performance under adaptive conditions and prevent teams from effectively employing adaptive responses during contexts of unforeseen change.

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FIGURES

Figure 1. **Duty Standard Performance Distrubution**

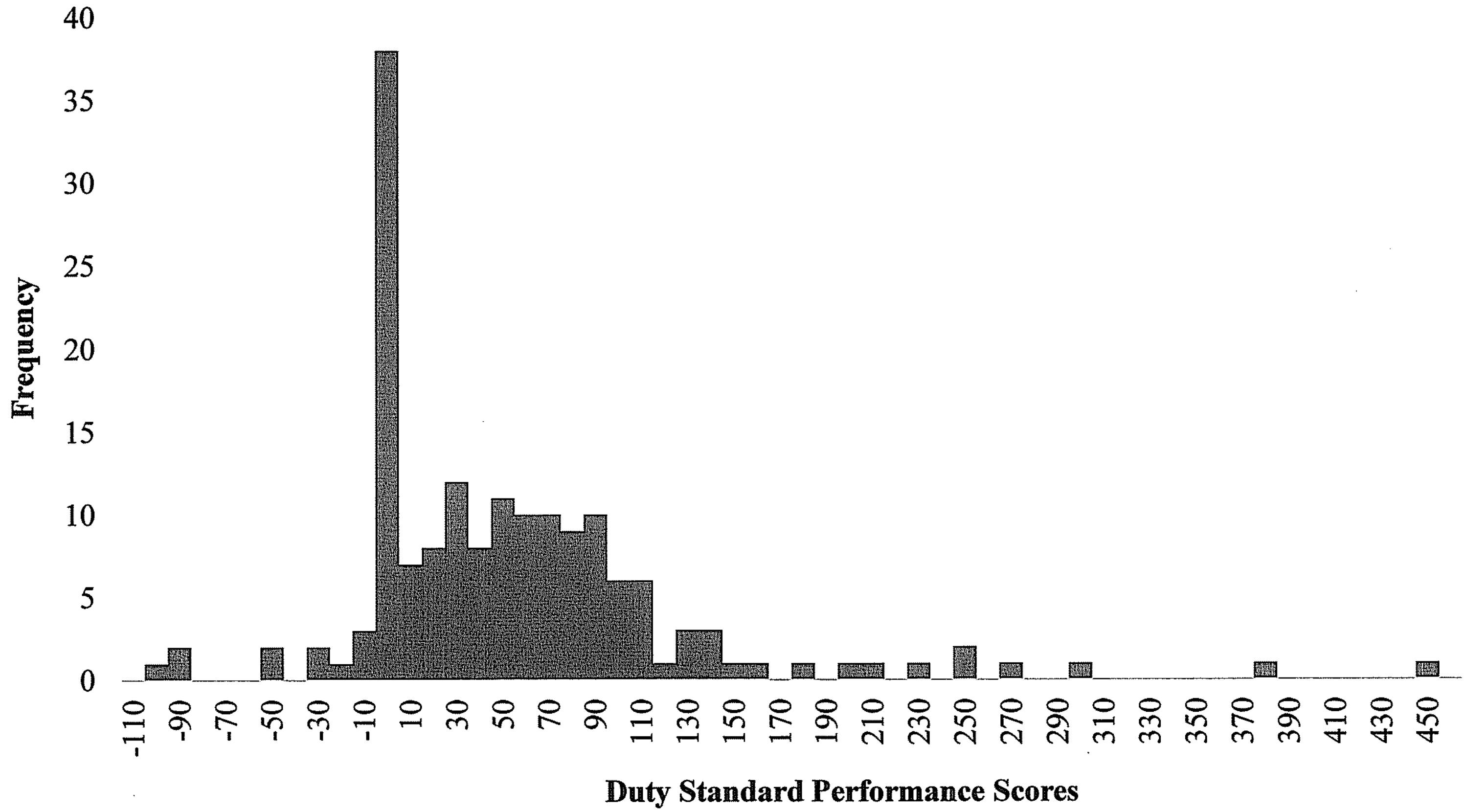


Figure 2. **Duty Adaptive Performance Distrubution**

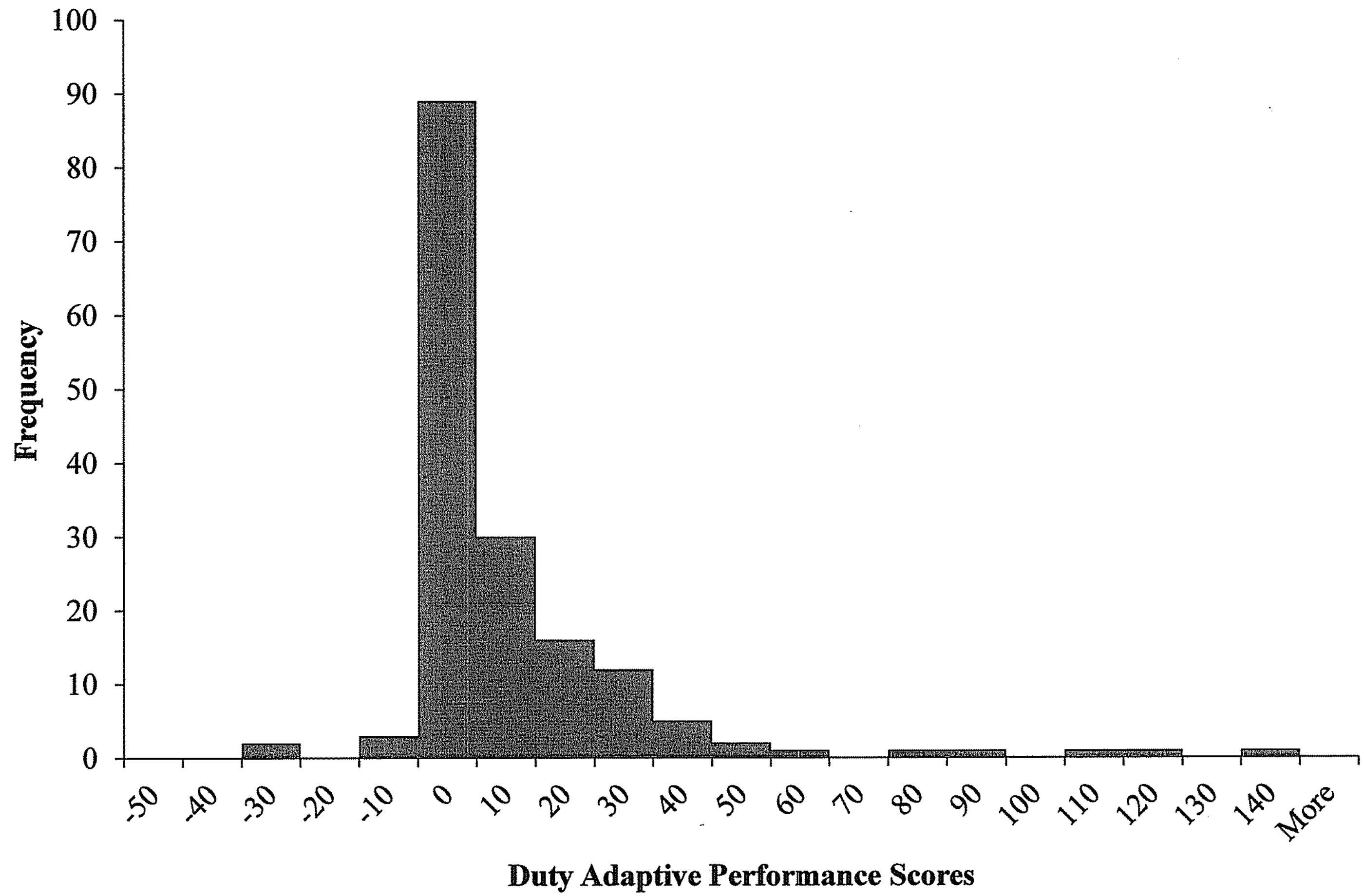
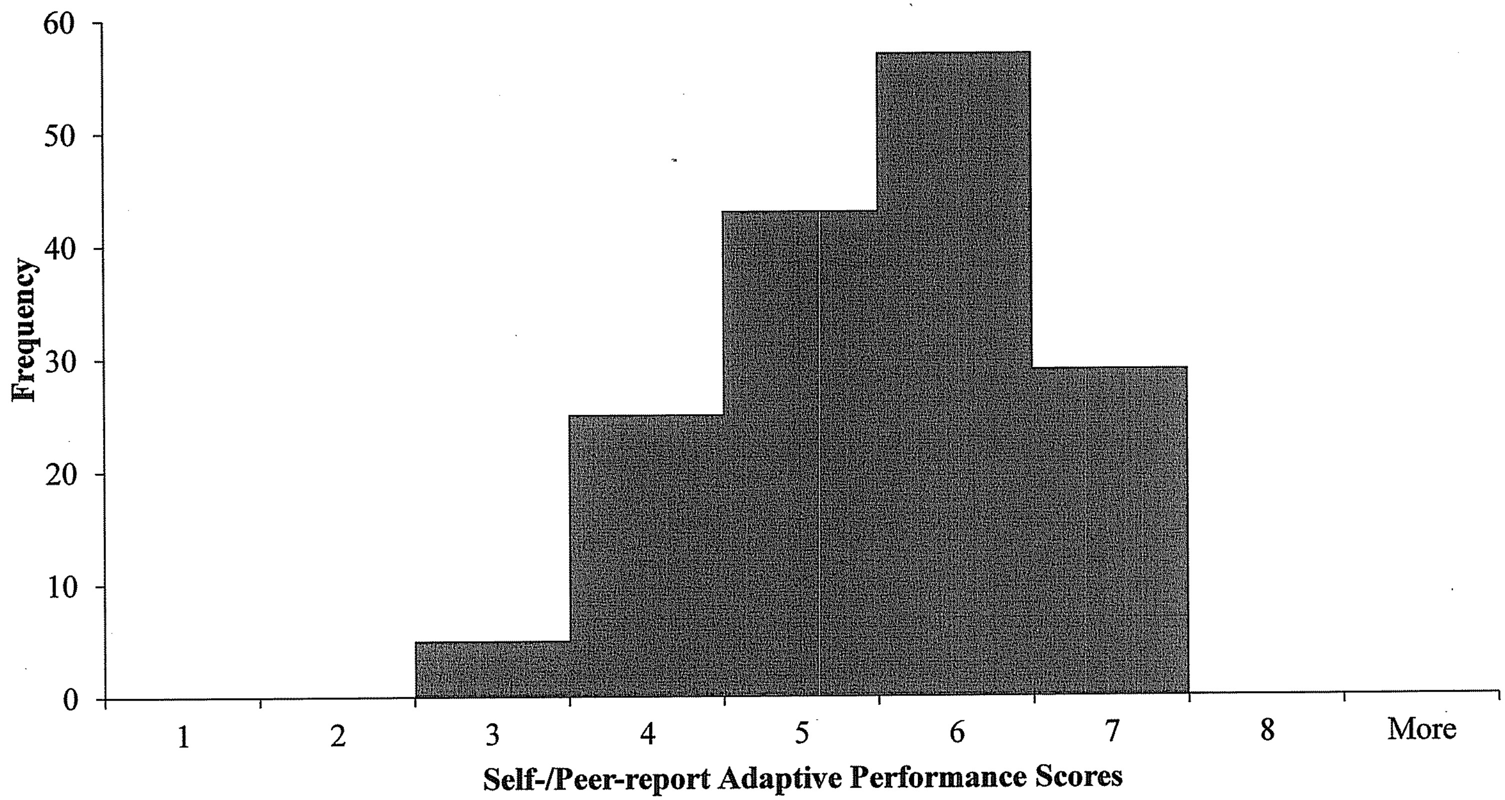


Figure 3. **Self-/Peer-report Adaptive Performance Distribution**



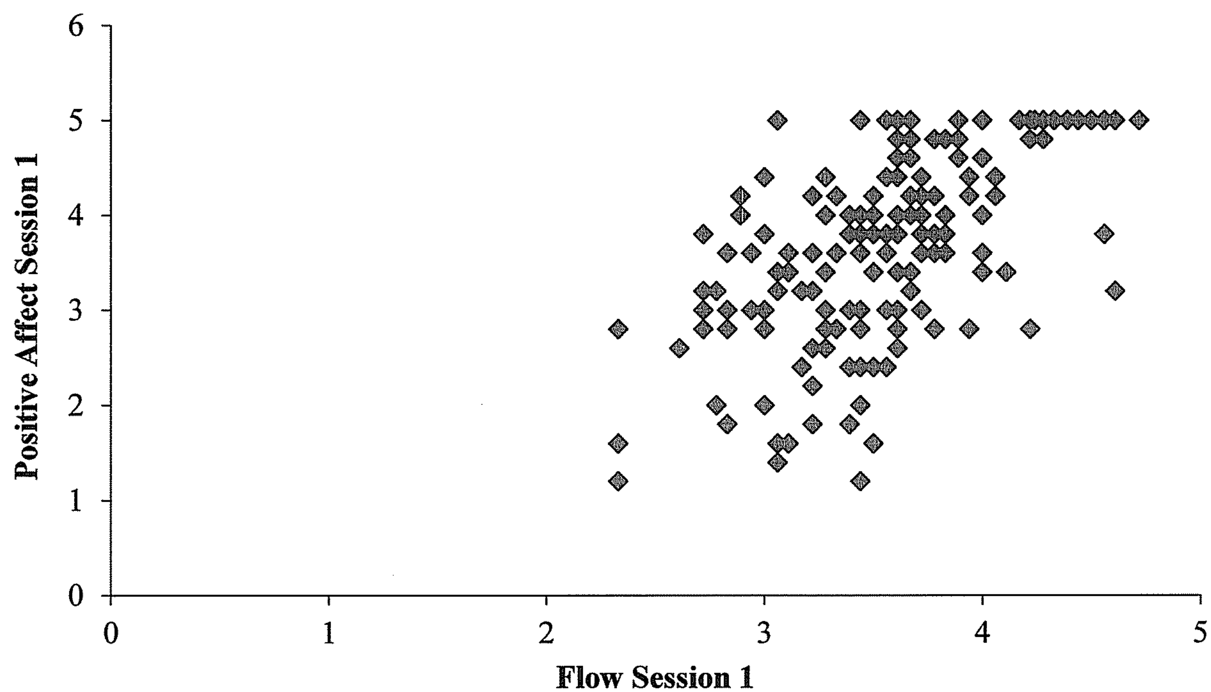


Figure 4. Scatter plot of flow measured after session 1 and positive affect measured after session 1.

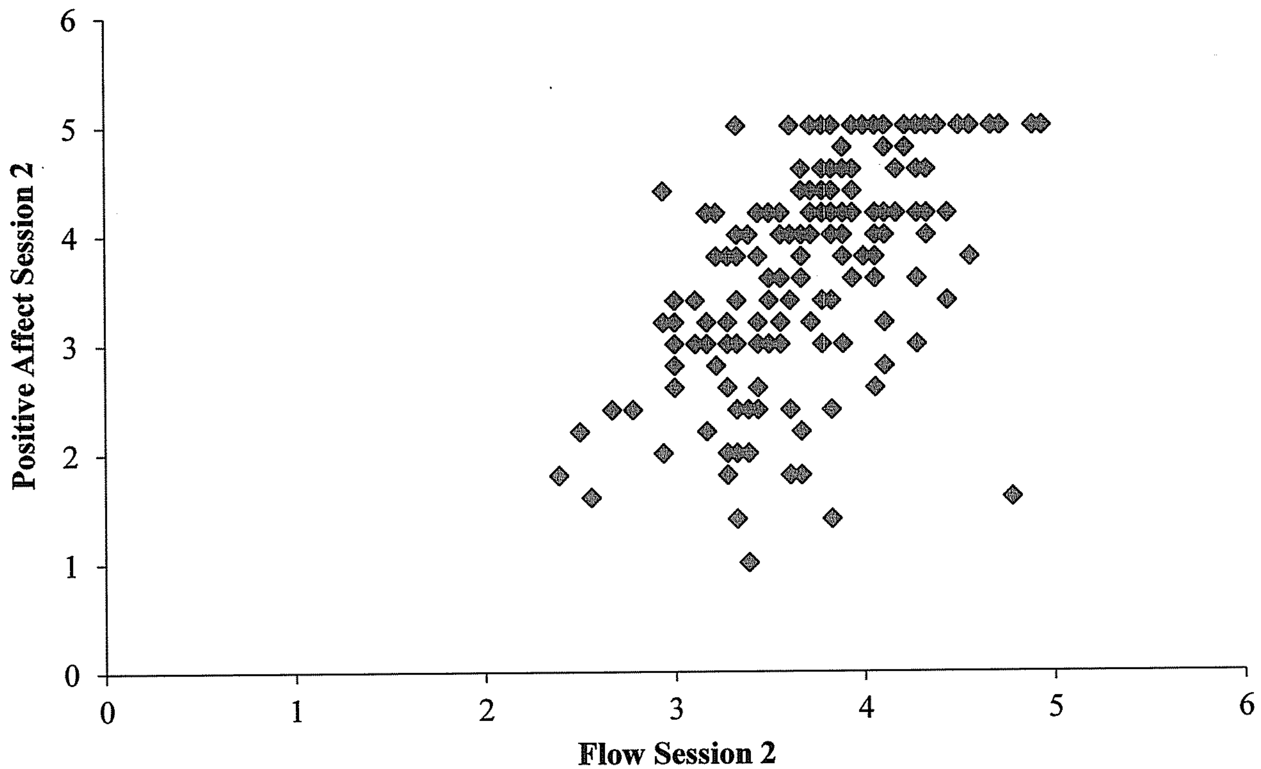


Figure 5. Scatter plot of flow measured after session 2 and positive affect measured after session 2.

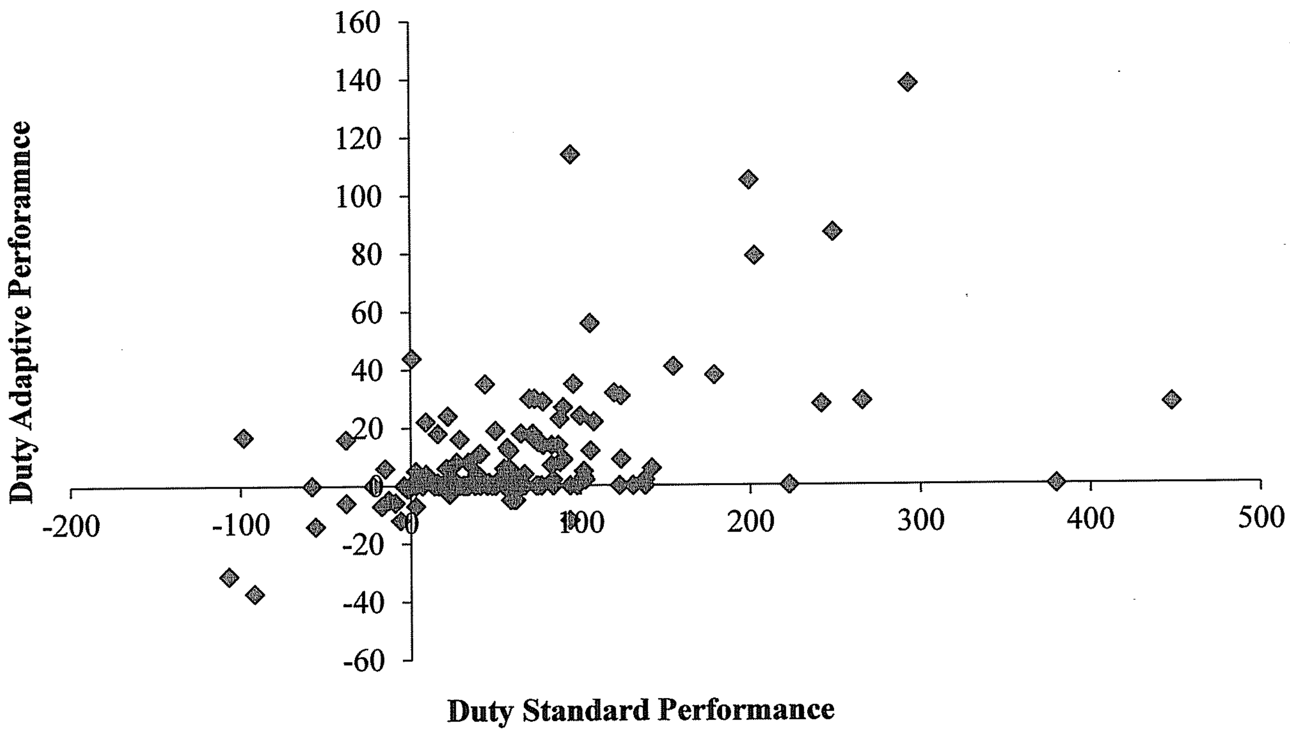


Figure 6. Scatter plot of duty standard and duty adaptive performance.

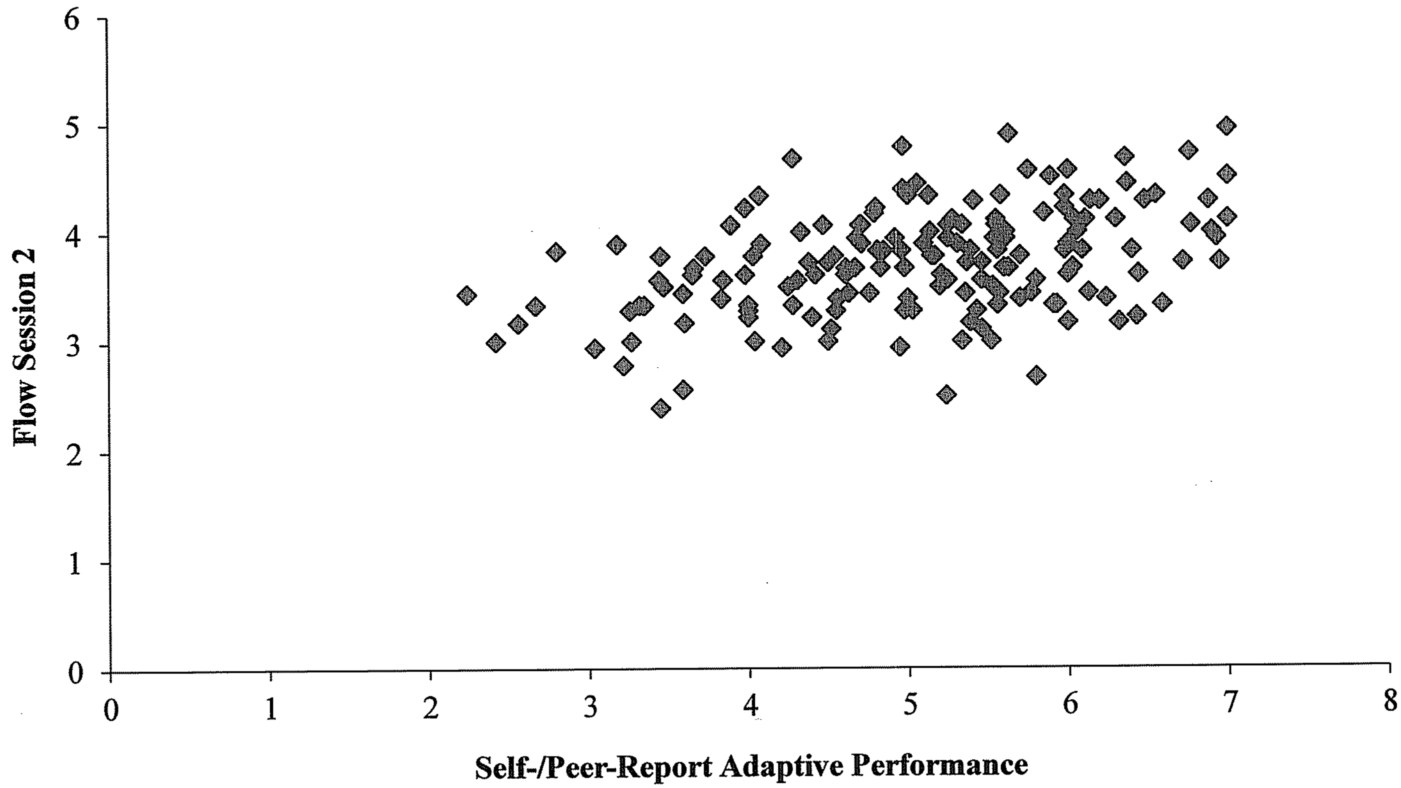


Figure 7. Scatter plot of self-/peer-report adaptive performance and flow measured after session 2.

Figure 8. **Aircraft Departed Standard Performance Distrubution**

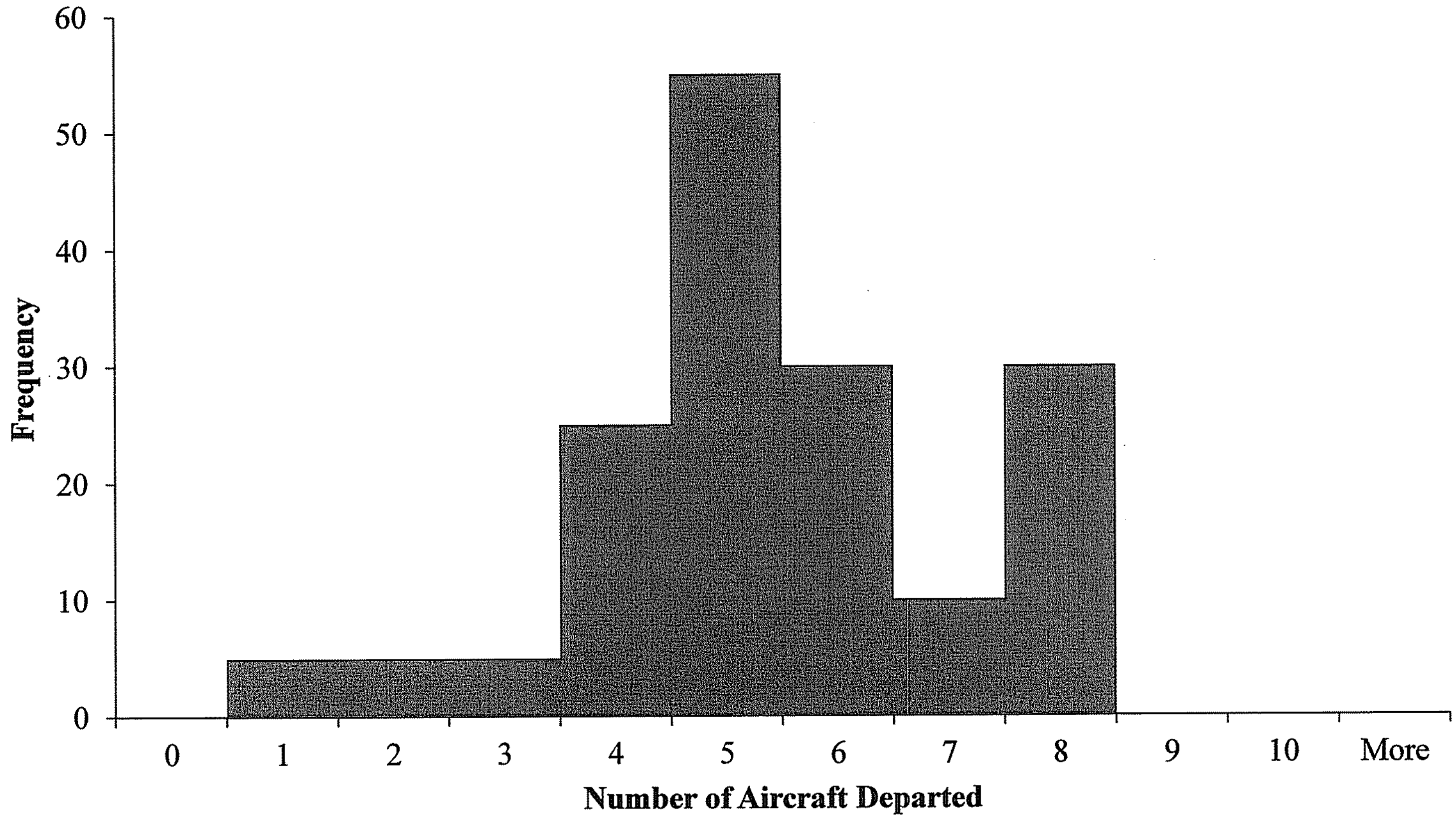
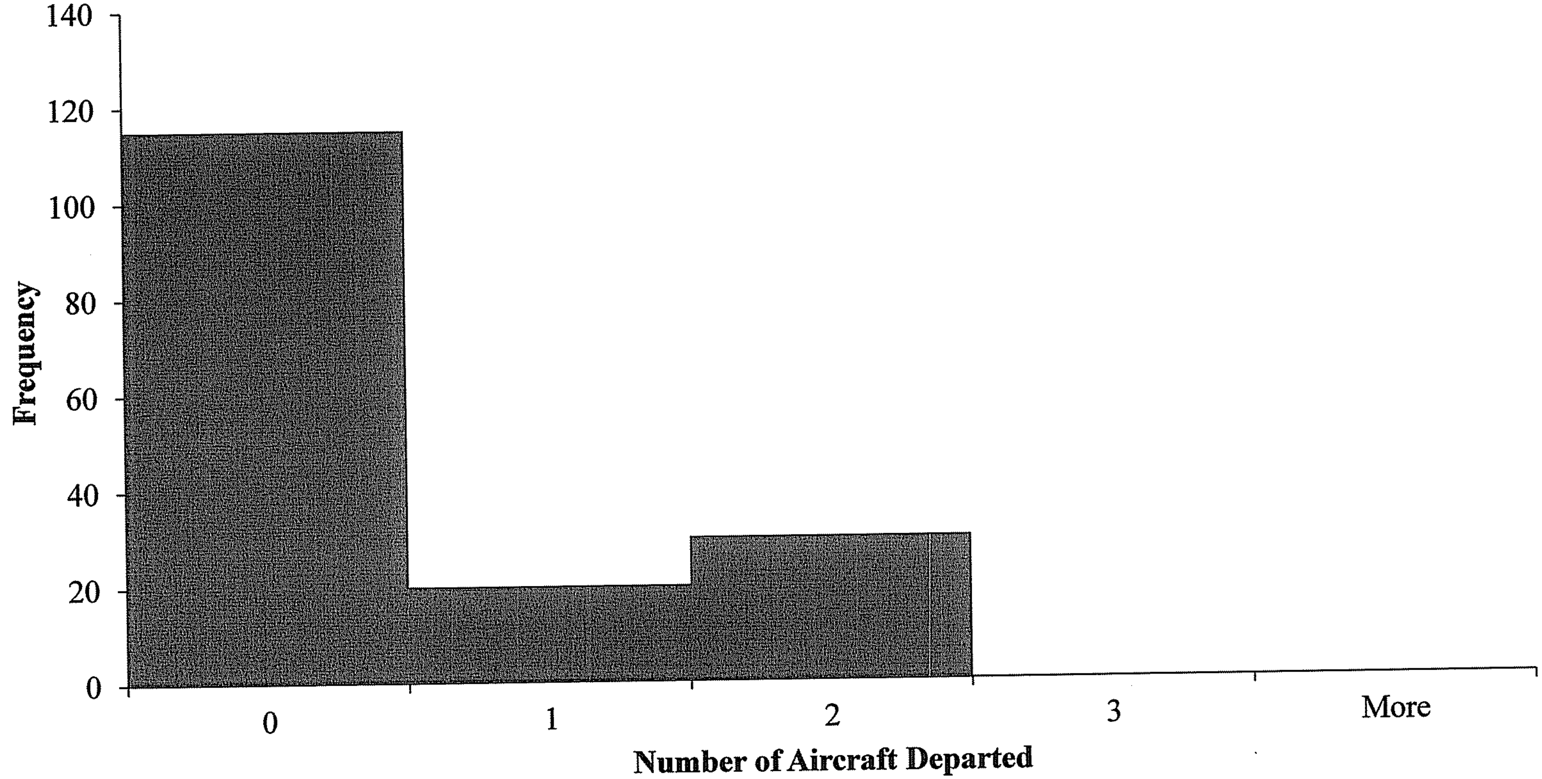


Figure 9. **Aircraft Departed Adaptive Perfomance Distribution**



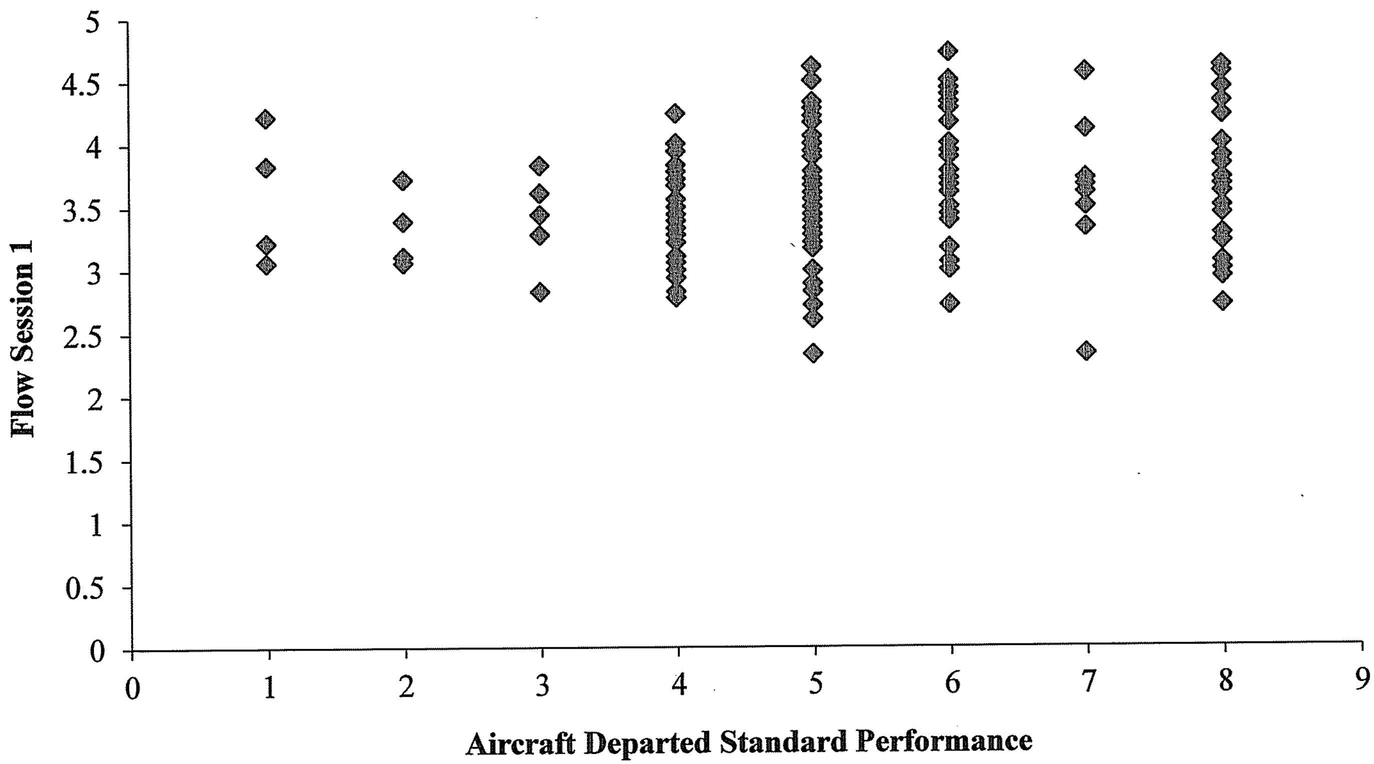


Figure 10. Scatter plot of number of aircraft departed standard performance and flow measured after session 1.

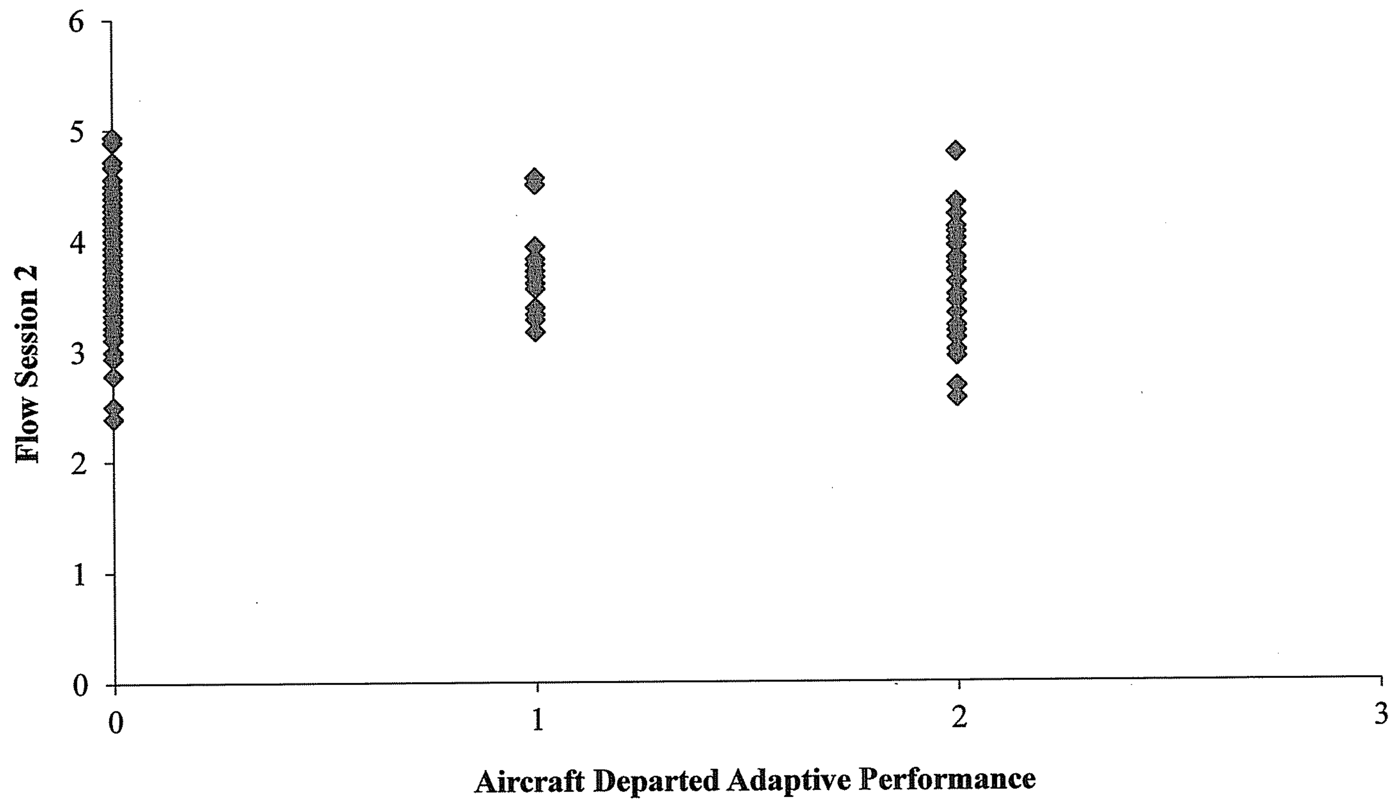


Figure 11. Scatter plot of number of aircraft departed adaptive performance and flow measured after session 2.

TABLES

Table 1

MANOVA Results for Raters and Performance Sum Differences by Aircraft and Rater.

Raters in rank order	*M*	*SD*	*F*
Aircraft 1			5.72
Rater C	12.8	12.8	
Rater A	9.8	13.2	
Rater B	2.9	7.9	
Rater D	1.6	7.7	
Aircraft 2			2.30
Rater C	10.6	18.7	
Rater A	8.4	15.8	
Rater B	3.6	10.3	
Rater D	-.12	15.1	
Aircraft 6			6.84
Rater C	14.6	15.6	
Rater A	13.6	15.1	
Rater B	4.9	8.3	
Rater D	2.8	8.6	
Aircraft 9			
Rater A	3.4	6.9	2.95
Rater B	.93	6.6	
Rater C	.90	3.7	
Rater D	-.16	4.7	
Aircraft 10			2.97
Rater A	9.0	18.7	
Rater C	9.5	25.7	
Rater B	1.8	11.1	
Rater D	-.60	6.2	

Note. $N = 165$.

Table 2

Descriptive Statistics and Bivariate Correlations for Study Variables

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Standard performance	49.9	70.8	-											
2. Adaptive performance	8.6	21.6	.59**	-										
3. Self-peer/report AP	5.1	1.1	.00	.10	-									
4. Cognitive ability	19.5	6.3	.10	.21**	.10	-								
5. Conscientiousness	5.1	.85	.07	.07	.07	-.05	-							
6. Extraversion	4.7	.86	-.07	.07	.03	-.10	.45**	-						
7. Agreeableness	5.3	.67	-.10	-.06	.05	-.11	.43**	.25**	-					
8. Flow session 1	3.5	.49	-.12	-.09	.27**	-.14	.09	.04	.18*	-				
9. Flow session 2	3.7	.49	.07	-.04	.40**	-.08	.09	.12	.06	.73**	-			
10. PA session 1	3.7	.98	.16*	.11	.27**	-.03	.12	.10	.03	.60**	.54**	-		
11. NA session 1	2.1	.87	-.09	-.11	-.23**	-.02	-.05	-.05	.00	-.34**	-.29**	-.24**	-	
12. PA session 2	3.7	1.1	.14	.11	.37**	-.03	.09	.04	.04	.47**	.56**	.72**	-.17*	-
13. NA session 2	1.9	.83	-.13	-.12	-.16**	-.05	-.11	-.00	-.04	-.20*	-.31**	-.06	.63**	-.04

Note. *$p < .05$, **$p < .01$. $N = 165$. AP = adaptive performance, PA = positive affect, NA = negative affect.

Table 3

Hierarchical Regression Analysis for Variables Predicting Duty Standard Performance

Variable: $N = 165$	β	R^2	ΔR^2
Step 1		.03*	
PA session 1	.16*		
Step 2		.08*	.05
PA session 1	.24*		
Cognitive ability	.07		
Conscientiousness	.17†		
Extraversion	-.13		
Agreeableness	-.12		
Flow session 1	-.14		

Note. $^{*}p < .05$. $^{\dagger}p < .10$.

Table 4

Hierarchical Regression Analysis for Variables Predicting Duty Adaptive Performance

Variable: $N = 165$	β	R^2	ΔR^2
Step 1		$.34^{**}$	
Standard performance	$.58^{**}$		
PA session 2	.03		
Step 2		$.40^{**}$	.06
Standard performance	$.58^{**}$		
PA session 2	:11		
Cognitive ability	$.16^{*}$		
Conscientiousness	-.03		
Extraversion	$.16^{*}$		
Agreeableness	.30		
Flow session 2	$-.14^{\dagger}$		

Note. $^{**}p < .01$, $^{*}p < .05$, $^{\dagger}p < .10$.

Table 5

Hierarchical Regression Analysis for Variables Predicting Self-report/Peer-Report Adaptive Performance

Variable: $N = 165$	β	R^2	ΔR^2
Step 1		$.13^{**}$	
PA session 2	$.37^{**}$		
Step 2		$.21^{**}$	.08
PA session 2	$.20^{*}$		
Cognitive ability	$.13^{\dagger}$		
Conscientiousness	.03		
Extraversion	-.02		
Agreeableness	.03		
Flow session 2	$.30^{**}$		

Note. $^{**}p < .01$, $^{*}p < .05$, $^{\dagger}p < .01$.

APPENDICES

Appendix A.

Adaptive Performance Dimensions

Dimension	Definition
Handling emergencies	Reacting appropriately and decisively to dangerous situations
Handling work stress	Remaining calm under pressure; handles frustration
Solving problems creatively	Employing unique types of analyses and generating innovative ideas in complex situations
Dealing with uncertain work situations	Taking effective action when necessary without having to know the total picture
Learning new work tasks	Anticipating, preparing for, and learning skills needed for task or job requirements
Demonstrating interpersonal adaptability	Adjusting interpersonal style to achieve goals working with others
Demonstrating cultural adaptability	Taking action to learn about and understand other cultures and adjusting behavior as necessary to comply with other cultures
Demonstrating physical adaptability	Adjusting to challenging physical factors and difficult environments

Appendix B.

Flow Dimensions

Dimension	Definition
Challenge-skill balance	The person perceives a balance between the challenges of a task and skills, with both operating at a personally high level
Merging of action & awareness	The person becomes so involved in what they are doing that the task becomes spontaneous, almost automatic
Clear goals	An objective is clearly defined
Unambiguous feedback	Immediate and clear feedback is received, usually from the task itself, allowing the person to track performance
Concentration on the task	Complete concentration; irrelevant stimuli disappear from consciousness, worries and concerns are temporarily suspended
Sense of control	The person feels in control of actions during performance of the task
Loss of self-consciousness	Concern for the self disappears as the person becomes more involved with the task
Transformation of time	Time alters perceptibly, either slowing down or speeding up. Alternatively, time may simply become irrelevant
Autotelic experience	The task is intrinsically rewarding

Appendix C.

CAPS Display Screen